Course Libraries 2017/18

Courses A – C

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc Advanced Chemical Engineering

Date of first publication/latest revision: 11/04/17

What is the course?

Course information

Course Title	Advanced Chemical Engineering
Course code	MSACGFTR, MSACGPTR, PDACGFTR, PDACGPTR, PCACGFTR, PCACGPTR
Academic Year	2017/18
Valid entry routes	PgCert, PgDip, MSc
Additional exit routes	PgDip, PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield
School(s)	School of Water, Energy & Environment
Theme	Energy & Power
Centre	Centre for Bioenergy & Resource Management
Course Director	Dr Beatriz Fidalgo-Fernandez
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	N/A
Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years
Course Start Month(s)	October

Institutions delivering the course

This course is delivered by Centre for Bioenergy & Resource Management where the research interests include:

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

- Energy Markets & Policy, Future Energy System
- Biofuels Processes & Technologies
- Thermodynamics in Bio-process Systems
- Biomass and Energy Conversion Technology
- Process and Energy Systems Design, Simulation and Optimisation
- Downstream process: Product Separation and Product Recovery
- Process Control
- Environmental Protection & Management

Cranfield University will interact with the following institutions and in the following ways:

- Seek support from industry for students to have professional experiences through group project.
- Seek industrial support for sponsoring MSc Thesis projects.
- Associated industrial advisory committee. The industrial advisory committee will meet on a yearly basis to help in steering the course content.
- Develop double degree relationships with European academic institutions.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not yet accredited formally by any external body. It is intended to apply for IChemE and Energy Institute accreditation

1. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to provide engineering and applied science graduates with an advanced understanding and practical experience of the methodologies employed in chemical engineering research and chemical process technology.

The general Chemical Engineering route will equip students with diversified skills in advanced engineering, which includes theoretical and practical elements in operation, design, and control of a wide range of chemical processes. The Biorefining route will equip students with fundamental understanding of chemical engineering and solid skills to address the challenges of the rapidly growing and dynamic bioenergy sector.

The aim of the course is to prepare engineering and applied science graduates to meet the increasing demand in industry, consultancies, and the education and public sectors for engineers, scientists and advisors with expertise in a range of areas including production of chemicals, petrochemicals, biochemicals, conventional energy and bioenergy, food, and materials.

This programme is intended for the following range of students:

- Graduates with engineering or related applied science degrees keen to pursue a career as chemical engineering professionals.
- Graduates currently in employment keen to extend their qualifications or to pursue a career change.
- Applicants are required to have at least a UK 2nd class honours degree or its equivalent.
- Applications from candidates with lesser qualifications but with considerable relevant working experience will be considered.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate in Advanced Chemical Engineering

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Holistically apply advanced theory and practice of chemical production processes.

ILO 2. Combine and compare appropriate techniques and tools for the operation, design, simulation, control and optimisation of a range of chemical processes.

Specific ILO for the General route:

ILO 3. Critically evaluate technologies and strategies for the generation and application of heat and power across a number of chemical processes and energy systems scenarios.

Specific ILO for the Biorefining route:

ILO 4. Critically evaluate and assess the current and future biorefining technologies for the sustainable production of bioenergy and biofuels based on the type biomass used as feedstock and the targeted products.

B. Postgraduate Diploma in Advanced Chemical Engineering

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Integrate knowledge and understanding of business operation, and commercial, marketing and finance aspects in a context relevant to chemical and energy industries.

ILO 6. Integrate knowledge, understanding and skills from the taught modules in a real-life situation.

ILO 7. Effectively work in a small project team to identify project objectives and select appropriate methodologies to address problems faced by industrial clients; collaborating with other team members to communicate findings in a professional manner in written, oral and visual forms.

C. MSc in Advanced Chemical Engineering

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 8. Define a research question, develop aim(s) and objectives, select and execute a methodology, analyse data, and evaluate findings and draw appropriate conclusions.

ILO 9. To communicate their findings successfully via a thesis, written in an approved School style and in an oral presentation.

4. How is the course taught?

The teaching methods include:

- Combination of structured lectures, tutorial sessions, computer-based workshops, lab-based practices and private study;
- Personal Development Planning is explicitly and implicitly developed during the course, including topics such as communication, time-management, team work, learning strategies and project management;
- Seminars delivered by invited industrial or academic experts in some areas covered by the course;
- Visits to industrial sites;
- Knowledge and understanding are further developed and enhanced through the assignments associated with some of the taught modules, the group project activity, and the final MSc individual research project;
- Timely and informative feedbacks on the assignments are an essential part of the learning process.

In addition to the teaching methods outlined above, students will be supported in their learning and personal development by:

- A dedicated electronic Blackboard site
- One-day workshop in MATLAB training
- 3-day laboratory training short course for students undertaking MSc research projects which involve experimental work
- Arrangement of attendance of relevant modules offered by other MSc programmes

The taught programme is generally delivered from October to December and from January to February. Each module is generally delivered over one to one week.

The group project/dissertation is taken between February and May. Each group will typically include 4-6 students and two academic supervisors will be assigned to each group.
Group Project teams are expected to hold a minimum of 5 team meetings during the project which must be minuted and all participants must sign off the minutes. The academic supervisor will attend at least two of these meetings to record attendance, to assess individual contribution, and to provide guidance as appropriate. Students undertaking the group project are required to participate in these 5 meetings. Additionally, it is expected that students will meet and work on the project outside of the formal weekly meetings. A (student) project co-ordinator will be responsible to ensure that these meetings are used to good effect, and that appropriate minutes are taken and findings reported to the academic supervisor. Part-time (and full-time) students are encouraged to use tele-conferencing, video-conferencing and web-conferencing facilities to participate in the group project review meeting i.e. they are not always required to attend in person. This will afford students with the experience of working within a disperse project team. However, all students will be required to attend in person the initial and final project review meetings. Facilities for telephone and web-conferencing already exist in several of the available meeting rooms in Building 52 and

are routinely used for research project meetings as well as MSc group project meetings within the School. Facilities for video-conferencing also exist in Building 83.

Part time students have the option of completing a Dissertation as an alternative to the Group Project. Students opting for the Part-Time Dissertation will be assigned a supervisor by the Course Director and will agree with the supervisor an appropriate topic of study. This may be related to a workplace/industrial activity that is relevant to the student's work environment. The Dissertation will include a comprehensive literature review of classical and contemporary related material and also a discussion and properly argued conclusions. Where appropriate the Dissertation will acknowledge the work and contribution of others. The Dissertation module will be assessed in a similar way to the group project by presentation and formal report.

The individual research project is typically pursued between May and September. Each student is allocated an academic supervisor who will guide and assess the students work. Again, it is expected that a formal weekly review meeting will occur at which the student will provide a brief presentation on the work performed to date and record minutes and arising actions.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
GENERAL ROUTE - COMPULSORY MODULES:	
Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 15)	10 10 10
GENERAL ROUTE - ELECTIVE MODULES:	
3 modules chosen from: N-PSE-PPO (Module 2) N-PSE-ACS (module 7) N-PSE-PGRES (module 14) N-PSE-TSOP (module 16)	 10 10 10 10
TOTAL:	60

Description	Credits
BIOREFINING ROUTE - COMPULSORY MODULES:	
Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 15)	10 10 10

N-BPE-EFB (module 5) N-BPE-BPT (module 4) N-BPE-CWM (module 3)	10 10 10
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
GENERAL ROUTE - COMPULSORY MODULES:	
Induction (module 1) Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 15) G-MTI (module 9) N-PSE-PPO (Module 2) N-PSE-ACS (module 7) N-PSE-PGRES (module 14) N-PSE-TSOP (module 16) Full-time students: I-ENE-GRPP (module 10)	0 10 10 10 10 10 10 10 10 40
GENERAL ROUTE - ELECTIVE MODULES:	
Part-time student to choose one: I-ENE-GRPP (module 10) I-ENE-DISS (module 11)	(40) 40 40
TOTAL:	120

Description	Credits
BIOREFINING ROUTE - COMPULSORY MODULES:	
Induction (module 1) Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 15) G-MTI (module 9) N-BPE-EFB (module 5) N-BPE-BPT (module 4) N-BPE-CWM (module 3) I-EDI-A1127 (module 6) Full-time students: I-ENE-GRPP (module 10)	0 10 10 10 10 10 10 10 10 40
BIOREFINING ROUTE - ELECTIVE MODULES:	
Part-time student to choose one: I-ENE-GRPP (module 10) I-ENE-DISS (module 11)	(40) 40 40
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
GENERAL ROUTE - COMPULSORY MODULES:	
Induction (module 1) Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 18) G-MTI (module 9) N-PSE-PPO (Module 2) N-PSE-ACS (module 7) N-PSE-PGRES (module 14) N-PSE-TSOP (module 16) I-ENE-THESIS (module 12) Full-time students: I-ENE-GRPP (module 10)	0 10 10 10 10 10 10 10 10 80 40
GENERAL ROUTE - ELECTIVE MODULES:	
Part-time student to choose one: I-ENE-GRPP (module 10) I-ENE-DISS (module 11)	(40) 40 40
TOTAL:	200

Description	Credits
BIOREFINING ROUTE - COMPULSORY MODULES:	
Induction (module 1) Principles of Chemical Processes (module 13) N-PSE-PSD (module 8) Pilot Plant Operations (module 18) G-MTI (module 9) N-BPE-EFB (module 5) N-BPE-BPT (module 4) N-BPE-CWM (module 3) I-EDI-A1127 (module 6) I-ENE-THESIS (module 12) Full-time students: I-ENE-GRPP (module 10)	0 10 10 10 10 10 10 10 10 80 40
BIOREFINING ROUTE - ELECTIVE MODULES:	
Part-time student to choose one: I-ENE-GRPP (module 10) I-ENE-DISS (module 11)	(40) 40 40
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months. This course is also offered on a part-time basis. Students would instead attend the required modules of the taught component according to a schedule agreed with the course director. Part time students taking the group project would still be expected to complete a group project within a six month period, the same as for Full-time students. MSc individual research projects are commonly undertaken in collaboration with the candidate's place of work.

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[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

All modules are taught over one week, with the following week largely free of structured teaching to allow time for more independent learning and reflection, and completion of assignments.

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-ENE-INWK Occ A	Induction	G Drew	24		0	Y		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	N-BPE-PPO Occ A	Process Plant Operations	D Hanak	30		10	Y		23/10/17	27/10/17	40	EX	100				W/C 11/12/17	10-14/09/18
3	N-BPE-CWM	Circular Waste Management:	R Villa	28		10	N		23/10/17	27/10/17	40	ICW	100				FT 4/11/17 PT 18/11/17	July 18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Biological Processes[12]																
4	N-BPE-BPT	Biofuels and Biorefining	B Fidalgo Fernandez	30		10	Y		08/01/18	12/01/18	40	ICW	100				FT 20/1/18 PT 3/2/18	10-14/09/18
5	N-BPE-EFB	Energy from Biomass and Waste: Thermochemical Processes	B Fidalgo Fernandez	30		10	Y		20/11/17	24/11/17	40	EX	100				w/c 3/1/18	10-14/09/18
6	I-EDI-A1127	Evaluating Sustainability through Lifecycle Approaches	P Goglio	30		10	Y		04/12/17	08/12/17	40	ICW	100				FT 2/1/18 PT 13/1/18	July 18
7	N-PSE-ACS Occ A	Advanced Control Systems	Y Cao	30		10	Y		06/11/17	10/11/17	40	ICW	100				FT 2/12/17 PT 16/12/17	July 18
8	N-PSE-PSD	Process Design and Simulation	G Kopanos	30		10	Y		22/01/18	26/01/18	40	ICW	100				FT 3/2/18	July 18

[12] Shares teaching with MSc Waste and Resource Management 20 credit module, I-WRM-CRM.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
	Occ A																PT 17/2/18	
9	G-MTI Occ A	Management for Technology	S Carver	50		10	Y		26/02/18	02/03/18	40	EX GCW	50 50				EX w/c 19/3/18 GCW FT 10/3/18 GCW PT 24/3/18	10-14/09/18 July 18
10	I-ENE-GRPP Occ A	Group Project	Supervisor	16		40	Y		05/03/18	04/05/18	50 50	GPROJ ICW	80 20				01/05/18 11/05/18	
11	I-ENE-DISS Occ A	Dissertation (P-T option only)	Supervisor	10		40	Y		02/10/17	29/09/18	50	IPROJ IPRES	80 20				28/09/18 28/09/18	
12	I-ENE-THESIS Occ A	Individual Research Project	Supervisor	20		80	Y		07/05/18	07/09/18	50 50	OR THESIS	10 90				03/09/18 03/09/18	
13	N-BPE-PCP	Principles of Chemical Processes	G Leeke	30		10	N		09/10/17	13/10/17	40	EX	100				w/c 11/12/17	10-14/09/18

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
14	N-PSE-PGRES Occ A	Power Generation Systems	G Di Lorenzo	30		10	Y		08/01/18	12/01/18	40	ICW	100				FT 27/1/18 PT 10/2/18	July 18
15	N-BPE-PPO	Pilot Plant Operations	S Wagland	35		10	Y		12/02/18	16/02/18	40	GCW ICW	50 50				GCW 16/2/18 ICW FT 24/2/18 ICW PT 10/3/18	July 18
16	N-PSE-TSOD Occ A	Thermal Systems and Operation Design	I Sher	30		10	Y		20/11/17	24/11/17	40			100	EX EX	50 50	w/c 1/1/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-BPE-CWM	Circular Waste Management: Biological Processes	Advanced Chemical Engineering	Shares teaching with the 20 credit Circular Waste Management; Recycle, Recover and Dispose modules used by • Energy from Waste • Environmental Engineering
N-BPE-EFB	Energy from Biomass and Waste: Thermochemical Processes	Advanced Chemical Engineering	• Energy from Waste • Renewable Energy Technology
G-MTI	Management for Technology	School of Management	• Advanced Mechanical Engineering • REMS EngD • Design of Rotating Machines • Food Chain Systems • Offshore and Ocean Technology with Subsea Engineering • Offshore and Ocean Technology with Materials Engineering • Offshore and Ocean Technology with Risk Management • Offshore and Ocean Technology with Pipeline Engineering • Offshore and Ocean Technology with Renewable Energy • Renewable Energy Engineering • Renewable Energy Technology • Flow Assurance for Oil and Gas Production • Energy Systems and Thermal Processes • Process Systems Engineering • Energy from Waste • Geothermal Engineering • Advanced Chemical

			Engineering
I-EDI-A1127	Evaluating Sustainability through Lifecycle Approaches	Environmental Management for Business	• Environmental Engineering • Cleantech Entrepreneurship • Advanced Chemical Engineering
N-PSE-PPO	Process Plant Operations	Process Systems Engineering	• Flow Assurance for Oil and Gas Production • Advanced Chemical Engineering • Cost Engineering • Process systems engineering (Muscat)
N-PSE-ACS	Advanced Control Systems	Process Systems Engineering	• Advanced Mechanical Engineering • Flow Assurance for Oil and Gas Production • Process systems engineering (Muscat) • Energy Systems and Thermal Processes • Renewable Energy Marine Structures EngD • Advanced Chemical Engineering
N-PSE-PSD	Process Design and Simulation	Process Systems Engineering	• Process systems engineering (Muscat) • Flow Assurance for Oil and Gas Production • Advanced Chemical Engineering.
N-PSE-TSOD	Thermal Systems and Operation and Design	Process Systems Engineering	• Energy Systems and Thermal Processes • Geothermal Engineering • Advanced Chemical Engineering
N-BPE-BPT	Biofuels & Biorefining	Advanced Chemical Engineering	• Process Systems Engineering
N-BPE-PPO	Pilot Plant Operations	Advanced Chemical Engineering	• Energy from waste
N-PSE-PGRES	Power generation systems	Energy systems and thermal processes	• Energy systems and thermal processes (Muscat) • Advanced mechanical engineering • Geothermal engineering • Advanced Chemical

			Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have 2 - 4 written examinations, 6 - 7 pieces of assessment by submitted work and 2 -3 elements of assessment by presentation or viva.

This approach has been adapted to:

- Assess the knowledge of the students using methods appropriate to the nature of the subject area.
- Help the students to improve their technical writing and oral presentation skill.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate in Advanced Chemical Engineering

General route

Award ILOs / Module No.	ILO1	ILO2	ILO3 (only for the General Route)
13	EX		
8	ICW	ICW	
15		GCW/ICW	
2	EX	EX	
7	ICW	ICW	ICW
14		ICW	ICW
16	EX		EX

Biorefining route

Award ILOs / Module No.	ILO1	ILO2	ILO4 (only for the Biorefining route)
13	EX		
8	ICW	ICW	
15		GCW/ICW	
5		EX	EX
4		ICW	ICW

Award ILOs / Module No.	ILO1	ILO2	ILO4 (only for the Biorefining route)
3			ICW

B. Postgraduate Diploma in Advanced Chemical Engineering

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

General Route

Award ILOs / Module No.	ILO5	ILO6	ILO7
9	EX/GCW		
10		GPROJ/ICW	GPROJ/ICW
11		IPROJ IPRES	

Biorefining Route

Award ILOs / Module No.	ILO4 (only for Biorefining route)	ILO5	ILO6	ILO7
6	ICW			
9		EX/GCW		
10			GPROJ/ICW	GPROJ/ICW
11			IPROJ IPRES	

C. MSc in Advanced Chemical Engineering

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Both routes

Award ILOs / Module No.	ILO8	ILO9
12	OR/THESIS	OR/THESIS

<u>CROSS-MODULAR ASSESSMENT</u> (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. <u>How will the University assure the quality of the provision?</u>

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

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and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

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As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

Graduates from the General route will be equipped with advanced interdisciplinary skills in chemical engineering, which includes theoretical and practical elements in operation, design, and control of a wide range of chemical and energy processes. Graduates from the Biorefining route will be equipped with fundamental understanding of chemical engineering and solid skills to address the challenges of the rapidly growing and dynamic bioenergy sector. Both routes include training in management applied to the energy sector which will enable graduate engineers to effectively fulfil a wider role in a business organisation.
Graduates are likely to work in companies competing in a range of industries, including chemicals, petrochemicals, biochemicals, conventional energy and bioenergy, food, materials, consultancy and management. Those wishing to continue their education via PhD or MBA studies in the chemical or energy sectors will be greatly facilitated by the interdisciplinary, project-oriented profile that they will have acquired through this course.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Advanced Lightweight Structures and Impact

Date of first publication/latest revision: March 2017

1. What is the course?

Course information

Course Title	MSc in Advanced Lightweight Structures and Impact
Course code	MSALSFTC, PDALSFTC, PCALSFTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip, PgCert
Mode of delivery	Full-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Structures, Assembly and Intelligent Automation
Course Director	Dr Hessam Ghasemnejad
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**enter here**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University Entry Requirements (2.2 in an Engineering related subject)
UK Qualifications Framework Level	QAA FHEQ level 7 (Masters)
Benchmark Statement(s)	N/A

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Registration Period(s) available	1 year full-time
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Structures, Assembly and Intelligent Automation where the research interests include:

- Structural analysis (linear/non-linear).
- Numerical methods development (mesh and meshless methods).
- Crashworthiness and material response to impact loading (ranging from quasi-static to dynamic).

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRB)

This course has previously been accredited formally by Royal Aeronautical Society (RAeS) and IMechE.

2. What are the aims of the course?

Cranfield University offers this course in order to:

- Provide in-depth understanding of the importance / implications of using advanced materials in the development of lightweight structures and their response to a range of loading (from quasi-static to dynamic loads).
- Acquire a systematic understanding of structural behaviour and failure and develop an awareness of impact and crash protection issues and phenomena, with the ability to apply this knowledge to structural design.
- Meet employer demand for graduates who have strong applied analytical skills in structural behaviour and failure, who can practically apply this knowledge to real engineering problems using the latest industry standard numerical tools.
- To develop a firm grasp of the relationship of basic phenomena to real life engineering systems, and develop industrially relevant and marketable applied skills in structures and crashworthiness.
- To supply high grade personnel to the structures and crashworthiness communities in UK, European and world industry, including aerospace, automotive, offshore and defense sectors.
- To provide a prime focus for Cranfield's growing activity in analysis and design for structural crashworthiness and impact.

This programme is intended for the following range of students:

- Any 1st or 2nd class UK honours degree (or equivalent) in an engineering related discipline.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Solve analytical and numerical problems for complex sub-structures and to analyse modern computer-based solutions for technical problems.
ILO 2. Examine how properties of an advanced materials affect the design process.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 3. Assess the stress analysis in modern structural development and their significance for economic design.
ILO 4. Plan the implementation of modern lightweight materials in advanced structural design and to prepare correct methods to practical demonstrations of processes.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Appraise a thorough technical understanding of modern lightweight materials, including a critical evaluation of existing processes and methods.
ILO 6. Judge and evaluate results and outcomes of various types of analysis (experimental, analytical and numerical) related to the advanced lightweight structures.
ILO 7. Compose a work program for evaluating new and existing design of lightweight materials structures.
ILO 8. Resource and task work programs individually and as part of a team, estimating the time and cost associated with delivery of requirements.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Lectures.
- Computer based workshops.
- Tutorial / video sessions (where appropriate)/
- The group and individual projects are used to develop research and presentation skills (feedback provided to aid development and time management skills).
- The students will be exposed to seminars from leading national and international figures in crashworthiness and impact fields.
- Industrial visits (where appropriate).
- IT and Library Training Courses.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

Postgraduate Certificate
The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction (1) 6 modules from 2-9	0 60
TOTAL:	60

A. Postgraduate Diploma
The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction (1) Modules 2-9 Group Design Project	0 80 40
TOTAL:	120

B. MSc
In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Induction (1) Modules 2-9 Group Design Project (10) Individual Research Project (11)	0 80 40 80
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
    - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
    - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
    - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within twelve calendar months. Each module is taught over one, or two weeks, depending upon module length.

Sufficient "free" time is allocated in the timetables to provide additional time for independent learning and reflection. In addition, the larger contact hour modules are split over two weeks, with the timetable specifically designed to incorporate at least a one week break between parts to allow students to consolidate the previously taught material, before attending the concluding part(s) of the module.

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ALS-INWK	Induction Week (ALSI Course)	Dr Hessam Ghasemnejad	16		0	N		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	N-ALS-ACAS	Advanced Composite Analysis and Impact	Dr Hessam Ghasemnejad	20		10	N		09/10/17	013/10/17	40	ICW	100				10/11/17	19/01/18
3	N-ALS-ICM	Introduction to Continuum Mechanics	Dr Iman Dayyani	20		10	N		23/10/17	27/10/17	40	EX	100				01/17	04/2017
4	N-ALS-TS	Thin-walled Structures	Dr Yigeng Xu	20		10	N		06/11/17	10/11/17	40	EX	100				01/18	06/ 2017

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
5	N-ALS-FEM	Finite Element Methods	Dr Iman Dayyani	20		10	N		20/11/17	01/12/17	40	EX	100				/04/18	06/ 2018
6	N-ALS-MCS2	Materials Characterisation and Failure Simulations	Dr Mehdi Yasaee	20		10	N		04/12/17	08/12/17	40	ICW	100				16/02/18	06/2018
7	N-AVD-SS	Structural Stability	Dr Wenli Liu	20		10	Y		/01/18	02/18	40	EX	100				04/18	June 2018
8	N-ALS-CRASH	Crashworthiness	Dr Hessam Ghasemnejad	30		10	N		05/02/18	9/02/18	40	ICW	100				06/04/18	06/2018
9	N-ALS-SIC	Advanced Simulation for Impact and Crashworthiness	Dr Mehdi Yasaee	20		10	N		19/02/18	23/02/18	40	ICW	100				16/03/18	/06/18
10	N-ALS-GA	Group Design Project	Dr Mehdi Yasaee	20		40	N		12/03/18	25/05/18				100 GPROJ	GPRES GCW	20 80	06/06/18	N/A
11	N-ALS-THES	Individual Research Project	Dr Hessam Ghasemnejad	20		80	N		28/05/18	22/08/18				100 THESIS	IPRES THESIS	20 80	06/09/18	N/A

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Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-AVD-SS	Structural Stability	Aerospace Vehicle Design	Aerospace Vehicle Design

7. How are the ILOs assessed?

The following assessment types are utilised:

- Exam, assignment, group and individual projects

This approach has been adopted because:

- The analytical skills can be assessed by the exam while the numerical skills are mainly assessed by the assignments which give students an opportunity to apply their knowledge in practical applications. The experimental studies are examined by individual and group projects which judge students' capabilities in planning and evaluating of technical solutions in the advanced lightweight structures.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

A. Postgraduate Certificate

Award ILOs / **Module No.**	ILO 1.	ILO 2.
1	*Not Assessed*	
2	*ICW*	*ICW*
3	*EX*	*EX*
4	*EX*	*EX*
5	*EX*	*EX*
6	*ICW*	*ICW*
7	*EX*	*EX*
8	*ICW*	*ICW*

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 1.	ILO 2.	ILO 3.	ILO 4.
1	*Not Assessed*			
2	*ICW*	*ICW*		
3	*EX*	*EX*		
4	*EX*	*EX*		
5	*EX*	*EX*		*EX*
6	*ICW*	*ICW*		*ICW*
7	*EX*	*EX*	*EX*	*EX*
8	*ICW*	*ICW*	*ICW*	*ICW*
9	*ICW*	*ICW*	*ICW*	*ICW*
10	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 1.	ILO 2.	ILO 3.	ILO 4.	ILO 5.	ILO 6.	ILO 7.	ILO 8.
1	*Not Assessed*							
2	*ICW*	*ICW*						
3	*EX*	*EX*						
4	*EX*	*EX*						
5	*EX*	*EX*		*EX*				
6	*ICW*	*ICW*		*ICW*				
7	*EX*	*EX*	*EX*	*EX*				
8	*ICW*	*ICW*	*ICW*	*ICW*				
9	*ICW*	*ICW*	*ICW*	*ICW*				
10	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*	*GPRES GCW*
11	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*	*IPRES THESIS*

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
N/A			

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at

least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

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As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Based on the past five years, the following patterns have emerged for typical career paths and employability of graduands:

- Return to home EU institution to complete double degree
- Continued Higher Education - PhD at different UK institutions and at Cranfield University
- Direct employment / Graduate trainee schemes (Automotive / Aerospace / Offshore/Defence)
- Consultancy – Software Development / Software Application / Crashworthiness, etc.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Advanced Materials

Date of first publication/latest revision: May 2017

1. What is the course?

Course information

Course Title	MSc in Advanced Materials
Course code	MSADMFTC, MSADMPTC, PDADMFTC, PDADMPTC, PCADMFTC, PCADMPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Manufacturing
Centre	Surface Engineering & Nanotechnology Institute
Course Director	Dr David Ayre
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	One year full-time, two-five years part-time

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Course Start Month(s)	Full-time: October. Part-time: October.

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Manufacturing Theme where the materials related research interests include:

- Composites.
- Surface science and engineering.
- Welding.
- Ultra precision engineering
- Microsystems and Nanotechnology.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Institution of Mechanical Engineers (IMechE) up to and including Academic year 2019-20, Institution of Engineering and Technology (IET) up to and including Academic year 2019-20, Royal Aeronautical Society (RAeS) up to and including Academic year 2019-20, Institute of Materials, Minerals and Mining (IOM3) up to and including Academic year 2018-19 and The Welding Institute (TWI) up to and including Academic year 2017-18.

2. <u>What are the aims of the course?</u>

AIM
The aim of the course is to provide graduate scientists and engineers with a fundamental understanding of materials properties and processing, and the necessary skills to apply their knowledge in a wide range of careers in engineering and related industries.

OBJECTIVES
The objectives of the course are to provide students with:

1. A scientific understanding of materials properties and an appreciation of how this understanding can be applied to relevant problems.
2. A scientific understanding of the processes and manufacturing routes used to convert materials into engineering products, and of the influence of processing conditions on product performance.
3. An introduction to a wide range of specific materials, including metals, polymers, ceramics and composites, and to the basic principles of materials selection for engineering and other applications.
4. An introduction to a research environment, providing familiarity with testing and processing equipment, practical approaches to problem solving, critical evaluation of data, and use of information technology.
5. The skills required to pursue a successful career in engineering and related industries.

On successful completion of the course students should be able to:

- Apply their understanding of materials properties and processing characteristics to problems in the areas of materials development, materials and process selection, and component design.
- Plan, execute and manage materials-related projects.
- Operate effectively in a team.
- Make effective oral and written presentations of their work.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- recent graduates wishing to extend their knowledge and skills in the above areas
- qualified engineers wishing to apply their skills into new areas.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic understanding of materials properties and an appreciation of how this understanding can be applied to relevant problems.
ILO 2. Demonstrate a critical awareness of a range of techniques for assessing the structure and properties of materials.
ILO 3. Demonstrate knowledge and scientific understanding of the processes and manufacturing routes used to convert materials into engineering products, and the influence of processing conditions on product performance.
ILO 4. Demonstrate knowledge of specific materials and their applications, including metals, polymers, ceramics and composites.
ILO 5. Use basic principles of materials selection for engineering and other applications.
ILO 6. Demonstrate an ability in practical approaches to problem solving.
ILO 7. Critically evaluate data.
ILO 8. Demonstrate a basic understanding of fracture mechanics and an awareness of approaches to failure assessment (by choice of module)
ILO 9. Make effective use of finite element analysis programmes (by choice of module).

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 10. Demonstrate knowledge of some key general, personnel and project management techniques and an awareness of the less science-dependent aspects of technology.
ILO 11. Demonstrate an awareness of current research/development in selected topics in the field of materials.
ILO 12. Make effective oral and/or written presentation of their work.
ILO 13. Operate effectively in a team.
ILO 14. Undertake an appraisal of technical and/or commercial literature.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 15. Demonstrate a critical awareness of current research/development in selected topics in the field of materials.
ILO 16. Undertake substantial critical appraisal of technical and/or commercial literature.
ILO 17. Carry out substantial scientific programmes of study.
ILO 18. Discuss their work and relate it to the work of others.
ILO 19. Demonstrate originality in the application of knowledge in relation to an extended individual project.

ILO 20. Plan, execute and manage materials-related projects.

4. How is the course taught?

Students will be supported in their learning and personal development by:

Comprehensive course materials are provided, as well as a web-site using the Blackboard™ Virtual Learning Environment (VLE). Students are guided through the use of interactive exercises, group and individual discussion. Students engage in class activities to practise the techniques taught.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2,3,7	30
ELECTIVE MODULES:	
Three Modules from 4, 6, 8, 9	30
RECOMMENDED MODULE	
Introduction	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2 to 9 Group Project for full-time students (11a) or Dissertation for part-time students (11b)	80 40
ELECTIVE MODULES:	
*Optional module 10 if available for part time students, plus choose modules to total 8 from taught modules 2 to 9	
RECOMMENDED MODULE	
Introduction	0
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Modules 2 to 9 Group Project for full-time students (11a) or Dissertation for part-time students (11b) Individual Research Project (12)	80 40 80
ELECTIVE MODULES:	
*Optional module 10 if available for part time students, plus choose modules to total 8 from taught modules 2 to 9	
RECOMMENDED MODULE	
Introduction	0
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does <u>not</u> have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment <u>on the first attempt</u> for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **<u>up to 30 learning credits</u>**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **<u>any additional learning credits</u>** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
- it is <u>not</u> permissible for you to fail an elective module and then proceed to take a different elective module in its place.

- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. <u>How is the course structured?</u>

Full-time students register for the course in October and are expected to complete the course within 11 calendar months.

This course is also offered on a part-time basis. The overall duration of the part-time course would normally be 2 years; the maximum overall duration normally permitted will be 3 years. For part-time Students the Group Project component is replaced by a dissertation.

The course has been structured through discussions with advisors from a range of industries centred on materials. The course comprises an introductory week and eight one week modules which are assessed, and an assessed group project and individual project. The course covers a broad range of materials areas. Specialisation is provided though suitable group and individual projects.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-MAT-INWK	Introduction	Dr Sue Impey	26		0	Y		02/10/17	06/10/17	n/a	AO	n/a				n/a	
2	I-MAT-A1009	Introduction to Materials Engineering	Dr David Ayre	30		10	Y		09/10/17	13/10/17	40	EX	100				03/01/18	Manufacturing resit exams will be during week commencing 18/09/17

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
3	I-MAT-A1011	Machining, Moulding and Metrology	Dr Isidro Durazo-Cardenas	30		10	Y		23/10/17	27/10/17	40			100 MULTI	ICW GPRES	70 30	10/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
4	I-MAT-A1015	Failure of Materials and Structures	Dr David Ayre	32		10	Y		13/11/17	17/11/17	40	EX	100				15/12/17	Manufacturing resit exams will be during week commencing 18/09/17
5	I-MNU-A1018	General Management	Dr Yuchun Xu	32		10	Y		20/11/17	24/11/17	40	EX	100				05/01/18	Manufacturing resit exams will be during week commencing 18/09/17
6	I-MAT-A1014	Finite Element Analysis	Dr Glenn Leighton/ Dr Renaud Jourdain	35		10	Y		04/12/17	08/12/17	40			100 MULTI	ICW ICW	40 60	19/01/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
7	I-MAT-A1017	Materials Selection	Dr Sue Impey/ Dr David Ayre	34		10	Y		08/01/18	12/01/18	40 40			100 MULTI	IPRES ICW	10 90	29/01/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
8	I-MAT-A1016	Surface Science and Engineering	Prof John Nicholls	30		10	Y		22/01/18	26/01/18	40	ICW	100				09/02/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
9	I-MAT-A1013	Composites Manufacturing for High Performance Structures	Andrew Mills	35		10	Y		30/10/17	03/11/17	40	ICW	100				01/12/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
10	N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures	Prof Philip Irving	35		10	Y		10/07/18	14/07/18	40	ICW	100				11/09/18	Re-assessment date to be set by agreement of Course Director

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		(option when available)**																and Module Leader as/when required.
11a	I-MAT-GRPP	Group Project for Full Time Students	Dr David Ayre	20		40	Y		05/02/18	20/04/18				80 MULTI 20 MULTI	GPRES GPROJ ICW observed behaviour	16 64 10 10	04/05/18	
11b	I-MAT-DISS	Dissertation for Part Time Students	Dr Sue Impey/ Dr David Ayre	20		40	Y		01/02/18	30/08/18		ICW	100				30/08/18	
12	I-MNU-THESIS	Individual Research Project	Dr Yuchun Xu	20		80	Y		30/04/18 †	03/09/18 †		THESIS OR	90 10				03/09/18 †	

**Timescales suit for part time students only
† Dates for Full time students only. Part time students have flexibility with dates in this component

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
I-MAT-INWK	Introduction	Manufacturing Technology and Materials Programme	Welding Engineering, Applied Nanotechnology, Aerospace Materials
I-MAT-A1009	Introduction to Materials Engineering	Advanced Materials	Aerospace Materials, Manufacturing Technology and Management
I-MAT-A1011	Machining, Moulding and Metrology	Advanced Materials	Manufacturing Technology and Management, Aerospace Manufacturing
I-MAT-A1015	Failure of Materials and Structures	Advanced Materials	Aerospace Materials, Aerospace Manufacturing
I-MNU-A1018	General Management	Engineering & Management of Manufacturing Systems	Applied Nanotechnology, Manufacturing Technology and Management, Global Product Development and Management, Management and Information Systems, Knowledge Management for Innovation (not currently running), Engineering & Management of Manufacturing Systems
I-MAT-A1014	Finite Element Analysis	Advanced Materials	Applied Nanotechnology, Manufacturing Technology and Management, Aerospace Materials MRes in Manufacturing
I-MAT-A1017	Materials Selection	Advanced Materials	Aerospace Materials EngD Sustainable Materials and Manufacturing
I-MAT-A1016	Surface Science and Engineering	Advanced Materials	Manufacturing Technology and Management, Aerospace Materials
I-MAT-A1013	Composites Manufacturing for High Performance	Advanced Materials	Manufacturing Technology and Management, Aerospace Manufacturing, Aerospace Materials, , Renewable Energy Marine Structures EngD
N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures	Airworthiness	Airworthiness, Military Aerospace and Airworthiness, Aerospace Materials
I-MAT-GRPP	Group Project for Full Time Students	Manufacturing Technology and Materials Programme	Aerospace Materials, Applied Nanotechnology, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not

			currently running), Management and Information Systems, Cyber-Secure Manufacturing, Welding Engineering
I-MAT-DISS	Dissertation for Part Time Students	Manufacturing Technology and Materials Programme	Aerospace Materials, Applied Nanotechnology, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Cyber-Secure Manufacturing, Welding Engineering
I-MNU-THESIS	Individual Research Project	Aerospace Manufacturing	Cyber-Secure Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Aerospace Materials, Applied Nanotechnology, Manufacturing Technology and Management, Welding Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

> Students can expect to have either examinations or assessment by submitted work and elements of assessment by presentation or viva.

This approach has been adopted in order to ensure that students demonstrate their understanding through a wide range of learning techniques, but are not disadvantaged through any one approach.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO1 & ILO2	ILO3	ILO4	ILO5	ILO6	ILO7	ILO8	ILO9
2	EX	EX	EX		EX	EX		
3		ICW			ICW	ICW		
4					EX	EX	EX	
6					ICW	ICW		ICW
7	ICW	ICW	ICW	ICW	ICW	ICW		
8		ICW			ICW			
9		ICW			ICW			

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO10	ILO11	ILO12	ILO13	ILO14
5	EX				
11a		GPROJ	GPROJ	GPROJ GPRES	GPROJ
11b		ICW	ICW		ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO15	ILO16	ILO17	ILO18	ILO19	ILO20

Award ILOs / Module No.	ILO15	ILO16	ILO17	ILO18	ILO19	ILO20
12	THESIS OR	THESIS	THESIS	THESIS OR	THESIS	THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

This course takes graduates on to a wide range of careers involving materials, with responsibilities in research, development, design, engineering, consultancy and management in industries including aerospace, automotive, medical, sports, food and drink processing, chemical processing and power generation.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Advanced Mechanical Engineering

Date of first publication/latest revision: 09/03/17

1. What is the course?

Course information

Course Title	Advanced Mechanical Engineering
Course code	MSAMEFTC, MSAMEPTC, PDAMEFTC, PDAMEPTC, PCAMEFTC, PCAMEPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	PgDip, PgCert
Mode of delivery	Full time, Part time
Location(s)[1] of Study	Cranfield
School(s)	School of Water, Energy and Environment
Theme	Energy & Power
Centre	Centre for Power Engineering
Programme Director **Course Director**	Dr Gill Drew Dr Joao Amaral Teixeira
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	A first or second class UK Honours degree (or equivalent) in mathematics, physics or an engineering discipline. Other recognised professional qualifications or several years relevant industrial experience may be accepted as equivalent; subject to approval by the Course Director.
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	N/A
Registration Period(s) available	Full-time MSc, PgDip and PgCert - one year, Part-time MSc, PgDip and PgCert - up to three years
Course Start Month(s)	October

Institutions delivering the course

This course is delivered by the Energy & Power Theme, where the research interests include fluid mechanics, structural integrity, renewable energy and biofuels.

Cranfield University interacts with the following institutions and in the following ways:

Double degree relationships with European academic institutions have been developed (France, Italy, Spain, and Slovenia) and future collaborations with other institutions are planned.

The course is developing an industrial partnership with BPP-tech.

Plans are in place to:
- Establish an industrial advisory committee
- Develop relationships with appropriate international industries.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited by the Institution of Mechanical Engineers (IMechE) and the Royal Aeronautical Society (RAeS) until 2019.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

Provide advanced, post-graduate education in the theory and practice of Mechanical Engineering. The course includes a broad range of Mechanical Engineering topics particularly relevant to the Energy and Transport sectors including Mechanical Engineering Design and Assessment. Material presented in the course modules deals with the design, operation and optimisation of machinery, structural integrity and project management. The course will appeal to graduates and practicing engineers who wish to enhance their understanding of Mechanical Engineering with a view to management of large engineering projects. It will also appeal to students as a conversion course from other branches of engineering and as an upskilling course particularly for overseas graduates. This is a broad course complementing the existing specialist MSc courses that the School of Water, Energy and Environment provides.

This programme is intended for the following range of students:

- Graduates and practicing engineers who wish to enhance their knowledge of various mechanical engineering fields with a view to managing key engineering projects.
- Graduates currently in employment, or overseas graduates, who wish to extend their technical qualifications or up-skill their qualifications.

- Graduates with science degrees or from other branches of engineering who wish to pursue a career change and require a conversion course.
- Candidates with other educational qualifications but who possess considerable relevant experience.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate in Advanced Mechanical Engineering

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Critically evaluate advanced mechanical engineering techniques necessary for solutions in the transport and energy sectors.

ILO 2. Design appropriate strategies for employing advanced technologies and management issues to provide solutions for international industries and/or research organisations.

ILO 3. Appraise, evaluate and interpret information and theories applied to the engineering solution of problems in fluid dynamics and loading, computational fluid dynamics, control systems, fatigue and fracture, analytical and computational stress analysis and power generation.

ILO 4. Assess and interpret management methodologies and techniques that apply to the planning and execution of engineering projects, performed both individually and in teams, and for which self-direction and the ability to work effectively and professionally under time pressure are required.

B. Postgraduate Diploma in Advanced Mechanical Engineering

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Integrate knowledge, understanding and skills from the taught modules in a real-life situation to address problems faced by industrial clients; creating new problem diagnoses, designs, or system insights; and communicating findings in a professional manner in written, oral and visual forms.

C. MSc in Advanced Mechanical Engineering

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 6. Define a research question, develop aim(s) and objectives, select and execute a methodology, analyse data, evaluate findings critically and draw justifiable conclusions, demonstrating self-direction and originality of thought

ILO 7. To communicate their individual research via a thesis and in an oral presentation in a style suitable for academic and professional audiences.

4. How is the course taught?

Students will be supported in their learning and personal development by engaging with the wider learning environment at Cranfield through attendance of seminars and lectures arranged from time to time. It is confirmed that the course will be delivered by conventional means with no element of distance learning and/or flexible delivery. The students will have access to the e-learning support through Blackboard.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction Week	0
Structural Integrity	10
Fluid Mechanics & Loading	10
CFD for Renewable Energy	10
Management For Technology.	10
ELECTIVE MODULES:	
2 modules from:	
Engineering Stress Analysis: Theory and Simulations	10
Advanced Control Systems	10
Power Generation Systems	10
Risk & Reliability Engineering	10
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction week Fluid Mechanics & Loading Advanced Control Systems Risk & Reliability Engineering Engineering Stress Analysis: Theory and Simulations Computational Fluid Dynamics for Renewable Energy Power Generation Systems Structural Integrity Management for Technology Group project (Full time students)	0 10 10 10 10 10 10 10 10 40
ELECTIVE MODULES:	
Part Time Students: Group Project OR Dissertation	 40 40
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Induction week Fluid Mechanics & Loading Advanced Control Systems Risk & Reliability Engineering Engineering Stress Analysis: Theory and Simulations Computational Fluid Dynamics for Renewable Energy Power Generation Systems Structural Integrity Management for Technology Group project (Full time students) Individual Research Project	0 10 10 10 10 10 10 10 10 40 80
ELECTIVE MODULES:	
Part Time Students: Group Project OR Dissertation	 40 40
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months
This course is also offered on a part-time basis for which students are able to register at any point during the year, and to complete the course within 24 or 36 (accordingly to the study plan agreed) calendar months.

Taught part 1: Modules
Each module is generally delivered over one week, with time allowed for more independent learning and reflection. Modules are given in the period between October and March. There are two exam periods; at the end of the first term and at the end of the second term. Full time students will undertake these modules in the same academic year. Part time students will agree a time plan with the Course Director before the start of the first year of their studies.

Taught part 2: Group Project / Dissertation (part time students only)
The Group Project takes place after the completion of the taught modules phase and consists of a total of 16 contact hours with a member of the teaching staff and 384 hours of private study and collaboration with the student members of the group. This corresponds roughly to 1.5 contact hours and 38 private study/group working hours per week. This module is compulsory for full time students, and optional for part time students. Part time students have the option of completing a Dissertation as an alternative to the Group Project. If part time students chose to take the Group Project module instead of completing a Dissertation they are required to attend (in person or remotely, ie through WebEx) the weekly group project meetings. A member of the teaching staff attends these meetings and attendance is recorded. It is compulsory for the part-time students to attend in person the first Group Project meeting (usually on the last week of February) and the

last meeting, when a group presentation with a poster is held. The majority of the work involved in the group project occurs outside the weekly meetings, and is planned and organized by the students. At the start of the Group Project, a group coordinator is nominated among the students. The group coordinator has to make sure that the part-time members of his group participate in the work outside the weekly meetings with the supervisor: this is not a new responsibility, since he/she has to do the same with full time students. For part time students, this collaboration outside the weekly meetings can be performed through attendance in person/remotely, phone, e-mail, written interim reports, etc. The group coordinator will take notes of these activities and report them to the group supervisor. Furthermore, the students use a shared drive owned by the Department, this is a repository for all the material produced and collected during the project. The supervisor, as member of the teaching staff, has access to it and he/she can monitor in a direct way the progresses of both part-time and full-time students.

Students opting for the Part-Time Dissertation will be assigned a supervisor by the Course Director and will agree with the supervisor an appropriate topic of study. This may be related to a workplace/industrial activity that is relevant to the student's work environment. The Dissertation will include a comprehensive literature review of classical and contemporary related material and also a discussion and properly argued conclusions. Where appropriate the Dissertation will acknowledge the work and contribution of others. The Dissertation module will be assessed in a similar way to the Group Project by presentation and formal report.

Individual Research Project
For full time students, the Individual Research Project takes place during the third term (April-September).
By the end of January each year, each student will be issued with a list of suggested titles for research projects. **Full time students** are expected to select three preferred topics of their thesis before the Christmas break. Students are encouraged to discuss the projects with the appropriate member(s) of academic staff, prior to making their selection. **Part time students** should define their research projects, to be undertaken commonly either partly or totally at their place of work, by the beginning of the second year of registration.

After the completion of the Group Project, full time students commence working on their research projects on a full-time basis. The research activity for part-time students starts commonly at the beginning of second year of registration (i.e. after successfully completing three taught modules). All students are required and must maintain regular contact (meetings, telephone conversations or e-mail correspondence) with their personal supervisor to discuss progress.

Course modules

The following modules outline all parts of the programme leading to an MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[3]	Total hours delivered by Visiting Lecturers[4]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[5] - 40% or 50%	Type of Assessment	Weighting within module[6] (%) of Independent assessments	Weighting within module of multi-part assessments[7] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[8]	Assessment Submission and/or exam date[9]	Assessment / Exam Retake date
1	I-ENE-INWK Occ A	Induction	G Drew	24		0	Y		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	N-AME-FML	Fluid Mechanics and Loading	M Collu	30		10	Y		09/10/17	13/10/17	40	ICW	100				FT 28/10/17 PT 11/11/17	July 18

[3] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[4] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[5] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[6] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[7] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[8] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[9] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[3]	Total hours delivered by Visiting Lecturers[4]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[5] - 40% or 50%	Type of Assessment	Weighting within module[6] (%) of Independent assessments	Weighting within module of multi-part assessments[7] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[8]	Assessment Submission and/or exam date[9]	Assessment / Exam Retake date
3	N-PSE-ACS Occ A	Advanced Control Systems	Y Cao	30		10	Y		06/11/17	10/11/17	40	ICW	100				FT 2/12/17 PT 16/12/17	July 18
4	N-AME-RR Occ A	Risk and Reliability Engineering	A Kolios	30		10	Y		13/11/17	17/11/17	40	EX	100				w/c 1/1/18	10 - 14/09/18
5	N-AME-ESA	Engineering Stress Analysis: Theory and Simulations	A Mehmanparast	32		10	Y		27/11/17	01/12/17	40	ICW	100				FT 2/1/18 PT 13/1/18	July 18
6	N-REE-CFDR	Computational Fluid Dynamics for Renewable Energy	T Nishino	30		10	Y		04/12/17	08/12/17	40	ICW	100				FT 20/1/18 PT 3/2/18	July 18
7	N-PSE-PGRES Occ A	Power Generation Systems	G Di Lorenzo	30		10	Y		08/01/18	12/01/18	40	ICW	100				FT 27/1/18	July 18

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[3]	Total hours delivered by Visiting Lecturers[4]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[5] - 40% or 50%	Type of Assessment	Weighting within module[6] (%) of Independent assessments	Weighting within module of multi-part assessments[7] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[8]	Assessment Submission and/or exam date[9]	Assessment / Exam Retake date
																	PT 10/2/18	
8	N-AME-SI	Structural Integrity	A Mehmanparast	38.5		10	Y		05/02/18	09/02/18	40	EX	100				W/C 19/2/18	10-14/09/18
9	G-MTI Occ A	Management for Technology	S Carver	50		10	Y		26/02/18	02/03/18	40	EX GCW	50 50				EX w/c 19/3/18 GCW FT 10/3/18 GCW PT 24/3/18	EX 10-14/09/18 GCW July 18
10	I-ENE-GRPP Occ A	Group Project	G Drew	16		40	Y		05/03/18	04/05/18	50 50	GPROJ ICW	80 20				01/05/18 11/05/18	
11	I-ENE-DISS Occ A	Dissertation (P/T students only)	G Drew	10		40	Y		02/10/17	29/09/18	50	IPROJ IPRES	80 20				28/09/18 28/09/18	
12	I-ENE-THESIS	Energy Individual Research Project	G Drew	20		80	Y		07/05/18	07/09/18	50 50	OR THESIS	10 90				03/09/18 03/09/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[3]	Total hours delivered by Visiting Lecturers[4]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[5] - 40% or 50%	Type of Assessment	Weighting within module[6] (%) of Independent assessments	Weighting within module of multi-part assessments[7] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[8]	Assessment Submission and/or exam date[9]	Assessment / Exam Retake date
	Occ A																	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
G-MTI	Management for Technology	School of Management	• Advanced Mechanical Engineering • REMS EngD • Design of Rotating Machines • Food Chain Systems • Offshore and Ocean Technology with Pipeline Engineering • Offshore Materials and Engineering • Offshore and Renewable Energy • Offshore Risk Management • Offshore and Ocean Technology with Subsea Engineering • Renewable Energy Engineering • Renewable Energy Technology • Flow Assurance for Oil and Gas Production • Energy Systems and Thermal Processes • Process Systems Engineering • Energy from Waste • Geothermal Engineering • Advanced Chemical Engineering
N-AME-ESA	Engineering Stress Analysis: Theory and Simulations	Advanced Mechanical Engineering	• Design of Rotating Machines • OOT With Offshore Materials Engineering • OOT With Pipeline Engineering • OOT With Risk Management • OOT With Offshore Renewable Energy • OOT With Subsea Engineering • Renewable Energy Engineering • REMS EngD

N-AME-RR	Risk and Reliability Engineering	Advanced Mechanical Engineering	• Flow Assurance for Oil and Gas Production • Process Systems Engineering • Renewable Energy Engineering • REMS EngD • Process Systems Engineering (Muscat)
N-AME-SI	Structural Integrity	Advanced Mechanical Engineering	• Flow Assurance for Oil and Gas Production • Design of Rotating Machines • Offshore and Ocean Technology With Offshore Materials Engineering • Offshore and Ocean Technology With Pipeline Engineering • Offshore and Ocean Technology With Offshore Renewable Energy • Offshore and Ocean Technology With Risk Management • Offshore and Ocean Technology With Subsea Engineering • Renewable Energy Engineering • Safety and Accident Investigation • REMS EngD
N-PSE-ACS	Advanced Control Systems	Process Systems Engineering	• Advanced Mechanical Engineering • Advanced Chemical EngineeringFlow Assurance for Oil and Gas Production • Energy Systems and Thermal Processes • Process Systems Engineering (Muscat) • REMS EngD
N-PSE-PGRES	Power Generation Systems	Energy Systems and Thermal Processes	• Advanced Mechanical Engineering • Advanced Chemical Engineering General Route • Geothermal Engineering • Energy Systems &

			Thermal Processes (Muscat)
N-REE-CFDR	Computational Fluid Dynamics for Renewable Energy	Renewable Energy Engineering	• Advanced Mechanical Engineering
N-AME-FML	Fluid Mechanics and Loading	Advanced Mechanical Engineering	• REMS EngD

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have three written examinations, seven pieces of assessment by submitted work and two elements of assessment by presentation or viva. This approach has been adopted in order to provide a balance between formal examination and a less rigid written/verbal communication.

Formal lecture courses are examined in accordance with the School of Water, Energy and Environment practice. Prior to the examinations taking place all examination papers are seen and approved first by a member of the department and then by the course external examiner.

The underlying assessment strategy across all modules will be to examine the understanding of mechanical engineering principles and applications. This will be achieved by testing the ability to solve realistic multi-disciplinary problems within a Mechanical Engineering context. Proper application and appreciation of mechanical engineering models and methodologies will be paramount to the successful completion of the course.

Coursework will be set to reinforce and expand taught elements of the course. This will be a combination of open ended assignments and analytical/numerical based problem solving. Coursework will be assessed on the rigour and quality of the reports with merit given to diligence and evidence of understanding of the underlying methods.

- Each course member is required to make a formal presentation on his/her Individual Research Project.
- Upon submission, all theses are reviewed by two internal examiners (one examiner being the course member's supervisor), plus the external examiner.
- If the Individual Research Project mark awarded by the internal examiners varies significantly, then a third internal examiner is appointed.
- All course members are subject to a presentation or viva voce examination in the presence of the External Examiner and members of Academic staff.

Assessment of Individual MSc Theses
The Individual Research Project (IRP) tests:

- The ability to define the project by reference to scientific, technical and/or commercial literature, the critical appraisal of such literature and the justification of the research;
- The ability to plan and manage the research programme, to define the work to be carried out and to report the results in a clear manner;
- The ability to analyse the work, relate it to the work of others where appropriate and to be self-critical;

- To communicate the work, its results and analysis in a technical and well-presented document.

Assessment of the Group Project (GP)
The Group project tests:

- The ability to undertake the design of an engineering component or system, and substantiate the design through analysis;
- The ability to plan and manage the design project programme, to define the work to be carried out and to report the results in a clear manner;
- The ability to analyse the design, relate it to the work of others where appropriate and to be self-critical;
- To communicate the design, its results and analysis in an oral presentation and in a technical and well-presented document.

Assessment of the Dissertation (Part-Time option) module tests:

- The ability to plan, structure and manage a detailed study of an engineering process, system, component or methodology and to communicate results in a clear manner;
- The ability to assemble a workplace/industrial activity into a coherent study formulating properly argued conclusions and where appropriate building upon and acknowledging the work and contribution of others;
- The ability to analyse and where appropriate to relate to the work of others and to be self-critical;
- To communicate the dissertation in an oral presentation and in a technical and well-presented document.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. PgCert

Award ILOs / **Module No.**	ILO 1.	ILO 2.	ILO 3.	ILO 4.
2	ICW	ICW	ICW	ICW
7	ICW	ICW	ICW	ICW
8	EX	EX	EX	EX
9	EX/GCW	EX/GCW	EX/GCW	EX/GCW
3	ICW	ICW	ICW	ICW
4	EX	EX	EX	EX
5	ICW	ICW	ICW	ICW
6	ICW	ICW	ICW	ICW

B. PgDip

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 5.
10	GPROJ ICW
11	IPROJ IPRES

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 6.	ILO 7
12	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Graduates from the course will be equipped with the academic skills and requirements to successfully pursue a career in a Mechanical Engineering discipline whether this is technical, management or research.

COURSE SPECIFICATION

Cranfield University: Course Specifications
Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE:	MSc in Advanced Motorsport Engineering

Date of first publication/latest revision:	February 2017

1. What is the course?

Course information

Course Title	MSc in Advanced Motorsport Engineering
Course code	MSAMGFTC, PDAMGFTC, PCAMGFTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip, PgCert
Mode of delivery	Full-Time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Advanced Vehicle Engineering Centre
Course Director	Mr Clive Temple
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	First or Upper Second class UK Honours degrees or the international equivalent in engineering, aerospace, materials science and closely related disciplines who wish to gain knowledge of the engineering, management, science and technologies relevant to motorsport. For students where their first language is not English they will need to provide evidence that they have achieved a satisfactory test result in an English qualification. The minimum requirement is IELTS - 7 or an equivalent, approved test.
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Advanced Vehicle Engineering Centre and other centres within the School where the research interests include:

- Active and passive aerodynamics
- Computational Fluid Dynamics (CFD)
- Carbon reduction and environmental impact
- Alternative energy sources, energy recovery systems and energy efficiency
- High temperature surface engineering including coatings
- Low carbon vehicles
- Powertrain development and refinement
- Condition monitoring and reliability
- Precision engineering
- Simulation including the supply of race car simulators to F1 (Cranfield Motorsport Simulation)
- Structural integrity and FIA approved impact testing including F1 and Le Mans Prototype (LMP) (Cranfield Impact Centre)
- Tyre modelling and characterisation
- Vehicle dynamics including on circuit and off road
- Vehicle light weighting, novel materials and composites with special reference to niche vehicles.
- Electronics and data acquisition
- The motorsport business cluster, technology transfer and diversification

Teaching and assessment is also provided by staff at the Shrivenham campus. Students benefit from access to motorsport related facilities at both campus sites.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by the following until September 2017:

- The Institution of Mechanical Engineers (IMechE)
- The Institution of Engineering and Technology (IET)
- The Royal Aeronautical Society (RAeS)

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- provide students with a sound understanding of the fundamental scientific, engineering and managerial principles involved in motorsport, and their implementation within a high performance technology context
- provide students with a clear knowledge of the design, construction and operation of competition vehicles, and related aspects of materials science, aerodynamics, structural analysis, vehicle systems, and management techniques related to motorsport.
- equip students with the skills required for the planning, execution and reporting of

motorsport projects and to prepare them for a variety of roles in motorsport.

This programme is intended for the following range of students:

- First or Upper Second class UK Honours degrees or the international equivalent in engineering, aerospace, materials science and closely related disciplines who wish to gain knowledge of the engineering, management, science and technologies relevant to motorsport.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Explain the key engineering subjects as applied to motorsport.
ILO 2. Evaluate the technologies that underpin motorsport engineering.
ILO 3. Exhibit an overview of motorsport engineering related disciplines and the context in which they are applied.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 4. Apply management skills such as team working to deliver a motorsport related group design project.
ILO 5. Demonstrate an evaluation of one or more motorsport engineering disciplines through contribution to a group report and delivery of a technical presentation as part of a team.
ILO 6. Critique the personal experience of the group design project in the form of a reflective report with reference to individual contribution and peer assessment.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 7. Provide critical analysis of an area of motorsport engineering in the form of a concisely written thesis project report.
ILO 8. Deliver a synthesis of the project in the form of an oral examination with reference to a poster that encapsulates the research.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Problem-based learning - this kind of learning encourages self-conducted, individualised learning and thereby also the students' own responsibility for learning, it should also support the personal and professional growth of the student.
- Use of experiences from laboratory or industrial practice, as a starting point when training abilities for problem solving and critical analysis, should greatly increase integration between theory and practice.

- Theoretical class exercises as a means for the students to learn how to apply variations of common solutions to standard problems and students get feedback from colleagues and lecturers.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Introduction to Motorsport To accumulate 60 credits from Modules 2-9	0 60
ELECTIVE MODULES:	
N/A	N/A
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Introduction to Motorsport Modules 2-9 Group Design Project	0 80 40
ELECTIVE MODULES:	
N/A	N/A
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Introduction to Motorsport Modules 2-9 Group Design Project	0 80 40

Individual Research Project	80
ELECTIVE MODULES:	
N/A	N/A
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in late September and are expected to complete the course within 12 calendar months, submitting their thesis, undertaking the oral examination with

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

poster and attending the industrial thesis exhibition in September (students with restricted theses are not required to attend the exhibition).

Each module is taught over five days, usually with an intervening week for assimilation and time to work on the assignments or revise for examinations.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-MEM-INWK	Introduction to Motorsport	Clive Temple	35	0	0	N		02/10/17	06/10/17	n/a	AO	n/a				n/a	n/a
2	I-MEM-A1519	Motorsport Structural Analysis	Dr Rishi Abhyankar	35	0	10	N		09/10/17	13/10/17	50	ICW	100				06/11/17	At the next available opportunity which may not be until the course runs the following year

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
3	I-MEM-A1001	Motorsport Electronics and Data Acquisition	Dr Kim Blackburn	35	0	10	N		23/10/17	27/10/17	50	EX	100				04/01/18	At the next available opportunity which may not be until the course runs the following year
4	I-MEM-A1007	Motorsport Vehicle Dynamics	Dr James Brighton	35	0	10	N		06/11/17	10/11/17	50	EX	100				05/01/18	At the next available opportunity which may not be until the course runs the following year
5	I-MEM-A1006	Motorsport Aerodynamics	Prof Kevin Garry	35	0	10	N		20/11/17	24/11/17	50	GCW	100				15/12/17	At the next available opportunity which may not be until the course runs the following year
6	I-MEM-A1012	Computational Fluid Dynamics for Motorsport	Dr Laszlo Konozsy	35	0	10	N		04/12/17	08/12/17	50	ICW	100				08/01/18	At the next available opportunity which may not be until the course runs the following year
7	I-MEM-A1005	The Business of Motorsport	Clive Temple	35	0	10	N		05/02/18	09/02/18	50			100 MULTI	GPRES GCW	30 70	19/02/18 19/02/18	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
8	I-MEM-A1004	Composite Structures for Motorsport	Dr Veronica Marchante Rodriguez	35	0	10	N		22/01/18	26/01/18	50	EX	100				13/02/18	At the next available opportunity which may not be until the course runs the following year
9	I-MEM-A1008	Motorsport Power Train Design	Clive Temple	35	32	10	N		08/01/18	12/01/18	50	ICW	100				29/01/18	At the next available opportunity which may not be until the course runs the following year
10	I-MEM-GRPP	Group Design Project	Clive Temple / Dr Kim Blackburn	40	0	40	N		11/02/18	10/05/18				MULTI (1) 80 MULTI (2) 20	GPROJ GPRES ICW ICW	80 20 50 50	10/05/18 10/05/18	
11	I-MEM-THESIS	Individual Research Project	Clive Temple / Dr Kim Blackburn	40	n/a	80	N		11/05/18	07/09/18		THESIS OR	80 20				30/08/18 05/09/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N/A	N/A	N/A	N/A

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have written examinations, assessment by submitted work and elements of assessment by oral presentation or viva. However, only one form of assessment will be used in relation to a taught module, either an assignment or a closed book examination.

This approach has been adopted in order to offer diversity in assessing students in relation to learning outcomes. The Course also employs peer- and self-assessment activities to reinforce the reflective abilities that are necessary for working effectively in teams. These encourage student involvement with their learning, and give them some sense of responsibility with regards to the unit of study.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO 1.	ILO 2.	ILO 3.
1	AO	AO	AO
2	ICW	ICW	
3	EX	EX	EX
4	EX	EX	EX
5	GCW	GCW	GCW
6	ICW	ICW	ICW
7		GCW GPRES	GCW GPRES
8	EX	EX	EX
9	ICW	ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 4.	ILO 5.	ILO 6.
10	GCW	GPRES GPRAC GCW	ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 7.	ILO 8.
11	THESIS	OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)
N/A	N/A	N/A	N/A
		N/A	N/A

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

Engineering roles in motorsport and high performance engineering: students have gone onto careers in F1, WRC, Moto GP, endurance racing, touring cars, motorsport equipment manufacturers and suppliers, automotive OEMs and consultancies.

COURSE SPECIFICATION

Cranfield University: Course Specifications
Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Aerospace Computational Engineering

Date of first publication/latest revision: 15.03.2017

1. What is the course?

Course information

Course Title	MSc in Aerospace Computational Engineering
Course code	MSACNFTC, MSACNPTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip, PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield
School(s)	School of Aerospace, Transport and Manufacturing (SATM)
Theme	Aerospace
Centre	Computational Engineering Sciences
Course Director	Dr. Laszlo Konozsy
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	N/A
Registration Period(s)	Full-time MSc - one year, Part-time MSc - three years

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

available	
Course Start Month(s)	September

Institutions delivering the course

This course is delivered by School of Aerospace, Transport and Manufacturing (SATM), Aerospace Theme, Centre of Computational Engineering Sciences where the research interests include:

- Fluid dynamics of single- and multi-phase and multi-species flows.
- Steady and unsteady aerodynamics for investigating laminar and turbulent flows.
- Transitional flows, classical and advanced turbulence modelling.
- Heat transfer and its application related to complex flow problems.
- Development of advanced numerical methods for a broad range of fluid flow problems.
- Scientific and high performance computing.
- Computational fluid dynamics with the applications in aerospace, automotive, environmental, energy, micro- and nanotechnology, nuclear, bio-medical, chemical and defence sectors.
- Computer vision.
- Vibro-acoustics for condition monitoring.
- Computational engineering for fluids and solids.
- Software Engineering for Technical Computing, Computer Aided Engineering.

Cranfield University interacts with the following institutions and in the following ways:

The course has a strong association with a number of academic institutions world-wide that regularly supply students onto MSc courses in the Centre of Computational Engineering Sciences at Cranfield University. Students may follow the course as part of a double degree arrangement with their home institution whereby the final year of their five year programme is replaced with the MSc here at Cranfield. Other students are self-funded.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)
We will be seeking accreditation for IET, IMechE, and RAeS. This course is designed to align with the MSc in Computational and Software Techniques in Engineering and the MSc in Computational Fluid Dynamics, which are already accredited.

2. <u>What are the aims of the course?</u>

- Provide a comprehensive training programme in Aerospace Computational Engineering (ACE) which will enhance the skills of the graduate student through a detailed introduction to the state-of-the-art computational methods and their applications for digital age aerospace engineering applications.
- Combination of both computational flow physics and computational science to enable the student to understand the current suite of digital techniques for aerospace simulations.
- Access to the university High Performance Computing (HPC) facilities for teaching and research projects and opportunity to work on research projects proposed by industry.
- Provide a unique opportunity to work within a team on a cutting edge group project based on a digital wind tunnel for aerospace applications through the Cranfield Aerospace Integrated Research Centre (AIRC).

- Provide a unique opportunity for cross-disciplinary education and knowledge transfer in the computational engineering of fluid and solid mechanics for aerospace industrial applications.
- Produce graduate engineers and leaders for the rapidly expanding digital simulation age focusing on fully integrated digital design for aerospace applications to understand and implement numerical methods on various computing platforms for aerospace applications.
- Provide a CPD opportunity through the part-time course option for qualified engineers wishing to extend their knowledge of Aerospace Computational Engineering and incorporate CFD into their practice.
- Equip graduates with the knowledge, understanding and skills required to enable them to meet the demand of an evolving workplace that requires highly qualified engineers possessing core software engineering skills together with competency in mathematical analysis techniques.
- Develop suitably trained and qualified engineers, scientists and mathematicians enabling them to apply the analytical, computational and software skills to the solution of practical engineering IT problems in industrial, commercial and governmental organisations.

This programme is intended for the following range of students:

- UK students with an honours degree in Engineering, Computer Science, Mathematics, Physics.
- Mature students with at least 5 years relevant industrial experience.
- Students studying at recognised EU Universities with at least 4 years of relevant academic study.
- Recent graduates wishing to extend their knowledge and skills in the above areas.
- Qualified engineers wishing to apply their skills in new areas.
- Qualified engineers working with computational methods in a particular area wishing to extend their knowledge and enhance their practice by knowledge transfer from different application areas.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Assess and evaluate the selection of computer languages, software tools, and technologies, and apply them to solve practical problems of a computational nature in aerospace engineering solutions.

ILO 2. Distinguish the principles of numerical analysis, concepts of stability, approximation and convergence, and estimate the numerical solution of the system of algebraic equations.

ILO 3. Create original software solutions to aerospace computational engineering problems by using industry standard software libraries, packages and engineering tools.

ILO 4. Assess the state-of-the-art computational methods for incompressible and compressible flows used in aerospace engineering including the understanding of the advantageous features and limitations of these methods to identify the possible sources of uncertainties for aerospace applications.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Compose written reports and prepare and deliver oral presentations that effectively communicate proposals, technical developments, and computational results.

ILO 6. Set up a systematic approach to mesh generation methods and visualisation techniques including their application and interpretation for aerospace engineering problems.

ILO 7. Distinguish between open source and commercial Computational Fluid Dynamics and Finite Element Analysis software packages relevant to aerospace application(s).

ILO 8. Use and select appropriate software packages to practical aerospace computational engineering application(s), and evaluate the outcome.

ILO 9. Critically evaluate a project to include: a) computational aerospace engineering methods; b) project outcomes and results; c) one or more aspects of strength and weakness of the selected methods; d) propose appropriate solutions for the investigated aerospace application; e) recommendations for the future work.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 10. Distinguish and assess systematic computational aerospace engineering methods for different industrially relevant fluid flow problems with the focus on planning and implementing assigned projects under time pressure, and undertake self-directed learning when necessary.

ILO 11. Assemble a body of relevant technical literature in the field of aerospace computational engineering and discuss and evaluate each work with respect to a technical problem relevant to an industrial application.

ILO 12. Propose, plan and implement an independent research project on a relevant technical topic of aerospace engineering and critically evaluate project results, discuss findings, and relate their contribution to other works in the field.

4. <u>How is the course taught?</u>

Students will be supported in their learning and personal development by:

- A comprehensive set of carefully prepared lecture notes that form the basis for the teaching will be available to students on the VLE. This is perhaps the most valuable resource and reference point for the student starting a new module. Secondly, many lectures are given in PC Labs in conjunction with some form of programming. Students are encouraged, given time and practical assistance to develop their software skills. Part-time students applying to current MSc's within the CES centre are primarily coming from industry and contribute to the diverse structure of the centre. Therefore, the learning experience of part-time students will be supported by providing them with course material and support through distance learning techniques. Part-time students will be supported through regular consultations by using e.g. WebEx and Skype as a part of their study. For performing simulations, part-time students will have opportunity to access our High-Performance Computing facilities remotely. Regular meetings will be organised for each group when the group design project will be running and part-time students will be able to attend on these meetings either in person or online. Additionally, a Part-Time Student Advisor (PTA) will be appointed from the academic team who can advise on module selection for years 1 and 2 and maintain university and course updates whilst away from Cranfield thus ensuring the part-time student is prepared before attending any modules in Cranfield.
- The library resources and search facilities here at Cranfield. A thorough introduction to these resources and demonstrations of information retrieval skills is provided at the

beginning of the course. The library facilities are extensive and there is a good representative selection of books and periodicals relevant to the course. Where an article, book or periodical is not available it can usually be obtained elsewhere via inter-library loans. Books, software and other resources are purchased by the group when it is necessary for one of the projects.

- This course uses assignment, group project and individual thesis project. This approach has been adopted in order to prepare the student with the requisite skills for a career in digital engineering, digital engineering management or research. This approach will enable the student to demonstrate an understanding of theory and application at masters level through written technical reports and papers and oral presentations. Since in this course practical application is key to development of understanding and skills acquisition, all taught modules are assessed by individual assignment. In addition, a group project will be assessed based on the skill sets acquired through the taught components of the course. Finally, application of the knowledge and its understanding is also assessed through the thesis project.
- A programme of seminars given by external and internal speaker is also provided for the MSc in Aerospace Computational Engineering students. These reflect the course, sponsoring companies and associated research carried out in the group enabling the students to get an appreciation of related work going on in industry and other universities. Part-time students will usually be able to attend on the aforementioned seminars through e.g. WebEx and Skype as a part of their study. Furthermore, additional consultation hours and support will be offered by the module leaders between the end of their completed modules and the start of their subsequent modules.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 1-4 20 credits selected from Modules 5-8	40 20
ELECTIVE MODULES:	
n/a	
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits

COMPULSORY MODULES:	
Modules 1-8 Group Project for full-time students (9) or Individual Dissertation for part-time students (10)	80 40
ELECTIVE MODULES:	
n/a	
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules 1-8 Group Project for full-time students (9) or Individual Dissertation for part-time students (10) Individual Research Project (11)	80 40 80
ELECTIVE MODULES:	
n/a	
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in September and are expected to complete the course within 11 calendar months.

Part-time students register for the course in September and are expected to complete the course within 3 years.

Each module is taught over a period of one week. Practical work forms an important part of the teaching and so a significant amount of time is devoted to hands-on sessions with a software package or development environment. This also facilitates independent learning on the part of the student.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-CST-C++P04	C++ Programming	Dr Irene Moulitsas	32	0	10	Y		26/09/17	06/10/17	40	ICW	100				18/12/17 (F-T) 03/01/18 (P-T)	19/03/18
2	N-CST-CM	Computational Methods	Dr Irene Moulitsas	31	0	10	Y		27/09/17	06/10/17								
3	N-CFD-NMCF	Numerical Modelling for Steady and	Dr Panagiotis Tsoutsanis	20	0	10	Y		15/01/18	19/01/18	40	ICW	100				16/02/18 (F-T)	13/06/18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Unsteady Compressible Flows															02/03/18 (P-T)	
4	N-CFD-NMIF	Numerical Modelling for Steady and Unsteady Incompressible Flows	Dr Laszlo Konozsy	20	0	10	Y		20/11/17	24/11/17	40	ICW	100				10/01/18 (F-T) 24/01/18 (P-T)	10/04/18
5	N-ACN-AVBDS	Analysis and Visualisation of Big Data System and High Performance Computing	Dr Zeeshan Rana	20	0	10	N		12/02/18	16/02/18	40	ICW	100				16/03/18 (F-T) 30/03/18 (P-T)	16/05/18
6	N-ACN-MAAE	Modelling Approaches for Aerospace Engineering	Dr Laszlo Konozsy	20	0	10	N		04/12/17	08/12/17	40	ICW	100				26/01/18 (F-T) 09/02/18 (P-T)	25/05/18
7	N-CST-CAEAA	CAE Advanced Applications	Dr Laszlo Konozsy	35	0	10	Y		29/01/18	02/02/18	40	ICW	100				30/03/18 (F-T)	18/05/18

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																	13/04/18 (P-T)	
8	N-ACN-VVAA	Validation and Verification for Aerospace Applications	Dr Zeeshan Rana	20	0	10	N		06/11/17	10/11/17	40	ICW	100				05/01/18 (F-T) 19/01/18 (P-T)	18/05/18
9	N-ACN-GP	Group Project - ACE	Dr Laszlo Konozsy	40	0	40			26/02/18	04/05/18	50 50			80 20	GPROJ GPRES RP	80 20 100	04/05/18	20/08/18
10	N-ACN-DISS	Individual Dissertation (for Part-Time Students)	Dr Laszlo Konozsy	40	0	40			26/02/18	02/03/18	50			100	ICW RP	80 20	20/04/18	20/08/18
11	N-ACN-THESIS	Individual Research Project - ACE	Dr Laszlo Konozsy	40	0	80			15/05/18	20/08/18	50 50	THESIS OR	90 10				20/08/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-CST-C++PO4	C++ Programming	Computational and Software Techniques in Engineering	MSc in Aerospace Computational Engineering
N-CST-CM	Computational Methods	Computational and Software Techniques in Engineering	MSc in Aerospace Computational Engineering
N-CFD-NMCF	Numerical Modelling for Steady and Unsteady Compressible Flows	Computational Fluid Dynamics	MSc in Aerospace Computational Engineering
N-CFD-NMIF	Numerical Modelling for Steady and Unsteady Incompressible Flows	Computational Fluid Dynamics	MSc in Aerospace Computational Engineering
N-CST-CAEAA	CAE Advanced Engineering	Computational and Software Techniques in Engineering	MSc in Aerospace Computational Engineering

7. How are the ILOs assessed?

This course uses assignment, group project and individual thesis project.

This approach has been adopted in order to prepare the student with the requisite skills for a career in digital engineering, digital engineering management or research. It will enable the student to demonstrate an understanding of theory and application at masters level through written technical reports and papers and oral presentations. Since in this course practical application is key to development of understanding and skills acquisition, all taught modules are assessed by individual assignment. In addition, a group project will be assessed based on the skill sets acquired through the taught components of the course. Finally, application of the knowledge and its understanding is also assessed through the thesis project.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / **Module No.**	ILO1	ILO2	ILO3	ILO4
1	ICW			

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4
2	ICW	ICW		ICW
3			ICW	ICW
4			ICW	ICW
5		ICW		
6		ICW		
7				ICW
8		ICW	ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO5	ILO6	ILO7	ILO8	ILO9
9	GPROJ GPRES RP	GPROJ GPRES RP	GPROJ GPRES RP	GPROJ GPRES RP	GPROJ GPRES RP
10	ICW RP	ICW RP	ICW RP	ICW RP	ICW RP

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO10	ILO11	ILO12
11	OR THESIS	OR THESIS	OR THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)
Two modules with an Integrated Assessment	N-CST-C++P04 – C++ Programming N-CST-CM Computational Methods	ICW	100

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

This Masters course in 'Aerospace Computational Engineering', with its blend of skills-based and subject-specific material equips students with the generic hands-on skills and up-to-date knowledge adaptable to the wide variety of applications in the field of aerospace computational engineering. This will lead to opportunities within the rapidly expanding digital engineering sector and specifically to the aerospace industry where fully integrated digital techniques are used. This approach is widely used in companies such as Airbus, Boeing, Rolls Royce and Siemens.

Typically students seek employment in the computational aerospace engineering market. Enquiries regarding availability of potential employees are received from many quarters, both in the EU and elsewhere. There is considerable demand for personnel with expertise in aerospace engineering software development and for those who have strong technical programming skills in industry standard languages and tools. Graduates of the courses currently within the Centre of Computational Engineering Sciences are in demand by CAD vendors, commercial engineering software developers, aerospace, automotive, and other industries and research organisations. Successful students, have been particularly successful in finding long-term employment.

Some students may go on to register for PhD degrees, many, on the basis of their MSc research project. Thesis topics are most often supplied by individual companies on in-company problems with a view to employment after graduation - an approach that is being actively encouraged by a growing number of industries.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Aerospace Dynamics

Date of first publication/latest revision: October 2017

1. What is the course?

Course information

Course Title	MSc in Aerospace Dynamics with options in: Aerodynamics Flight Dynamics
Course code	MSASDFTC, MSASDPTC, PCASDFTC, PCASDPTC
Academic Year	2017-18
Valid entry routes	MSc
Additional exit routes	PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Aeronautics
Course Director	Jenny Holt
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Aeronautics where the research interests include:

- Fluid Mechanics
- Flight Dynamics
- Applied Aerodynamics Applications

Cranfield University interacts with the following institutions and in the following ways:

- We offer APL to students of the Empire Test Pilot School who wish to undertake this course and meet the standard entry requirements of the University.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by The Royal Aeronautical Society (RAeSoc) until 2016.

2. What are the aims of the course?

Cranfield University offers this course in order to:

- equip candidates from backgrounds in engineering or physical science with the knowledge, understanding and skills required to enable them to contribute to the aerospace industry or to aerospace related research;
- develop a candidates' specialist technical skills and to give them an awareness of aerospace sciences so that their specialist skills can be most effectively applied;
- develop the candidates transferable skills for a professional career in the aerospace or related industry.

Postgraduate Certificate (PGCert) exit route is provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Those with undergraduate qualifications in General Engineering, Mathematics or Physics seeking to move into the aerospace sector.
- Those with undergraduate qualifications in Aeronautical Engineering seeking to specialise in a specific branch of Aerospace Dynamics or to broaden their knowledge and understanding of this area.
- Those with the other academic qualifications together with the required number of years industrial experience such that they meet Cranfield University's equivalent entry requirements, who are looking to obtain a formal Masters level qualification in Aerospace Dynamics.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic knowledge and critical evaluation of the key principles of the aerospace disciplines (aerodynamics, control, flight dynamics, etc.) and apply appropriate engineering analysis methodologies.

ILO 2. Demonstrate the ability to critically analyse the engineering aspects of aerospace applications, methodologies, systems and design. Assess limitations and apply theory, simulation or experimentation to mitigate deficiencies.

ILO 3. Demonstrate a critical judgement of their specialist subject area(s) at a level appropriate to new recruits to the aerospace industry such that they are able to contribute directly without significant further training with a knowledge and understanding of the commercial and social context in which the aerospace industry operates

ILO 4. Be able to apply their knowledge and understanding practically to the design and analysis of aerospace projects. Monitoring and adjusting both an individual programme of work and demonstrating the ability to work as an effective team member exercising initiative appropriately.

B. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Identify a research question. Collect and analyse research data investigating new and emerging aerospace applications

ILO 6. Develop project objectives.

ILO 7. Select and justify methodologies appropriate to the task. Selecting engineering analysis methodologies, experimental methodologies and design processes and adapting them where necessary

ILO 8. Plan and execute a work programme with reference to professional project management processes (e.g. time management; risk management; contingency planning; resource allocation; health and safety).

ILO 9. Evaluate and critically analyse literature; analyse data, synthesise a discussion, generate conclusions.

ILO 10. Place the findings of the work into the context of the work of others.

ILO 11. Communicate findings in the form of a thesis, formal presentation and viva.

4. <u>How is the course taught?</u>

Students will be supported in their learning and personal development by:

Candidates are required to undertake a Group Flight Test exercise (20 credits) which is conducted in conjunction with the National Flying Laboratory Centre (NFLC), based within the School of Aerospace, Transport and Manufacturing, Cranfield University. This element of the programme involves flights in the Jetstream aircraft flying laboratory, together with conventional supporting lectures, laboratory sessions and tutorials.

The taught element of the programme (80 credits) involves a considerable degree of choice such that candidates can select the module portfolio to reflect their personal career aspirations and skills. The final MSc option – Aerodynamics or Flight Dynamics, is determined by the choice of Research thesis topic.

5. <u>What do students need to achieve in order to graduate?</u>

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate
The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	**Credits**
COMPULSORY MODULES:	
N/A	N/A
ELECTIVE MODULES:	
Taught Component – a total of 60 credits taken from modules 1-18	60
TOTAL:	60

B. MSc
The accumulation of 200 credits (or more) through the assessment of taught modules and the successful completion of the thesis as detailed below:

Description	**Credits**
COMPULSORY MODULES:	
Flight Experimental Methods (Group Flight Test Report) (module 1) Individual Research Project (module 20)	20 100
ELECTIVE MODULES:	
Taught Component – a total of 80 credits taken from modules 2-18	80
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout

the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months.

This course is also offered on a part-time basis. Students taking this route would instead register for a minimum of 3 years and agree with the Course Director beforehand a programme of work that meets the same minimum requirements as the full time variant, but over the longer period.

Individual modules are taught over a period of one, two or three weeks (usually, but not always arranged consecutively). The duration depends on whether the module contains 10, 20 or 30 hours of lecture contact time. These are normally arranged such that there are two hours of lectures per day, 5 days per week, with additional laboratory and/or tutorial sessions arranged during each week. Two modules would normally be offered during each week.

The formal taught part of the programme is split into two Teaching Periods each of nominally 11 weeks. A period during which formal written examinations can be scheduled follows each Teaching Period. For Masters students the remainder of the programme is devoted to the Research Thesis.

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[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ASD-GFTR	Flight Experimental Methods (Group Flight Test Report)	Dr Alastair Cooke	50		20	Y		10/10/17	28/10/17	50			100 MULTI	GPRAC OR	70 30	23/11/17	At the next available opportunity which may not be until the course runs the following year
2	N-ASD-CF	Compressible Flows	Dr Simon Prince	20		10	N		09/11/17	11/11/17	40	EX	100				15/12/17	At the next available opportunity which may not be until the course runs the

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
3	N-ASD-VF	Viscous Flow	Prof Kevin Garry	22		10	N		14/11/17	09/12/17	40	EX	100				10/01/18	At the next available opportunity which may not be until the course runs the following year
4	N-ASD-CS	Control Systems	Dr James Whidborne	28		10	Y		07/11/17	25/11/17	40			100 MULTI	ICW EX	50 50	16/12/17 11/01/18	At the next available opportunity which may not be until the course runs the following year
5	N-ASD-FRPSC	Fundamentals of Rotorcraft Performance, Stability and Control	Dr Alastair Cooke	10		5	Y		21/11/17	25/11/17	40	EX	100				09/01/18	At the next available opportunity which may not be until the course runs the following year
6	N-ASD-FDP	Flight Dynamics Principles	Dr Alastair Cooke	20		10	Y		21/11/17	02/12/17	40	ICW	100				01/02/18	At the next available opportunity which may not be until the course runs the following year
7	N-ASD-TF	Introduction to Transonic Flow	Dr Nick Lawson	10		5	N		31/10/17	01/11/17	40	EX	100				16/12/17	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		may not be until the course runs the following year
8	N-ASD-FQFC	Flying Qualities and Flight Control	Dr Alastair Cooke	40		15	Y		23/01/18	10/02/18	40	ICW	100				10/03/18	At the next available opportunity which may not be until the course runs the following year
9	N-ASD-MVCAA	Multivariable Control Systems for Aerospace Applications	Dr James Whidborne	30		10	Y		30/01/18	10/02/18	40	EX	100				08/04/18	At the next available opportunity which may not be until the course runs the following year
10	N-ASD-AMS	Air-Vehicle Modelling and Simulation	Dr James Whidborne / Dr Mudassir Lone	28		10	Y		16/01/18	20/01/18	40	GCW	100				03/02/18	At the next available opportunity which may not be until the course runs the following year
11	N-ASD-LRA	Launch and Re-Entry Aerodynamics	Dr Simon Prince	10		5	Y		25/01/18	27/01/18	40	EX	100				27/04/18	At the next available opportunity which may not be until the course runs the following year
12	N-ASD-TSA	Technology for Sustainable	Prof Kevin Garry and	10		5	N		30/01/18	03/02/18	40	EX	100				28/04/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Aviation	Jenny Holt															may not be until the course runs the following year
13	N-ASD-ICFD	Introduction to CFD	Dr Panagiotis Tsoutsanis	35		10	N		20/02/18	24/02/18	40	GCW	100				07/04/18	At the next available opportunity which may not be until the course runs the following year
14	N-ASD-EXA	Experimental Aerodynamics	Jenny Holt	34		10	N		13/03/18	17/03/18	40			100 MULTI	GCW OR	55 45	13/04/18	At the next available opportunity which may not be until the course runs the following year
15	N-ASE-GPS	Aerospace Navigation and Sensors	Dr Stephen Hobbs	26		10	Y		27/02/18	14/03/18	40			100 MULTI	EX ICW	50 50	24/04/18 07/04/18	At the next available opportunity which may not be until the course runs the following year
16	N-ASD-SAD	Supercritical Aerofoil Design	Dr Simon Prince	10		5	N		01/03/18	03/03/18	40	ICW	100				31/03/18	At the next available opportunity which may not be until the course runs the following year
17	N-ASD-FASD	Fundamentals of Aircraft System	Dr Mudassir Lone	20		10	Y		06/03/18	10/03/18	40	EX	100				25/04/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Identification																may not be until the course runs the following year
18	N-ASD-EFARW	CFD for External Flows in Aerospace Applications and Rotating Wings	Dr Panagiotis Tsoutsanis	20		10	N		04/04/18	07/04/18	40	GCW	100				08/05/18	At the next available opportunity which may not be until the course runs the following year
19	N-AVD-MDS	Modelling of Dynamic Systems	Dr James Whidborne	13		0	Y		24/10/17	28/10/17	N/A	AO	N/A				N/A	N/A
20	N-ASD-THESIS	Individual Research Project	Prof Kevin Garry	0		100	N		02/05/18	16/08/18				100 MULTI	THESIS OR	85 15	16/08/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ASD-GFTR	Flight Experimental Methods (Group Flight Test Report)	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control
N-ASD-CS	Control Systems	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control, Aerospace Vehicle Design, Astronautics and Space Engineering
N-ASD-FRPSC	Fundamentals of Rotorcraft Performance, Stability and Control	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control
N-ASD-FDP	Flight Dynamics Principles	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control
N-ASD-FQFC	Flying Qualities and Flight Control	Aerospace Dynamics	Flight Test and Flight Dynamics
N-ASD-MVCAA	Multivariable Control Systems for Aerospace Applications	Aerospace Dynamics	Flight Test and Flight Dynamics, Astronautics and Space Engineering
N-ASD-AMS	Air Vehicle Modelling and Simulation	Aerospace Dynamics	Flight Test and Flight Dynamics, Autonomous Vehicle Dynamics and Control
N-ASD-LRA	Launch and Re-Entry Aerodynamics	Aerospace Dynamics	Astronautics and Space Engineering
N-ASE-GPS	Aerospace Navigation and Sensors	Astronautics and Space Engineering	Astronautics and Space Engineering, Flight Test and Flight Dynamics
N-ASD-FASD	Fundamentals of Aircraft System Identification	Aerospace Dynamics	Flight Test and Flight Dynamics
N-AVD-MDS	Modelling of Dynamic Systems	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control, Aerospace Vehicle Design, Astronautics and Space Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students following the Masters programme can expect to have 6 - 10 written examinations, 4 - 8 pieces of assessment by submitted work and 1 - 3 elements of assessment by presentation or viva. (The range in each case depends on the modules selected within the two options available). This approach has been adopted in order to assess as broad a range as possible of a candidates' skills and abilities.

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Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4
N-ASD-GFTR	ICW	ICW	ICW	ICW
N-ASD-CF	EX			
N-ASD-VF	EX			
N-ASD-CS	ICW, EX	ICW		ICW
N-ASD-FRPSC	EX			
N-ASD-FDP	ICW	ICW		ICW
N-ASD-TF	EX			
N-ASD-FQFC	ICW	ICW	ICW	ICW
N-ASD-MVCAA	EX			
N-ASD-AMS	GCW	GCW		GCW
N-ASD-LRA	EX			
N-ASD-TSA	EX		EX	
N-ASD-ICFD	GCW	GCW		GCW
N-ASD-EXA	ICW, OR	ICW, OR		ICW
N-ASE-GPS	ICW, EX	ICW, EX	ICW, EX	
N-ASD-SAD	ICW	ICW		ICW
N-ASD-FASD	EX	EX		
N-ASD-EFARW	GCW	GCW		GCW

B. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9	ILO 10	ILO 11
N-ASD-GFTR			ICW, OR		ICW, OR	ICW, OR	OR
N-ASD-ICFD			GCW				
N-ASD-EXA			ICW	ICW	ICW	ICW	OR
N-ASD-EFARW			GCW		GCW	G7CW	
N-ASD-THESIS	THESIS, OR	THESIS, OR	THESIS, OR	THESIS, OR	THESIS, OR	THESIS, OR	THESIS, OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the

University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

Aerospace Dynamics graduates obtain employment in a wide range of industrial organisations both within Europe and worldwide. Employment is predominantly within the Aerospace Industry but increasingly graduates are in demand from the Energy, Environment and Automotive sectors.

A significant proportion of graduates go on to undertake higher degrees both in the UK and overseas.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Aerospace Manufacturing

Date of first publication/latest revision: December 2016

1. What is the course?

Course information

Course Title	MSc in Aerospace Manufacturing
Course code	MSAMFFTC, MSAMFPTC, PDAMFFTC, PDAMFPTC, PCAMFFTC, PCAMFPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace , Transport and Manufacturing
Theme	Manufacturing
Centre	Sustainable Manufacturing Systems Centre
Course Director	Dr Konstantinos Salonitis
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years, Full-time PgDip - one year, Part-time PgDip - two years, Full-time PgCert - one

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

	year, Part-time PgCert – two years
Course Start Month(s)	Full-time: October and March. Part-time: throughout the year

Institutions delivering the course

This course is delivered by the School of Aerospace, Transport and Manufacturing, Manufacturing Theme, Sustainable Manufacturing Systems Centre where the research interests include:

- Operations Management
- Manufacturing Systems Engineering
- Product-Service Systems
- Supply Chain Management
- Simulation and Modelling

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Institution of Mechanical Engineers (IMechE) up to and including Academic year 2015-16**, Institution of Engineering and Technology (IET) up to and including Academic year 2015-16**, Royal Aeronautical Society (RAeS) up to and including Academic year 2015-16****.**

(** Accreditation up to and including Academic year 2019-20 is awaiting review of the output of the accreditation visit).

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to prepare and develop future aerospace manufacturing engineers and managers/ leaders who will be able to manage major implementation programmes or instigate interventions that deliver improvements to the performance of their aerospace manufacturing businesses.

The objectives of the course have been set to:

- Equip students with the skills necessary for aerospace manufacturing/production systems and their supply chain.
- Develop student's awareness and understanding of manufacturing strategy and operations management to address aerospace manufacturing industry problems.
- Provide students with an appreciation of manufacturing technologies, concepts and tools relevant to the aerospace manufacturing sectors.
- Develop students' transferable skills such as analytical and interpersonal skills needed for the creative and effective application of knowledge to address aerospace manufacturing issues.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Talented UK students with a high grade BSc level.
- Ambitious high quality students with an international background.
- Mid-career professionals who want to boost their career.
- Those wishing to work nationally or internationally with aerospace manufacturing companies that need to address manufacturing systems problems.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic understanding of *aerospace manufacturing functions* including manufacturing systems, supply chain management and manufacturing strategy development.

ILO 2. Analyse different methods and techniques needed for credible aerospace manufacturing system design and improvement projects.

ILO 3. Develop original and in-depth knowledge of aerospace manufacturing operations and critically evaluate the appropriate applications of methodologies to support them.

ILO 4. Critically evaluate theories for the analysis and design tools and their application to (a) solve aerospace manufacturing problems in terms of technology and/or organisations and (b) increase the effectiveness of aerospace manufacturing systems.

ILO 5. Demonstrate comprehensive knowledge of aerospace materials including metals, ceramics and composites, aerospace structures, advanced joining techniques and precision machining.

ILO 6. Analyse and re-design aircraft assembly processes.

ILO 7. Analyse different assessment techniques to fracture mechanics.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 8. Demonstrate the ability to apply practical and rigorous approaches to formulate projects, develop engineering solutions and evaluate their effectiveness.

ILO 9. Asses some key project management techniques, and at the same time, demonstrate awareness of the less science-dependent aspects of technology.

ILO 10. Demonstrate transferable skills including, personal responsibility, complex decision making and independence for further learning.

ILO 11. Demonstrate ability to provide technical and additionally commercial leadership through planning industrial/research projects (budgets, people, tasks) and contributing to teams delivering under time pressures individually and as a team member.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 12. Synthesise a sound theoretical approach to critically evaluate data and information, undertaking a critical appraisal of technical and/or commercial literature.

ILO 13. Propose and bring about improvements to appropriate business standards.

4. <u>How is the course taught?</u>

The teaching methods include lectures, case studies, group exercises, field visits, seminar and computer-based demonstrations and exercises. All students attend a week of introductory lectures (given during the first week of the course). Within this induction week, students will be introduced to personal development planning and asked to reflect on their transferable skills and to take ownership of their personal development during the course. Induction is followed by 8 weeks of assessed modules.

All MSc students will undertake a Group Project (full time students) or produce a Dissertation (part time students). The Group projects are group-based activities typically undertaken for 12 weeks

between February and April (for October intake) or between August and October (for March intake). The projects are designed to integrate knowledge, understanding and skills from the taught modules in a real-life situation. The Group Project will typically involve a team of students between 5 and 8, working to investigate a manufacturing opportunity or solve a manufacturing problem. For part-time students, a Dissertation replaces the Group Project. The topic is to be agreed between the University and the student.

All MSc students will undertake a research projects (thesis project) under the supervision of a member of academic staff. For the individual research project, each student is allocated a supervisor. Guidance sessions are provided as to what is required from the thesis and oral presentation.

In addition to the teaching methods outlined in section 3 above, students will be supported in their learning and personal development by:

- The use of Virtual Learning Environment, i.e. Blackboard
- On-demand tutorials
- Coaching throughout group project periods

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2-6	50
ELECTIVE MODULES:	
Modules 7-12 (Select 1) NOTE: for the March intake some electives may not be available	10
RECOMMENDED MODULE:	
Induction	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2-6 Group Project for full-time students (13a) or Dissertation for part-time students (13b)	50 40

ELECTIVE MODULES:	
Modules 7-12 (Select 3) NOTE: for the March intake some electives may not be available	30
RECOMMENDED MODULE:	
Induction	0
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules 2-6 Group Project for full-time students (13a) or Dissertation for part-time students (13b) Individual Research Project (14)	50 40 80
ELECTIVE MODULES:	
Modules 7-12 (Select 3) NOTE: for the March intake some electives may not be available	30
RECOMMENDED MODULE:	
Induction	0
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October or March and are expected to complete the course within 12 calendar months. MSc students must successfully complete 5 core modules and 3 elective ones, the Group Project/Dissertation and an Individual Research Project.

This course is also offered on a part-time basis. In such a situation, students typically complete the various components of the course over two or three years. Typical case is to complete four taught modules plus a Dissertation in year 1 and the remainder of the modules plus the Thesis in year two and/or year 3.

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

October Intake

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-MAN-INWK	Induction	Dr Konstantinos Salonitis	22		0	Y		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	I-MNU-A1034	Operations Management	Prof Charalampos (Harris)	32		10	Y		9/10/17	1310/17	40	EX	100				Wc 06/11/17	Manufacturing resit exams will be during week commencing

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
			Makatsoris															18/09/17
3	I-MNU-A1027	Manufacturing Systems Engineering	Prof Charalampos (Harris) Makatsoris	32		10	Y		20/11/17	24/11/17	40	ICW	100				08/01/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
4	I-MNU-A1038	Supply Chain Management	Dr Chris Turner	32		10	Y		15/01/18	19/01/18	40	ICW	100				05/02/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
5	I-MNU-A1019	Manufacturing Strategy	Dr Patrick McLaughlin	35		10	Y		29/01/18	2/02/8	40			100 MULTI	GPRES GCW ICW	30 50 20	09/02/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
6	I-MNU-A1047	Aircraft Assembly	Prof Phil Webb	34		10	N		04/12/17	08/12/17	40	ICW	100				12/01/18	Re-assessment date to be set by agreement of Course Director and Module Leader

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		as/when required.
7	I-MAT-A1011	Machining, Moulding and Metrology	Dr Isidro Durazo-Cardenas	30		10	Y		23/10/17	27/10/17	40			100 MULTI	ICW GPRES	70 30	10/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
8	I-UPT-A1181	Precision Engineering	Paul Morantz	30		10	Y		16/10/17	20/10/17	40	ICW	100				17/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
9	I-MAT-A1013	Composites Manufacturing for High Performance Structures	Andrew Mills	35		10	Y		13/11/17	17/11/17	40	ICW	100				01/12/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
10	I-MAT-A1015	Failure of Materials and Structures	Dr David Ayre	32		10	Y		13/11/17	17/11/17	40	EX	100				15/12/17	Manufacturing resit exams will be during week commencing 18/09/17

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
11	I-WEE-A1110	Advanced Welding Processes	Dr Wojciech Suder	32		10	Y		27/11/17	01/12/17	40	EX	100				wc 05/02/18	Manufacturing resit exams will be during week commencing 18/09/17
12	I-MNU-A1029	Operations Analysis	Dr Konstantinos Salonitis	32	8	10	Y		30/10/17	03/11/17	40	EX	100				wc 11/12/17	Manufacturing resit exams will be during week commencing 18/09/17
13a	I-MAT-GRPP	Group Project for Full Time Students	Dr David Ayre	20		40	Y		02/02/18	25/04/18				80 MULTI 20 MULTI	GPRES GPROJ ICW observed behaviour	16% 64% 10% 10%	25/04/18	
13b	I-MAT-DISS	Dissertation for Part Time Students	Dr Konstantinos Salonitis	20		40	Y		31/01/18	30/08/18		ICW	100				30/08/97	
14	I-MNU-THESIS	Individual Research Project	Dr Yuchun Xu	20		80	Y		07/05/18	05/09/18		THESIS OR	90 10				05/09/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

March Intake

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Type of Assessment	Weighting within module15 (%) of Independent assessments	weighting within module of multi-part assessments[16] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
1	I-MAN-INWK	Induction	Dr Konstantinos Salonitis	22		0	Y		05/03/18	09/03/18	N/A	AO	N/A				N/A	
2	I-MNU-A1034	Operations Management	Prof Charalampos (Harris) Makatsoris	32		10	Y		12/03/18	16/03/18	40	EX	100				Wc 26/03/18	November 2017
3	I-MNU-A1027	Manufacturing Systems	Prof Charalampos	32		10	Y		30/04/18	04/05/18	40	ICW	100				01/06/18	Re-assessment date to be set by agreement of

[12] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[13] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[14] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[15] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[16] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[17] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[18] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module15 (%) of Independent assessments	weighting within module of multi-part assessments[16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
		Engineering	(Harris) Makatsoris															Course Director and Module Leader as/when required.
4	I-MNU-A1038	Supply Chain Management	Dr Chris Turner	32		10	Y		21/05/18	25/05/18	40	ICW	100				28/07/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
5	I-MNU-A1019	Manufacturing Strategy	Dr Patrick McLaughlin	35		10	Y		04/06/18	08/07/18	40			100 MULTI	GPRES GCW ICW	30 50 20	15/06/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
6	I-MNU-A1047	Aircraft Assembly	Prof Phil Webb	34		10	N		19/03/18	23/03/19	40	ICW	100				13/04/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
7	I-MAT-A1011	Machining, Moulding and Metrology	Dr Isidro Durazo-Cardenas	30		10	Y		19/03/18	23/03/19	40			100 MULTI	ICW GPRES	70 30	13/04/18	Re-assessment date to be set by agreement of Course Director and Module Leader

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Type of Assessment	Weighting within module15 (%) of Independent assessments	weighting within module of multi-part assessments[16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
																		as/when required.
8	I-UPT-A1181	Precision Engineering	Paul Morantz	30		10	Y	Not available for this intake			40	ICW	100				Not available for this intake	
9	I-MAT-A1013	Composites Manufacturing for High Performance Structures	Andrew Mills	35		10	Y		16/04/18	20/04/18	40	ICW	100				27/04/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
10	I-MAT-A1015	Failure of Materials and Structures	Dr David Ayre	32		10	Y	Not available for this intake			40	EX	100				Not available for this intake	
11	I-WEE-A1110	Advanced Welding Processes	Dr Wojciech Suder	32		10	Y	Not available for this intake			40	EX	100				Not available for this intake	
12	I-MNU-A1029	Operations Analysis	Dr Konstantinos Salonitis	32	8	10	Y		09/04/18	13/04/18	40	EX	100				wc 23/04/2018	December 2017
13a	I-MAT-GRPP	Group Project for Full Time Students	Dr David Ayre	20		40	Y		18/06/18	26/10/18				80 MULTI 20	GPRES GPROJ ICW	16% 64% 10%	w/c 26/10/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Type of Assessment	Weighting within module15 (%) of Independent assessments	Weighting within module of multi-part assessments[16] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
														MULTI	observed behaviour	10%		
13b	I-MAT-DISS	Dissertation for Part Time Students	Dr Konstantinos Salonitis	20		40	Y		18/06/18	29/03/19		ICW	100				w/c 2/03/19	
14	I-MNU-THESIS	Individual Research Project	Dr Yuchun Xu	20		80	Y		29/10/18	29/03/19		THESIS OR	90 10				w/c 25/03/19	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
I-MAN-INWK	Induction	Engineering and Management of Manufacturing Systems	Engineering & Management of Manufacturing Systems, Management and Information Systems, Knowledge Management for Innovation (not currently running), Global Product Development and Management, Cyber-Secure Manufacturing
I-MNU-A1034	Operations Management	Engineering and Management of Manufacturing Systems	Manufacturing Technology and Management, Engineering & Management of Manufacturing Systems, Global Product Development and Management, Management and Information Systems, Cyber-Secure Manufacturing
I-MNU-A1027	Manufacturing Systems Engineering	Engineering and Management of Manufacturing Systems	Engineering & Management of Manufacturing Systems, Cyber-Secure Manufacturing
I-MNU-A1038	Supply Chain Management	Engineering and Management of Manufacturing Systems	Engineering & Management of Manufacturing Systems,
I-MNU-A1019	Manufacturing Strategy	Engineering and Management of Manufacturing Systems	Engineering & Management of Manufacturing Systems
I-MAT-A1011	Machining, Moulding and Metrology	Advanced Materials	Advanced Materials, Manufacturing Technology and Management
I-UPT-A1181	Precision Engineering	Manufacturing Technology and Management	Manufacturing Technology and Management
I-MAT-A1013	Composites Manufacturing for High Performance	Advanced Materials	Advanced Materials, Manufacturing Technology and Management, Aerospace Materials, Renewable Energy Marine Structures EngD
I-MAT-A1015	Failure of Materials and Structures	Advanced Materials	Advanced Materials, Aerospace Materials
I-WEE-A1110	Advanced Welding Processes	Welding Engineering	Manufacturing Technology and Management, Welding Engineering, Renewable Energy Marine Structures EngD
I-MNU-A1029	Operations Analysis	Engineering and Management of Manufacturing Systems	Engineering & Management of Manufacturing Systems,

I-MAT-GRPP	Group Project for Full Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Aerospace Materials, Applied Nanotechnology, Manufacturing Technology & Management, Engineering & Management of Manufacturing Systems, Management and Information Systems, Knowledge Management for Innovation (not currently running), Global Product Development and Management, Cyber-Secure Manufacturing, Welding Engineering
I-MAT-DISS	Dissertation for Part Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Aerospace Materials, Applied Nanotechnology, Manufacturing Technology & Management, Engineering & Management of Manufacturing Systems, Management and Information Systems, Knowledge Management for Innovation (not currently running), Global Product Development and Management, Cyber-Secure Manufacturing, Welding Engineering
I-MNU-THESIS	Individual Research Project	Aerospace Manufacturing	Engineering & Management of Manufacturing Systems, Management and Information Systems, Knowledge Management for Innovation (not currently running), Global Product Development and Management, Cyber-Secure Manufacturing, Advanced Materials, Aerospace Materials, Applied Nanotechnology, Manufacturing Technology & Management, Welding Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have at least two written examinations, and depending on the elective modules they undertake, between four and seven pieces of assessment by submitted work, one piece of group project work (including an assessment of personal contribution to group work), and one element assessed by a thesis and an oral presentation.

This approach has been adopted in order to perform formative and summative assessments of the students to demonstrate their ability in a range of contexts. Part time students will be assessed by dissertation in place of the group project.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7
1	Non Assessed						
2	EX	EX	EX	EX			
3	ICW	ICW	ICW	ICW			
4	ICW	ICW	ICW	ICW			
5		ICW	ICW	ICW			
6	ICW	ICW	ICW	ICW	ICW	ICW	
7		ICW			ICW	ICW	
8					ICW		
9					ICW	ICW	
10					EX		EX
11					EX		
12	EX	EX	EX	EX			

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 8	ILO 9	ILO 10	ILO 11
13a	GPRES GPROJ ICW	GPRES GPROJ ICW	GPRES GPROJ ICW	GPRES GPROJ ICW
13b	ICW	ICW	ICW	ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 12	ILO 13
14	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

The intention of the course is to provide students with knowledge and understanding and associated transferrable skills to make a contribution to industry on graduation. Aerospace Manufacturing graduates will typically seek employment in aerospace manufacturing industry, consultancies or research institutions. Common starting roles are manufacturing engineer, industrial engineer, technical analyst, project manager and PhD researcher. With time (quicker for those with background experience) graduates progress to senior positions with significant responsibility for people, budgets and projects.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Aerospace Materials

Date of first publication/latest revision: April 2017

1. What is the course?

Course information

Course Title	MSc in Aerospace Materials
Course code	MSAMRFTC, MSAMRPTC, PDAMRFTC, PDAMRPTC, PCAMRFTC, PCAMRPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Manufacturing
Centre	Surface Engineering & Nanotechnology Institute
Course Director	Dr Sue Impey
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years, Full-time PgDip - one year, Part-time PgDip - two years, Full-time PgCert - one

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

	year, Part-time PgCert - two years
Course Start Month(s)	Full-time: October. Part-time: October.

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Manufacturing Theme, where the materials related research interests include:

- Enhanced Composites and Advanced Structures.
- Surface Engineering and Nanotechnology.
- Welding Engineering and Laser Processing
- Precision Engineering

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Institution of Mechanical Engineers (IMechE) up to and including Academic year 2015-16**, Institution of Engineering and Technology (IET) up to and including Academic year 2015-16**, Royal Aeronautical Society (RAeS) up to and including Academic year 2015-16**,, Institute of Materials, Minerals and Mining (IOM3) up to and including Academic year 2015-16***,

(** Accreditation up to and including Academic year 2019-20 is awaiting review of the output of the accreditation visit.
*** Accreditation up to and including Academic year 2018-19 is awaiting review of the output of the accreditation visit).

2. <u>What are the aims of the course?</u>

AIM
The aim of the course is to provide graduate scientists and engineers with a fundamental understanding of materials properties and processing relevant for aeronautics and astronautics, and the necessary skills to apply their knowledge in aerospace engineering and related industries.

OBJECTIVES
The objectives of the course are to provide students with:

1. A scientific understanding of materials properties and an appreciation of how this understanding can be applied to problems relevant to aeronautics and astronautics.
2. An appreciation of the processes and manufacturing routes used to convert materials into engineering products, and of the influence of processing conditions on product performance.
3. An overview of a wide range of aerospace materials, including metals, polymers, ceramics and composites, and to the basic principles of materials selection for aerospace engineering.
4. An introduction to a research environment, providing familiarity with testing and processing equipment, practical approaches to problem solving, critical evaluation of data, and use of information technology.
5. The skills required to pursue a successful career in aerospace engineering and related industries.

On successful completion of the course students should be able to:

- Apply their understanding of materials properties and processing characteristics to problems in aerospace materials development, materials and process selection, and component design.
- Plan, execute and manage materials-related projects

- Operate effectively in a team
- Make effective oral and written presentations of their work.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- recent graduates wishing to extend their knowledge and skills in aerospace materials engineering
- qualified engineers wishing to apply their skills into new areas.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a critical awareness of a range of techniques for assessing the structure and properties of aerospace materials.
ILO 2. Describe, demonstrating scientific understanding, selected processes and manufacturing routes used to convert materials into aerospace engineering products, and the influence of processing conditions on properties and performance.
ILO 3. Discuss specific materials, their benefits and applications.
ILO 4. Use basic principles of materials selection for aerospace engineering and other applications.
ILO 5. Demonstrate an ability in practical approaches to problem solving.
ILO 6. Critically evaluate data.
ILO 7. Demonstrate a basic understanding of fracture mechanics and an awareness of approaches to failure assessment.
ILO 8. Make effective use of finite element analysis programmes.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 9. Demonstrate an awareness of current research and development in selected topics in the field of aerospace materials engineering.
ILO 10. Make effective oral and/or written presentation of their work.
ILO 11. Operate effectively in a team.
ILO 12. Undertake an appraisal of technical and/or commercial literature.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 13. Demonstrate a critical awareness of current research/development in selected topics in the field of aerospace materials.
ILO 14. Undertake substantial critical appraisal of technical and/or commercial literature.
ILO 15. Carry out substantial scientific programme of study.
ILO 16. Discuss their work and relate it to the work of others.

ILO 17. Demonstrate originality in the application of knowledge in relation to an extended individual project.
ILO 18. Plan, execute and manage materials-related projects.

4. How is the course taught?

Students will be supported in their learning and personal development by:
Comprehensive course materials are provided, as well as a web-site using the Blackboard™ Virtual Learning Environment (VLE). Students are guided through the use of interactive exercises, group and individual discussion. Students engage in class activities to practise the techniques taught.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2, 3, 8	30
ELECTIVE MODULES:	
Three modules from 4-7, 9, 10* (if available) Choose three modules from six	30
RECOMMENDED MODULE	
Introduction	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2-9 Group Project for full-time students (11a) or Dissertation for part-time students (11b)	80 40
ELECTIVE MODULES:	
*Optional module 10 if available for part time students, plus choose modules to total 8 from taught modules 2 to 9	
RECOMMENDED MODULE	
Introduction	0
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Modules 2-9 Group Project for full-time students (11a) or Dissertation for part-time students (11b) Individual Research Project (12)	80 40 80
ELECTIVE MODULES:	
*Optional module 10 if available for part time students, plus choose modules to total 8 from taught modules 2 to 9	
RECOMMENDED MODULE	
Introduction	0
TOTAL:	200

* Module 10 is based on a short CPD course, which may or may not be available in any one academic year. Students are advised to consult with the Course Tutor about availability.

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **<u>any additional learning credits</u>** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
- it is <u>not</u> permissible for you to fail an elective module and then proceed to take a different elective module in its place.

- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. <u>How is the course structured?</u>

Full-time students register for the course in October and are expected to complete the course within 12 calendar months.

This course is also offered on a part-time basis. In such a situation, students typically complete the various components of the course over two or three years. A typical case is to complete four taught modules plus a Dissertation in year 1 and the remainder of the modules plus the Thesis in year two and/or year 3.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-MAT-INWK	Introduction	Dr Sue Impey	26		0	Y		02/10/17	06/10/17	n/a	AO	n/a				n/a	
2	I-MAT-A1009	Introduction to Materials Engineering	Dr David Ayre	30		10	Y		09/10/17	13/10/17	40	EX	100				03/01/18	Manufacturing resit exams will be during week commencing 18/09/17
3	I-MAT-A1005	Aerospace Materials Properties and Processing	Dr Sue Impey	30		10	N		23/10/17	27/10/17	40	GCW	100				10/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		required.
4	I-MAT-A1013	Composites Manufacturing for High Performance Structures	Andrew Mills	35		10	Y		30/10/17	03/11/17	40	ICW	100				01/12/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
5	I-MAT-A1015	Failure of Materials and Structures	Dr David Ayre	32		10	Y		13/11/17	17/11/17	40	EX	100				15/12/17	Manufacturing resit exams will be during week commencing 18/09/17
6	I-MAT-A1007	Functional Materials	Dr Qi Zhang	30		10	N		20/11/17	24/11/17	40	ICW	100				11/12/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
7	I-MAT-A1014	Finite Element Analysis	Dr Glenn Leighton/ Dr Renaud Jourdain	35		10	Y		04/12/17	08/12/17	40			100 MULTI	ICW ICW	40 60	20/01/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
8	I-MAT-A1017	Materials Selection	Dr Sue Impey/ Dr David Ayre	34		10	Y		08/01/18	12/01/18	40 40			100 MULTI	IPRES ICW	10 90	29/01/18	Re-assessment date to be set by

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		agreement of Course Director and Module Leader as/when required.
9	I-MAT-A1016	Surface Science and Engineering	Prof John Nicholls	30		10	Y		22/01/18	26/01/18	40	ICW	100				09/02/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
10	N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures - (option when available)**	Prof Philip Irving	35		10	Y		10/07/18	14/07/18	40	ICW	100				11/09/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
11a	I-MAT-GRPP	Group Project for Full Time Students	Dr David Ayre	20		40	Y		0/02/18	20/04/18				80 MULTI 20 MULTI	GPRES GPROJ ICW observed behaviour	16 64 10 10	04/05/18	
11b	I-MAT-DISS	Dissertation for Part Time Students	Dr Sue Impey/ Dr David Ayre	20		40	Y		01/02/18	30/08/18		ICW	100				30/08/17	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
12	I-MNU-THESIS	Individual Research Project	Dr Yuchun Xu	20		80	Y		30/04/18	03/09/18		THESIS OR	90 10				03/09/18	

**Timescales suit for part time students only

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
I-MAT-INWK	Introduction	Manufacturing Technology and Materials Programme	Welding Engineering, Applied Nanotechnology, Advanced Materials
I-MAT-A1009	Introduction to Materials Engineering	Advanced Materials	Advanced Materials, Manufacturing Technology and Management
I-MAT-A1015	Failure of Materials and Structures	Advanced Materials	Advanced Materials, Aerospace Manufacturing
I-MAT-A1014	Finite Element Analysis	Advanced Materials	Applied Nanotechnology, Manufacturing Technology and Management, Advanced Materials
I-MAT-A1017	Materials Selection	Advanced Materials	Advanced Materials EngD in Sustainable Manufacturing Systems
I-MAT-A1016	Surface Science and Engineering	Advanced Materials	Manufacturing Technology and Management, Advanced Materials
I-MAT-A1013	Composites Manufacturing for High Performance Structures	Advanced Materials	Manufacturing Technology and Management, Aerospace Manufacturing, Advanced Materials, Renewable Energy Marine Structures EngD
N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures	Airworthiness	Airworthiness, Military Aerospace and Airworthiness, Advanced Materials, Aircraft Engineering
I-MAT-GRPP	Group Project for Full Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Applied Nanotechnology, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Cyber-Secure Engineering Welding Engineering
I-MAT-DISS	Dissertation for Part Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Applied Nanotechnology, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems,

			Cyber-Secure Manufacturing, Welding Engineering
I-MNU-THESIS	Individual Research Project	Aerospace Manufacturing	Cyber-Secure Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Advanced Materials, Applied Nanotechnology, Manufacturing Technology and Management, Welding Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have at least two written examinations, and depending on the elective modules they undertake, between four and six pieces of assessment by submitted work, one piece of group project work (including an assessment of personal contribution to group work), and one element assessed by a thesis and an oral presentation.

This approach has been adopted in order to perform formative and summative assessments of the students to demonstrate their ability in a range of contexts. Part time students will be assessed by dissertation in place of the group project.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / **Module No.**	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8
2	EX	EX	EX		EX	EX	EX	
3	GCW	GCW		GCW	GCW			
4	ICW	ICW	ICW		ICW			
5					ICW	ICW	ICW	
6	ICW	ICW	ICW					
7					ICW	ICW		ICW
8			ICW	ICW	ICW	ICW		
9		ICW	ICW	ICW	ICW			
10							ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 9	ILO 10	ILO 11	ILO 12
11a	GPROJ	GPRES	GPROJ	GPROJ
11b	ICW	IPRES	ICW	ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 13	ILO 14	ILO 15	ILO 16	ILO 17	ILO 18
12	THESIS OR	THESIS	THESIS	THESIS OR	THESIS R& RP	THESIS RP

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

The intention of the course is to provide students with knowledge and understanding and associated transferrable skills to make a contribution to industry on graduation. Aerospace Materials graduates will typically seek employment in the aerospace manufacturing industry, consultancies or research institutions related to the aerospace industry. However other related industries such as power generation, space, sports and automotive industries are also relevant. Common starting roles are materials engineer, design and development, project engineer, project manager and PhD researcher. With time (quicker for those with more background experience) graduates progress to senior positions with responsibility for people, budgets and projects.

COURSE SPECIFICATION

Cranfield University: Course Specifications
Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE:	MSc in Aerospace Vehicle Design

Date of first publication/latest revision:	March 2017

1. What is the course?

Course information

Course Title	MSc in Aerospace Vehicle Design with options in: Aircraft Design *(October and March Intake)* Avionic Systems Design *(October and March Intake)* Structural Design *(October Intake only)*
Course code	MSAVDFTC, MSAV2FTC
Academic Year	2017-18
Valid entry routes	MSc
Additional exit routes	Not Applicable
Mode of delivery	Full-Time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Aeronautics
Course Director	Ioannis Giannopoulos (October Intake) Professor Shijun Guo (March Intake)
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Registration Period(s) available	Full-time MSc - one year
Course Start Month(s)	March or October

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Aeronautics where the research interests include:

- Novel aircraft configurations
- Unmanned air vehicles
- Aeroelasticity
- More electric and green aircraft technologies
- Modelling and simulation
- Flight simulation
- Multidisciplinary design, analysis and optimisation

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Royal Aeronautical Society (RAeS) through 2019.

2. What are the aims of the course?

The Aerospace Vehicle Design MSc aims to build on knowledge acquired from undergraduate study to develop a comprehensive understanding of aircraft design methods and techniques in the areas of aircraft structures, systems and avionics.

This programme is intended for the following range of students:

- Recent graduates wishing to extend their knowledge and skills in the above areas.
- Qualified engineers wishing to apply their skills into new areas.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

***A.* MSc**

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic understanding in the knowledge, the principles and the applicable regulatory requirements of Aerospace Vehicle Design.
ILO 2. Apply the current aircraft design methods, tools and techniques used in the aerospace industry onto aircraft design projects in the engineering fields of either aerospace structures, systems or avionics.
ILO 3. Independently undertake research in a relevant field of either aerospace structures, systems or avionics by means of critically analysing and processing current research and generating valuable research outcomes.

Aircraft Design Option and Avionic Systems Design Option
ILO 4. Effectively plan, communicate, collaborate and manage tasks individually and within a project team.

Structural Design Option (Oct Intake only)

ILO 5. Effectively plan, communicate, collaborate and manage tasks within a research project relevant to Aerospace Structures.

4. How is the course taught?

The course is taught using a combination of methods:

- Taught modules (lectures and lab work) are provided over two teaching periods. These are assessed through exams, assignments and in-class exercises and for the Aircraft Design Option and Avionic Systems Design Option through the content of their Group Design Project report.
- The Aircraft Design Option and Avionic Systems Design Option students participate in a comprehensive group design project which is a strong example of problem-based learning at the post graduate level providing a virtual industrial environment supported by experienced staff.
- All students must undertake individual research under the guidance of academic staff which is assessed through a thesis.

In addition to the teaching methods outlined in section 3 above, students will be supported in their learning and personal development by:

- Extensive computer network and IT facilities.
- Library facilities including journals, papers, and numerous databases.
- A dedicated course electronic Blackboard.
- Numerous social events to enhance team building.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. MSc

The accumulation of 200 credits (or more) through the assessment of taught modules and the successful completion of the Group Design Project (where required) and Thesis as detailed below:

Aircraft Design Option (October and March Intake)

Description	Credits
COMPULSORY MODULES - Assessed:	
15 17a 34 – Group Design Project 35a – Individual Research Project	10 10 100 80
COMPULSORY MODULES– Non Assessed:	
1, 7, 9, 16, 18, 19a, 22, 24, 28, 31	0
ELECTIVE MODULES – Non Assessed:	

4, 6, 8, 12, 14, 21a, 26, 27, 32, 33a	0
TOTAL:	200

Avionic Systems Design Option (October and March Intake)

Description	Credits
COMPULSORY MODULES - Assessed:	
2 13 23 34 – Group Design Project 35a – Individual Research Project	0 10 10 100 80
COMPULSORY MODULES– Non Assessed:	
3, 5, 7, 9, 10, 11, 17b, 20, 22, 25, 29, 30	0
ELECTIVE MODULES – Non Assessed:	
4, 6, 8, 12, 16, 24, 26, 27, 31	0
TOTAL:	200

Structural Design Option (October Intake only)

Description	Credits
COMPULSORY MODULES - Assessed:	
15, 19b, 21b, 33b 35b – Individual Research Project	40 160
ELECTIVE MODULES – Non Assessed:	
1, 6, 7, 8, 9, 12, 14, 16, 17b, 18, 22, 24, 27, 28, 31, 32	0
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in either October or March and are expected to complete the course within 12 calendar months.

The course has 3 main components, a taught component (all course options), a group design project component (aircraft design and avionic systems design options only), and an individual research project component (all course options). Timeframes for the delivery of these components is indicated in the table below.

October Intake	**Aircraft Design Option**	**Avionic Systems Design Option**	**Structural Design Option**
Course Start	October	October	October
Taught Component	October to March	October to March	October to March
Examinations	January	January	January and April
Group Design Project	October to April	October to April	Not Applicable
Group Project Thesis Submission	April	April	Not Applicable
Group Project Industry Presentation	May	May	Not Applicable
Individual Research Project	May to September	May to September	October to September
Oral Examination	August	August	August
Thesis Submission	August	August	August
Course End	September	September	September

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

March Intake	Aircraft Design Option	Avionic Systems Design Option
Course Start	March	March
Taught Component	March to August	March to August
Examinations	June	June
Group Design Project	March to Sept	March to Sept
Group Project Thesis Submission	September	September
Group Project Industry Presentation	October	October
Individual Research Project	March to February	March to February
Oral Examination	February	February
Thesis Submission	January	January
Course End	February	February

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

October Intake

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-AVD-AE	Aeroelasticity	Prof Shijun Guo	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
2	N-AVD-ANCS	Aeronautical Communication Systems	Dr Huamin Jia	10		0	N		01/18	01/18	n/a	AO	n/a				n/a	n/a

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
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3	N-AVD-ASE	Aerospace Software Engineering and Ada	Dr Huamin Jia Dr Irfan Madani	20		0	N		10/17	11/17	n/a	AO	n/a				n/a	n/a
4	N-AVD-ASDL	Aerospace System Development and Life Cycle Model	Tim Mackley	10		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
5	N-AVD-ATC	Avionics Air Traffic Control	Dr Francisco J Saez-Nieto	10		0	N		02/18	02/18	n/a	AO	n/a				n/a	n/a
6	N-AVD-AA	Aircraft Aerodynamics	Prof Howard Smith	10		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
7	N-AVD-AP	Aircraft Performance	Dr Craig Lawson	10		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
8	N-AVD-APPI	Aircraft Power Plant Installation	Dr Adrian Clarke	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
9	N-AVD-ACSC	Aircraft Stability and Control	Dr Alastair Cooke	10		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
10	N-AVD-AISI	Avionics Data Networking, Hardware Integration and Testing	Dr Huamin Jia	10		0	N		11/17	02/18	n/a	AO	n/a				n/a	n/a
11	N-AVD-CE	Cockpit Environment	Dr David Zammit-Mangion	10		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
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12	N-AVD-CAD	Computer Aided Design	Dr Helen Lockett	20		0	N		10/17	12/17	n/a	AO	n/a				n/a	n/a
13	N-ASD-CS	Control Systems	Dr James Whidborne	28		10	Y		11/17	11/17	40			100 MULTI	ICW EX	50 50	01/18 01/18	06/18 06/18
14	N-AVD-CW	Crashworthiness	Ioannis Giannopoulos	20		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
15	N-AVD-FRP	Design and Analysis of Composite Structures	Prof Shijun Guo	20		10	Y		11/17	12/17	40			100 MULTI	EX ICW	75 25	01/18 12/17	06/18 05/18
16	N-AVD-DMO	Design for Manufacture and Operation	Prof Howard Smith	10		0	N		12/17	12/17	n/a	AO	n/a				n/a	n/a
17a	N-AVD-DAS	Design of Airframe Systems	Dr Craig Lawson	23		10	N		10/17	10/17	40	EX	100				01/18	06/18
17b	N-AVD-DASY	Design of Airframe Systems	Dr Craig Lawson	23		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
18	N-AVD-DS	Detail Stressing	Ioannis Giannopoulos	20		0	Y		11/17	11/17	n/a	AO	n/a				n/a	n/a
19a	N-AVD-FFMDT	Fatigue, Fracture Mechanics and Damage Tolerance	Dr Wenli Liu	20		0	Y		11/17	11/17	n/a	AO	n/a				n/a	n/a

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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19b	N-AVD-ASC	Fatigue, Fracture Mechanics and Damage Tolerance	Dr Wenli Liu	20		10	Y		11/17	11/17	40	EX	100				01/18	06/18
20	N-AVD-FTAD	Fault Tolerant Avionics Design	Dr Huamin Jia	10		0	N		01/18	01/18	n/a	AO	n/a				n/a	n/a
21a	N-AVD-FINEA	Finite Element Analysis	Ioannis Giannopoulos	32		0	Y		11/17	11/17	n/a	AO	n/a				n/a	n/a
21b	N-AVD-FEA	Finite Element Analysis	Ioannis Giannopoulos	32		10	Y		11/17	11/17	40	EX	100				01/18	06/18
22	N-AVD-FEM	Flight Experience	Dr Alastair Cooke	4 plus 2 flights		0	N		10/17	03/18	n/a	AO	n/a				n/a	n/a
23	N-AVD-N1	Inertial and Satellite Navigation Systems	Dr Huamin Jia Dr Irfan Madani	20		10	N		11/17	11/17	40	EX	100				01/18	06/18
24	N-AVD-IAD	Initial Aircraft Design	Prof Howard Smith	30		0	N		12/17	12/17	n/a	AO	n/a				n/a	n/a
25	N-AVD-N2	Integrated Navigation Systems	Dr Huamin Jia	20		0	N		12/17	12/17	n/a	AO	n/a				n/a	n/a
26	N-AVD-IVHM	Integrated Vehicle Health Management	Dr Suresh Perinpanayagam	10		0	N		01/18	01/18	n/a	AO	n/a				n/a	n/a

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27	N-AVD-LGD	Landing Gear Design	Jack Stockford	10		0	N		12/17	12/17	n/a	AO	n/a				n/a	n/a
28	N-AVD-LA	Loading Actions	Prof Howard Smith	20		0	N		10/17	10/17	n/a	AO	n/a				n/a	n/a
29	N-AVD-MDS	Modelling of Dynamic Systems	Dr James Whidborne	13		0	Y		10/17	10/17	n/a	AO	n/a				n/a	n/a
30	N-AVD-RS	Radio Systems	Dr David Zammit-Mangion	10		0	N		02/18	02/18	n/a	AO	n/a				n/a	n/a
31	N-AVD-RSAC	Reliability, Safety Assessment and Certification	Jack Stockford	20		0	N		02/18	02/18	n/a	AO	n/a				n/a	n/a
32	N-AVD-SD	Structural Dynamics	Prof Shijun Guo	20		0	Y		02/18	02/18	n/a	AO	n/a				n/a	n/a
33a	N-AVD-STS	Structural Stability	Dr Wenli Liu	20		0	Y		01/18	01/18	n/a	AO	n/a				n/a	n/a
33b	N-AVD-SS	Structural Stability	Dr Wenli Liu	20		10	Y		01/18	01/18	40	EX	100				04/18	04/19
34	N-AVD-GP	Group Design Project	Prof Howard Smith	200		100	N		10/17	05/18		THESIS GPRAC	90 10				05/18	

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35a	N-AVD-THESIS	Individual Research Project	Various	10		80	N		10/17	09/18		THESIS OR	90 10				08/18	
35b	N-AVD-SDTHES	Individual Research Project	Various	20		160	N		10/17	09/18		THESIS OR	90 10				08/18	

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March Intake

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers [13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Type of Assessment	Weighting within module15 (%) of Independent assessments	weighting within module of multi-part assessments [16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
1	N-AVD-AE Occ B	Aeroelasticity	Prof Shijun Guo	10		0	N		07/18	08/18	n/a	AO	n/a				n/a	n/a
2	N-AVD-ANCS Occ B	Aeronautical Communication Systems	Dr Huamin Jia	10		0	N		08/18	08/18	n/a	AO	n/a				n/a	n/a
3	N-AVD-ASE Occ B	Aerospace Software Engineering and Ada	Dr Huamin Jia Dr Irfan Madani	20		0	N		04/18	04/18	n/a	AO	n/a				n/a	n/a
4	N-AVD-ASDL Occ B	Aerospace System Development and Life Cycle Model	Tim Mackley	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a

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[13] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
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5	N-AVD-ATC Occ B	Avionics Air Traffic Control	Dr Francisco J Saez-Nieto	10		0	N		08/18	08/18	n/a	AO	n/a				n/a	n/a
6	N-AVD-AA Occ B	Aircraft Aerodynamics	Prof Howard Smith	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
7	N-AVD-AP Occ B	Aircraft Performance	Dr Craig Lawson	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
8	N-AVD-APPI Occ B	Aircraft Power Plant Installation	Dr Adrian Clarke	10		0	N		07/18	07/18	n/a	AO	n/a				n/a	n/a
9	N-AVD-ACSC Occ B	Aircraft Stability and Control	Dr Alastair Cooke	10		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
10	N-AVD-AISI Occ B	Avionics Data Networking, Hardware Integration and Testing	Dr Huamin Jia	10		0	N		07/18	07/18	n/a	AO	n/a				n/a	n/a
11	N-AVD-CE Occ B	Cockpit Environment	Dr David Zammit-Mangion	10		0	N		04/18	04/18	n/a	AO	n/a				n/a	n/a
12	N-AVD-CAD Occ B	Computer Aided Design	Dr Helen Lockett	20		0	N		03/18	05/18	n/a	AO	n/a				n/a	n/a
13	N-ASD-CS Occ B	Control Systems	Dr James Whidborne	28		10	Y		04/18	05/18	40			100 MULTI	ICW EX	50 50	06/17 06/17	01/18 01/18

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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14	N-AVD-CW Occ B	Crashworthiness	Ioannis Giannopoulos	20		0	N		08/18	08/18	n/a	AO	n/a				n/a	n/a
15	N-AVD-FRP Occ B	Design and Analysis of Composite Structures	Prof Shijun Guo	20		10	Y		04/18	05/18	40			100 MULTI	EX ICW	75 25	06/18 05/18	01/19 11/18
16	N-AVD-DMO Occ B	Design for Manufacture and Operation	Prof Howard Smith	10		0	N		04/18	04/18	n/a	AO	n/a				n/a	n/a
17a	N-AVD-DAS Occ B	Design of Airframe Systems	Dr Craig Lawson	23		10	N		03/18	03/18	40	EX	100				06/18	01/19
17b	N-AVD-DASY Occ B	Design of Airframe Systems	Dr Craig Lawson	23		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
18	N-AVD-DS Occ B	Detail Stressing	Ioannis Giannopoulos	20		0	Y		07/18	07/18	n/a	AO	n/a				n/a	n/a
19a	N-AVD-FFMDT Occ B	Fatigue, Fracture Mechanics and Damage Tolerance	Dr Wenli Liu	20		0	Y		05/18	05/18	n/a	AO	n/a				n/a	n/a
20	N-AVD-FTAD Occ B	Fault Tolerant Avionics Design	Dr Huamin Jia	10		0	N		05/18	05/18	n/a	AO	n/a				n/a	n/a
21a	N-AVD-FINEA Occ B	Finite Element Analysis	Ioannis Giannopoulos	32		0	Y		04/17	04/17	n/a	AO	n/a				n/a	n/a

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22	N-AVD-FEM Occ B	Flight Experience	Dr Alastair Cooke	4 plus 2 flights		0	N		03/18	09/18	n/a	AO	n/a				n/a	n/a
23	N-AVD-N1 Occ B	Inertial and Satellite Navigation Systems	Dr Huamin Jia Dr Irfan Madani	20		10	N		04/18	04/18	40	EX	100				06/18	01/19
24	N-AVD-IAD Occ B	Initial Aircraft Design	Prof Howard Smith	30		0	N		04/18	07/18	n/a	AO	n/a				n/a	n/a
25	N-AVD-N2 Occ B	Integrated Navigation Systems	Dr Huamin Jia	20		0	N		05/18	05/18	n/a	AO	n/a				n/a	n/a
26	N-AVD-IVHM Occ B	Integrated Vehicle Health Management	Dr Suresh Perinpanayagam	10		0	N		08/18	08/18	n/a	AO	n/a				n/a	n/a
27	N-AVD-LGD Occ B	Landing Gear Design	Jack Stockford	10		0	N		05/18	05/18	n/a	AO	n/a				n/a	n/a
28	N-AVD-LA Occ B	Loading Actions	Prof Howard Smith	20		0	N		03/18	03/18	n/a	AO	n/a				n/a	n/a
29	N-AVD-MDS Occ B	Modelling of Dynamic Systems	Dr James Whidborne	13		0	Y		04/18	04/18	n/a	AO	n/a				n/a	n/a
30	N-AVD-RS Occ B	Radio Systems	Dr David Zammit-Mangion	10		0	N		06/18	06/18	n/a	AO	n/a				n/a	n/a

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								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module15 (%) of Independent assessments	weighting within module of multi-part assessments [16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
31	N-AVD-RSAC Occ B	Reliability, Safety Assessment and Certification	Jack Stockford	20		0	N		06/18	06/18	n/a	AO	n/a				n/a	n/a
32	N-AVD-SD Occ B	Structural Dynamics	Prof Shijun Guo	20		0	Y		07/18	07/18	n/a	AO	n/a				n/a	n/a
33a	N-AVD-STS Occ B	Structural Stability	Dr Wenli Liu	20		0	Y		06/18	06/18	n/a	AO	n/a				n/a	n/a
34	N-AVD-GP Occ B	Group Design Project	Prof Howard Smith	200		100	N		03/18	11/18		THESIS GPRAC	90 10				09/18	04/19
35a	N-AVD-THESIS Occ B	Individual Research Project	Various	10		80	N		03/18	02/19		THESIS OR	90 10				01/19	08/19

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ASD-CS	Control Systems	Aerospace Dynamics	Aerospace Dynamics, Autonomous Vehicle Dynamics and Control, Astronautics and Space Engineering
N-AVD-FRP	Design and Analysis of Composite Structures	Aerospace Vehicle Design	Astronautics and Space Engineering
N-AVD-DS	Detail Stressing	Aerospace Vehicle Design	Airworthiness, Aircraft Engineering
N-AVD-ASC (assessed) N-AVD-FFMDT (non-assessed)	Fatigue, Fracture Mechanics and Damage Tolerance	Aerospace Vehicle Design	Aircraft Engineering
N-AVD-FEA (assessed) N-AVD-FINEA (non-assessed)	Finite Element Analysis	Aerospace Vehicle Design	Astronautics and Space Engineering
N-AVD-MDS	Modelling of Dynamic Systems	Aerospace Dynamics	Autonomous Vehicle Dynamics and Control, Astronautics and Space Engineering, Aerospace Dynamics
N-AVD-SD	Structural Dynamics	Aerospace Vehicle Design	Astronautics and Space Engineering
N-AVD-SS (assessed) N-AVD-STS (non-assessed)	Structural Stability	Aerospace Vehicle Design	Advanced Lightweight Structures and Impact

7. How are the ILOs assessed?

The course assessment strategy must be consistent with its teaching and learning strategy. The assessments therefore are designed around problem based learning and problem solving skills. Hence much more emphasis is placed on the thesis assessment rather than knowledge recall assessment such as examinations.

The following assessment types are utilised:

- The course uses a range of assessment types. The taught component of the course is assessed by a combination of both examinations, and also by the application of the knowledge gained to the group design project and the individual research project, which are both examined by a thesis.

- Students following the aircraft design and avionic systems design options can expect to have 2 written examinations and 1 assignment. All students participate in the group design project which is assessed by a thesis and peer review. The group design project is an example of problem based learning. Peer review has been shown to be a good fit with problem based learning because it emphasises the cooperative nature of learning environment. The individual research project requires students to be assessed on their written and oral presentation skills, through a submitted thesis and oral examination.

- Students following the structural design option do not participate in the group design project, but instead undertake a more extensive individual research project. Students can

expect to have 4 written examinations and 1 assignment. The individual research project requires students to be assessed on their written and oral presentation skills, through a submitted thesis and oral examination.

This approach has been adopted to ensure that students demonstrate their understanding through a range of learning techniques and are therefore not disadvantaged through any one approach.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. MSc

Award ILOs / Module No.	*ILO 1.*	*ILO 2.*	*ILO 3.*	*ILO 4.*	*ILO 5.*
1	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
2	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
3	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
4	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
5	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
6	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
7	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
8	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
9	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
10	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
11	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
12	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
13	GPROJ, EX, ICW	GPROJ, EX, ICW	GPROJ, EX, ICW		
14	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
15	GPROJ, EX, ICW	GPROJ, EX, ICW	GPROJ, EX, ICW		
16	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
17a	GPROJ, EX	GPROJ, EX	GPROJ, EX		
17b	AO	AO	AO		
18	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
19a	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
19b	EX	EX	EX		
20	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
21a	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
21b	EX	EX	EX		
22	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		

Award ILOs / Module No.	*ILO 1.*	*ILO 2.*	*ILO 3.*	*ILO 4.*	*ILO 5.*
23	GPROJ, EX	GPROJ, EX	GPROJ, EX		
24	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
25	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
26	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
27	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
28	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
29	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
30	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
31	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
32	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
33a	GPROJ, AO, THESIS	GPROJ, AO, THESIS	GPROJ, AO, THESIS		
33b	GPROJ, EX	GPROJ, EX	GPROJ, EX		
34	GPROJ	GPROJ	GPROJ	GPROJ	
35a	THESIS, OR	THESIS, OR	THESIS, OR		THESIS, OR
35b	THESIS, OR	THESIS, OR	THESIS, OR		THESIS, OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
Group Design Project	All modules except IRP	Thesis	90
		Peer Review 1	5
		Peer Review 2	5
Individual Research Project	All modules except GDP	Thesis	90
		Oral Exam	10

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Cranfield University has been at the forefront of postgraduate education in aerospace engineering since 1946. Aircraft design at Cranfield was one of the original foundation courses of the College of Aeronautics, which has evolved over the years, and more recently broadened in content, into the Aerospace Vehicle Design course that we have today.

Cranfield has a global reputation for advanced postgraduate education and extensive applied research. 94% of Cranfield graduates secure employment within 6 months. The Aerospace Vehicle Design course is valued and respected by employers worldwide.

The aerospace industry has a continuing need to recruit structural designers, stress engineers, systems design engineers and avionics design engineers. Graduates from the MSc in Aerospace Vehicle Design can therefore look forward to a varied choice of challenging career opportunities in the above disciplines. Many of the graduates occupy very senior positions in their organisations, making valuable contributions to the international aerospace industry.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Air Transport Management

Date of first publication/latest revision: January 2017

1. What is the course?

Course information

Course Title	MSc in Air Transport Management
Course code	MSATRFTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip
Mode of delivery	Full-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Centre for Air Transport Management
Course Director	Dr Robert Mayer
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	1st or upper 2nd class UK honours degree or equivalent in any relevant discipline. A lower qualification plus a number of year's relevant working experience may be accepted as equivalent. For applicants whose first language is not English there is a requirement to achieve the level of 7.0 on IELTS and equivalent grades on other English language qualifications recognised by the University.
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Centre for Air Transport Management where the research interests include:

- Air Transport Economics
- Airline and Airport Planning and Operations
- Safety and Air Accident Investigation.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- provide a masters-level programme of learning for existing air transport managers to enhance their knowledge and skills;
- provide a masters-level programme of learning for graduates seeking to pursue a career in air transport management;
- provide the foundation necessary for graduates to go on to undertake doctoral research in air transport management.

This programme is intended for the following range of students:

- New graduates seeking to pursue a career in the air transport industry
- Practitioners in the sector, particularly at junior and middle management levels, who are seeking to expand their knowledge and skills in air transport management in order to further develop their careers.
- Practitioners who are not employed in the sector, who are seeking a career in the air transport industry.
- Both practitioners and new graduates seeking to pursue doctoral research in the area of air transport.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. MSc Air Transport Management

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate an in-depth understanding of economics and financial management relevant to air transport, air transport commercial practice and air transport operations (as they relate to both aircraft and infrastructure);

ILO 2. Demonstrate an understanding of regulatory framework that defines the air transport industry;
ILO 3. Demonstrate an understanding of mathematical modelling relevant to air transport management problems;
ILO 4. Demonstrate an in-depth understanding of the complex interrelationships of technical and operational aspects of the air transport industry with the commercial pressures and realities facing its management;
ILO 5. Analyse critically practical problems in the air transport and related industries to provide timely solutions, having regard to technical, regulatory, commercial, political, social and environmental constraints;
ILO 6. Demonstrate originality in data collection;
ILO 7. Undertake independent research on a subject relevant to technical, operational or commercial aspects of the air transport or related industries, including a review of relevant literature, methodological planning, data collection, analysis, presentation of results, and evaluation and discussion of these results, and the contribution made;
ILO 8. Make effective use of electronic and hardcopy library resources;
ILO 9. Undertake critical appraisal of literature pertaining to the technical, operational and commercial aspects of the air transport industry;
ILO 10. Select and use appropriate analytical and decision making approaches to research and investigative air transport management problems;
ILO 11. Make effective oral and written presentations of their work;
ILO 12. Work effectively to set deadlines;
ILO 13. Demonstrate the ability to work within teams and possess an understanding and appreciation of the contributions made by other specialists;
ILO 14. Undertake and successfully complete a substantial programme of research independently, applying robust methods of data collection and analysis, and communicating the findings coherently.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- lectures and workshops delivered by industry practitioners, demonstrating the application of theory to various examples and case studies;
- training on how to use the library's on-campus and on-line resources undertaken by a Cranfield University librarian;
- training on how to use the OAG airline schedule database.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	

Modules 1, 2, 3, 4, 5, 6, 8, 12 Group Project (13)	90 20
ELECTIVE MODULES:	
Modules 7, 9, 10, 11 (Choose One)	10
TOTAL:	120

B. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules 1, 2, 3, 4, 5, 6, 8, 12 Group Project (13) Individual Research Project (14)	90 20 80
ELECTIVE MODULES:	
Modules 7, 9, 10, 11 (Choose One)	10
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does <u>not</u> have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment <u>on the first attempt</u> for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **<u>up to 30 learning credits</u>**, you will be permitted to re-take all of those assessments (except for circumstances where a resit

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **<u>any additional learning credits</u>** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is <u>not</u> permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. <u>How is the course structured?</u>

Full-time students register for the course in October and are expected to complete the course within 11 calendar months.

Teaching is delivered in one week modules. In the first teaching period, students will have completed five modules. During teaching period two students complete the remaining modules. Students complete a group project which starts mid-April and concludes just before May. Students are required to submit a thesis proposal by the end of January. The thesis is handed-in at the beginning of August. Oral examinations are held in early September.

Students are typically granted four weeks to complete course work. Exams are scheduled in December (before Christmas). Students are required to contribute to a report for their group projects and to participate in a group presentation. Once students have handed in their thesis, students must deliver a presentation summarising their thesis and be cross-examined on this presentation as part of their thesis viva.

Course modules

The following modules outline all parts of the programme leading to **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ATF-IAT10	Introduction to the Air Transport Industry	Mr Andy Foster	25		10	Y	09/10/17	09/10/17	13/10/17	40	ICW	100				13/11/17	09/05/18
2	N-ATF-TEF10	Air Transport Economics and Finance	Dr Robert Mayer	50		20	N	30/10/17	30/10/17	10/11/17	40 40	GPRES EX	40 60				10/11/17 TBC	09/05/18
3	N-ATF-RPA10	Regulatory Policy and Air Law	Dr Keith Mason	25		10	Y	16/10/17	16/10/17	20/10/17	40	EX	100				27/10/17	09/05/18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
4	N-APM-STA10	Research Methods and Statistics	Dr Nicola Volta	30		10	Y	27/11/17	27/11/17	08/12/17	40	ICW	100				22/01/18	09/05/18
5	N-APM-RMF10	Air Transport Market Analysis and Forecasting	Dr Chika Miyoshi	25		10	Y	08/01/18	08/01/18	12/01/18	40	ICW	100				12/02/18	09/05/18
6	N-ATF-ATO10	Air Transport Operations	Mr Andy Foster	25		10	N	15/01/18	15/01/18	19/01/18	40	ICW	100				19/02/18	09/05/18
7	N-ATF-ATN10	Air Transport and the Environment	Dr Chika Miyoshi	25		10	Y	29/01/18	29/01/18	02/02/18	40	ICW	100				05/03/18	09/05/18
8	N-ATF-ATS10	Air Transport Strategic Management	Dr Frankie O'Connell	25		10	N	05/02/18	05/02/18	09/02/18	40 40	ICW GPRES	75 25				12/03/18 09/02/18	09/05/18 Next opportunity
9	N-SAI-ISMS Occ C	Aviation Safety Management	Dr Simon Mitchell/ Mr Dave Barry	30		10	Y	12/02/18	12/02/18	16/02/18	40	ICW	100				19/03/18	09/05/18
10	N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Cengiz Turkoglu	30		10	Y	12/02/18	12/02/18	16/02/18	40			100 MULTI	EX ICW	30 70	16/02/18 19/03/18	09/05/18

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
11	N-ATF-AFP10	Airline Fleet Planning	Mr Andy Foster	25		10	Y	19/02/18	19/02/18	23/02/18	40	ICW	100				26/03/18	09/05/18
12	N-ATF-ATM10	Air Transport Marketing	Dr Keith Mason	25		10	Y	26/02/18	26/02/18	02/03/18	40	ICW	100				04/04/18	09/05/18
13	N-ATF-GP20	Group Project	Mr Andy Foster Dr Frankie O'Connell	10		20	N	09/04/18	09/04/18	27/04/18	40 40	GCW GPRES	50 50				27/04/18	09/05/18
14	N-ATF-THES10	Individual Research Project	Dr Romano Pagliari	10		80	Y	22/01/18	22/01/18	09/09/18		THESIS OR	80 20				01/08/18 29 & 30/08/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ATF-IAT10	Introduction to Air Transport Industry	Air Transport Management	Airport Planning and Management
N-ATF-RPA10	Regulatory Policy and Air Law	Air Transport Management	Airport Planning and Management Air Transport Management (Executive)
N-APM-STA10	Research Methods and Statistics	Airport Planning and Management	Airport Planning and Management
N-APM-RMF10	Air Transport Market Analysis and Forecasting	Airport Planning and Management	Airport Planning and Management Air Transport Management (Executive)
N-ATF-ATM10	Air Transport Marketing	Air Transport Management	Air Transport Management (Executive)
N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Airworthiness	Airworthiness Air Transport Management (Executive) Military Aerospace and Airworthiness Safety and Human Factors in Aviation
N-ATF-ATN10	Air Transport and the Environment	Air Transport Management	Air Transport Management (Executive)
N-SAI-ISMS	Aviation Safety Management	Safety & Accident Investigation	Airworthiness Air Transport Management (Executive) Military Aerospace and Airworthiness Safety and Human Factors in Aviation Safety & Accident Investigation
N-ATF-AFP10	Airline Fleet Planning	Air Transport Management	Air Transport Management (Executive)
N-ATF-THES10	Individual Research Project	Air Transport Management	Airport Planning and Management Air Transport Management (Executive)

7. How are the ILOs assessed?

The course uses a range of assessment types. Students can expect to have two written examinations, ten pieces of assessment by submitted work and two elements of assessment by presentation or viva.

Students are subject to two forms of assessment with regard to the group project. Firstly, they must submit group coursework and secondly, their group project oral presentation is also assessed. In the latter form of assessment, each presentation is judged on how well their presentation is organised, the quality of their individual presentations and visual aids and how well they are able to answer questions from the audience. Both forms of assessment have an equal weighting with regard to the module mark.

The thesis is assessed using a combination of their written work and an oral presentation. The oral presentation provides an opportunity for each student to present their thesis to members of staff. These oral presentations are judged on the basis of the quality of the presentation in terms of content and visual aids, how well the key findings and other important elements of the research been communicated and how well the student has responded to questions from the audience.

This approach has been adopted in order to ensure that students achieve the intended learning outcomes.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. MSc

Award ILOs Module No.	ILO1	ILO2	IL3	ILO4	ILO5	ILO6	ILO7	ILO8	ILO9	ILO10	ILO 11	ILO 12	ILO 13	ILO 14
1								ICW						
2	EX				EX			EX						
3		EX			EX			EX						
4			ICW				ICW	ICW						
5			ICW				ICW	ICW						
6	ICW			ICW	ICW			ICW	ICW					
7					ICW			ICW						
8								ICW						
9								ICW						
10								ICW	ICW					
11								ICW						
12								ICW						
13						GCW		GCW					GCW	
14						THESIS		THESIS	THESIS	THESIS	OR	THESIS OR		THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)
N/A			

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and

additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

Graduates from this course will be well prepared for employment in the field of air transport management. The MSc Air Transport Management is designed to equip students with the skills required to pursue a successful career in various sectors of the air transport industry, including, but not restricted to, airlines, airport companies and authorities, civil aviation departments, air transport consultancies and aerospace companies. Cranfield students are also well prepared to undertake research leading to the award of a PhD.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

PROGRAMME TITLE: Aviation Management (Executive) Programme

Date of first publication/latest revision: July 2016/Revision February 2017

1. What is the course?

Course information

Course Title	MSc in Air Transport Management (Executive) – *Cranfield* MSc in Air Transport Management (Executive) - *Singapore* MSc in Air Transport Management (Executive) - *Muscat*
Course code	MSATRPTC, PDATRPTC – Air Transport Management (Executive) – *Cranfield* MSATSPTC – MSc in Air Transport Management (Executive) - *Singapore* MSATOFTC, MSATOPTC – MSc in Air Transport Management (Executive) - *Muscat* PCAVMPTC - PgCert in Aviation Management
Academic Year	2016/17
Valid entry routes	MSc in Air Transport Management (Executive) – *Cranfield* MSc in Air Transport Management (Executive) - *Singapore* MSc in Air Transport Management (Executive) - *Muscat* PgDip in Air Transport Management PgCert in Aviation Management
Additional exit routes	PgDip in Air Transport Management PgCert in Aviation Management
Mode of delivery	Cranfield / Singapore - Part-time, Distance Muscat - Full-time / Part-time
Location(s)[1] of Study	Cranfield University / Singapore Aviation Academy / Muscat University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Centre for Air Transport Management
Course Director	Dr Robert Mayer

[1] If any part of this course is delivered at another site, please note which one(s) here

Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	1st or upper 2nd class UK honours degree or equivalent in any relevant discipline. A recognised professional qualification plus a number of years relevant working experience may be accepted as equivalent. For applicants whose first language is not English there is a requirement to achieve the level of 7.0 on IELTS and equivalent grades on other English language qualifications recognised by the University.
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Part-time MSc – up to three years, Part-time PgDip – two years, Part-time PgCert – two years Full-time MSc (Muscat only) – one year
Course Start Month(s)	July (Cranfield) / September (Singapore) / September (Muscat)

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Centre for Air Transport Management where the research interests include:

- Air Transport Management
- Airline and Airport Planning and Operations
- Safety and Air Accident Investigation

Cranfield University interacts with the following institutions and in the following ways:

Teaching and assessment is also provided by the School of Management.

Teaching and assessment for the course in Singapore is primarily (but not completely) held at the Singapore Aviation Academy (SAA). The SAA provides the infrastructure and is involved in marketing the course while teaching and assessment is solely the responsibility of Cranfield University.

Teaching and assessment for the course in Muscat is primarily (but not completely) held at Muscat University. Fly-in Cranfield faculty provide over 60% of the teaching in Muscat (as per the MoU). Muscat University provides the infrastructure and is involved in marketing the course whilst the majority of the teaching and all the assessment is the responsibility of Cranfield University.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

2. What are the aims of the course?

Cranfield University offers this course in order to:

- Provide a part-time masters-level programme of learning for individuals either working in the air transport, airport or related industries to develop and enhance their skills in air transport management offering a mode of study that enables them to combine study with work commitments;
- Provide a part-time masters-level programme of learning to meet the management training needs of existing air transport companies, airport operators, suppliers, aviation and planning consultants and government regulators offering a mode of study that allows their employees to combine study with work commitment.
- Provide a flexible model of delivery that enables students in Muscat to complete the degree in an accelerated manner in one year.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) entrance routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Practitioners in the air transport industry, particularly at middle management level, who are seeking to expand their knowledge and skills in air transport management in order to further develop their careers.
- Practitioners in the related sectors who are seeking to gain an in-depth understanding of the air transport industry.
- Practitioners seeking to pursue doctoral research in air transport management.

Please note that the courses in this programme differ from the full-time MSc in Air Transport Management (Cranfield) variant also offered.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate in Aviation Management

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Describe and critique the regulatory frame that defines the air transport industry, detail the fundamental elements (and the application to current problems in) airline and airport business management and air transport economics and financial management;

ILO 2. Make critical appraisal of literature pertaining to the technical, operational and commercial aspects of the air transport industry, and identify, evaluate and apply appropriate statistical and research strategies in industrial and academic research and analysis;

ILO 3. Summarise and critically analyse the concepts of personal/professional development and leadership and demonstrate their application to self and work;

ILO 4. Demonstrate the ability to work within teams and possess an understanding and appreciation of the contributions made by other specialists, working effectively to set deadlines and to make effective oral and written presentations of their work.

B. Postgraduate Diploma in Air Transport Management

In addition to the intended learning outcomes outlined for the Postgraduate Certificate, a diligent student would also be expected to:

ILO 5. Analyse critically practical problems in the air transport and related industries to provide timely solutions, having regard to technical, regulatory, commercial, political, social and environmental constraints;

ILO 6. Evaluate the complex interrelationships of technical and operational aspects of the air transport industry with the commercial pressures and realities facing its management;

ILO 7. Undertake group research on a subject relevant to technical, operational or commercial aspects of the air transport or related industries, including a review of relevant literature, methodological planning, data collection, data analysis, presentation of results, and evaluation and discussion of the results, and the contribution made.

C. Executive MSc in Air Transport Management / Executive MSc in Air Transport Management (Singapore) / Executive MSc in Air Transport Management (Muscat)

In addition to the intended learning outcomes outlined for the Postgraduate Diploma, a diligent student would also be expected to:

ILO 8. Formulate research questions, develop aims and objectives for completing the research task. Conduct a literature review and present it in an appropriate style. Critically assess different methodologies and select an appropriate one to test hypotheses, collecting primary and/or secondary data and using appropriate analytical techniques, whilst understanding potential biases that may influence researchers and methods to limit such occurrences;

ILO 9. Prepare a scientific thesis and present results based upon the techniques listed above and be able to defend the thesis orally.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Lectures and workshops delivered by industry practitioners, demonstrating the application of theory to various examples and case studies;
- Training on how to use the library's online resources and bibliographical software undertaken by a Cranfield University librarian;
- Workshops on thesis development and progression.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate in Aviation Management

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 1-6	60
ELECTIVE MODULES:	
None	
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 1-6 Group Project (24)	60 20
ELECTIVE MODULES:	
40 credits from Modules 7-23	40
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

MSc in Air Transport Management (Executive) - Cranfield / MSc in Air Transport Management (Executive) - Singapore

Description	Credits
COMPULSORY MODULES:	
Modules 1-6 Group Project (24) Individual Research Project (25)	60 20 80
ELECTIVE MODULES:	
40 credits from Modules 7-23 *(Modules 7-19 only run at Cranfield on Singapore variant)*	40
TOTAL:	200

MSc in Air Transport Management (Executive) - Muscat

Description	Credits
COMPULSORY MODULES:	
Modules 1-6 Group Project (24) Individual Research Project (25)	60 20 80
ELECTIVE MODULES:	
40 credits from Modules 7-19 *(Modules 8, 11-13 and 15-19 only run at Cranfield on Muscat variant)* *(Modules 20-23 not available on Muscat variant)*	40
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Part-time students register for the course in July in Cranfield or September in Singapore and are expected to complete the course within 3 years. Muscat based students register for the course in September and can complete the degree in an accelerated study programme within 1 year.

The majority of modules will be run over a three or four day period. In addition to the standard 10 credit modules, the course offers four modules each carrying 5 credits. These 5 credit modules will be delivered on a distance learning basis, supported by interactive e-learning technologies. (Please Note: distance learning modules are available to Cranfield and Singapore students only). Providing these 5 credit modules is a key part of our commitment to facilitating flexible learning. It also reflects the market demand for these subject areas as well as the growing expertise of faculty members. Students may choose no more than two 5 credit modules. With an exceptionally wide portfolio of optional modules, we provide our students with opportunity to tailor the programme to their specific needs and interests, accelerating to a senior management role.

In addition to the optional modules, PgDip students are required to complete a 20 credit supervised group project. This element has consistently proved to be a source of positive feedback (from our students, external examiners and industrial advisory boards) in the full-time version of this course and we want it to be a similarly successful addition to this executive course. The group project will be launched early at the end of the core modules to give students plenty of time to develop and discuss their plans and to carry out background research in advance of coming to Cranfield or in Singapore for a week of intensive group work.

As for the PgDip route, in addition, MSc students are required to complete a supervised thesis on a subject of their choice within the field of air transport management. The research is expected to go into much greater depth than that required for the PgDip.

Singapore and Muscat students will be able to complete their entire course in Singapore or Muscat (respectively), or may take the opportunity to select some optional modules that are delivered only at Cranfield. If students at Cranfield, Singapore or Muscat cannot attend a particular module in their registered location, they are able to attend at one of the other locations.

The following modules are only delivered at Cranfield;

- Crisis Management and Business Continuity
- Regulatory Policy and Air Law
- Airport Environmental Planning
- Air Transport Engineering
- Airport Commercial Revenue Development
- Airport Strategic Planning
- Aviation Safety Management
- Airport Design
- Air Transport and the Environment

The following modules are delivered by Distance Learning (for Cranfield and Singapore students only);

- Air Transport in Emerging Markets
- Air Transport in Remote Regions

- The Business Travel Market
- Aviation Marketing

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

MSc in Air Transport Management (Executive) - Cranfield

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-AEX-TALB Occ A	The Airline Business	Dr Keith Mason	20		10	Y	03/07/17	03/07/17	05/07/17	40 40	EX ICW	50 50				05/07/17 04/09/17	At the next available opportunity which may not be until the course runs

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		the following year
2	N-AEX-TAPB Occ A	The Airport Business	Dr Romano Pagliari	20		10	N	30/11/17	30/11/17	02/12/17	40	ICW	100				05/02/18	At the next available opportunity which may not be until the course runs the following year
3	N-AEX-SFS Occ A	Strategies for Success	Dr Frankie O'Connell	20		10	N	18/09/17 05/03/18	18/09/17 05/03/18	20/09/17 07/03/18	40	ICW	100				20/11/17 08/05/18	At the next available opportunity which may not be until the course runs the following year
4	N-AEX-PPD Occ A	Professional and Personal Development	Graham Clark	18		10	N	06/07/17	06/07/17	08/07/17	40	ICW	100				20/11/17	At the next available opportunity which may not be until the course runs the following year
5	N-AEX-ATEFM	Air Transport Economics and	Dr Robert Mayer	25		10	N	27/11/17	27/11/17	29/11/17	40	EX	100				05/03/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
	Occ A	Financial Management																may not be until the course runs the following year
6	N-AEX-RM Occ A	Research Methods	Dr Nicola Volta	24		10	N	08/03/18	08/03/18	10/03/18	40	ICW	100				08/05/18	At the next available opportunity which may not be until the course runs the following year
7	N-APM-RMF10	Air Transport Market Analysis and Forecasting	Dr Chikage Miyoshi	25		10	Y	22/01/18	22/01/18	26/01/18	40	ICW	100				12/03/18	At the next available opportunity which may not be until the course runs the following year
8	N-AEX-CMBC	Crisis Management and Business Continuity	Dave Barry	24		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				08/01/18	At the next available opportunity which may not be until the course runs the following year
9	N-ATF-ATM10	Air Transport Marketing	Dr Keith Mason	20		10	Y	15/03/18	15/03/18	17/03/18	40	ICW	100				14/05/18	At the next available

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
	Occ B																	opportunity which may not be until the course runs the following year
10	N-ATF-AFP10 Occ B	Airline Fleet Planning	Andy Foster	25		10	Y	12/03/18	12/03/18	14/03/18	40	ICW	100				14/05/18	At the next available opportunity which may not be until the course runs the following year
11	N-ATF-RPA10 Occ B	Regulatory Policy and Air Law	Dr Keith Mason	25		10	Y	16/10/17	16/10/17	20/10/17	40	EX	100				27/10/17	At the next available opportunity which may not be until the course runs the following year
12	N-ATF-ATN10	Air Transport and the Environment	Dr Chika Miyoshi	25		10	Y	29/01/18	29/01/18	02/02/18	40	ICW	100				19/03/18	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
13	N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Cengiz Turkoglu	30		10	Y	12/02/18	12/02/18	16/02/18	40			100 MULTI	EX ICW	30 70	16/04/18	At the next available opportunity which may not be until the course runs the following year
14	N-APM-APO10	Airport Operations	Richard Moxon	30		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				18/12/17	At the next available opportunity which may not be until the course runs the following year
15	N-APM-AEP10	Airport Environmental Planning	Dr Thomas Budd	24		10	Y	29/01/18	29/01/18	02/02/18	40 40	ICW GPRES	75 25				19/03/18 02/02/18	At the next available opportunity which may not be until the course runs the following year
16	N-APM-ASP10	Airport Strategic Planning	Mr Richard Moxon	30		10	Y	15/01/18	15/01/18	19/01/18	40	ICW	100				05/03/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		may not be until the course runs the following year
17	N-SAI-ISMS	Aviation Safety Management	Dr Simon Mitchell/Mr David Barry	30		10	Y	12/02/18	12/02/18	16/02/18	40	ICW	100				03/04/18	At the next available opportunity which may not be until the course runs the following year
18	N-APM-ADE10	Airport Design	Mr Henrik Rothe	30		10	Y	19/02/18	19/02/18	23/02/18	40 40	ICW GPRES	90 10				09/04/18	At the next available opportunity which may not be until the course runs the following year
19	N-AEX-ACR	Airport Commercial Revenue Development	Dr Romano Pagliari	20		10	N	30/10/17	30/10/17	03/11/17	40	ICW	100				12/01/18	At the next available opportunity which may not be until the course runs the following year
20	N-AEX-AM	Aviation Marketing	Dr Keith Mason	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		opportunity which may not be until the course runs the following year
21	N-AEX-ATEM	Air Transport in Emerging Markets	Dr Frankie O'Connell	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year
22	N-AEX-BTM	The Business Travel Market	Dr Keith Mason	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year
23	N-AEX-ATRR	Air Transport in Remote Regions	Dr Romano Pagliari	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
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24	N-AEX-GP	Group Project	Mr Andy Foster	10		20	N	02/07/18	02/07/18	13/07/18	50	GCW GPRES ICW	40 40 20				10/09/18 13/07/18 29/06/18	
25	N-ATF-THES10	Individual Research Project	Dr Romano Pagliari	10		80	Y	15/07/17	15/07/17	May 2018		THESIS OR	80 20				May 2018 Jun 2018	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

MSc in Air Transport Management (Executive) - Singapore

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[15] (%) of Independent assessments	Weighting within module of multi-part assessments[16] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
1	N-AEX-TALB Occ B	The Airline Business	Dr Keith Mason	20		10	Y	18/09/17	18/09/17	20/09/17	40 40	EX ICW	50 50				20/09/17 17/11/17	At the next available opportunity which may not be until the course runs the following year

[12] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[13] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[14] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[15] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[16] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[17] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[18] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module15 (%) of Independent assessments	Weighting within module of multi-part assessments[16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
2	N-AEX-TAPB Occ B	The Airport Business	Dr Romano Pagliari	20		10	N	15/03/18	15/03/18	18/03/18	40	ICW	100				19/05/18	At the next available opportunity which may not be until the course runs the following year
3	N-AEX-SFS Occ B	Strategies for Success	Dr Frankie O'Connell	20		10	N	09/07/18	09/07/18	11/07/18	40	ICW	100				14/09/18	At the next available opportunity which may not be until the course runs the following year
4	N-AEX-PPD Occ B	Professional and Personal Development	Graham Clark	18		10	N	21/09/17	21/09/17	23/09/17	40	ICW	100				29/01/18	At the next available opportunity which may not be until the course runs the following year
5	N-AEX-ATEFM	Air Transport Economics and	Dr Robert Mayer	25		10	N	12/03/18	12/03/18	14/03/18	40	EX	100				09/07/18	At the next available opportunity

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
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	Occ B	Financial Management																which may not be until the course runs the following year
6	N-AEX-RM Occ B	Research Methods	Dr Nicola Volta	24		10	N	12/07/18	12/07/18	14/07/18	40	ICW	100				14/09/18	At the next available opportunity which may not be until the course runs the following year
7	N-APM-RMF10	Air Transport Market Analysis and Forecasting	Dr Chikage Miyoshi	25		10	Y	22/01/18	22/01/18	26/01/18	40	ICW	100				12/03/18	At the next available opportunity which may not be until the course runs the following year
8	N-AEX-CMBC	Crisis Management and Business Continuity	Dave Barry	24		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				08/01/18	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module15 (%) of Independent assessments	Weighting within module of multi-part assessments[16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
																		following year
9	N-ATF – ATM10 Occ B	Air Transport Marketing	Dr Keith Mason	20		10	Y	15/03/18	15/03/18	17/03/18	40	ICW	100				14/05/18	At the next available opportunity which may not be until the course runs the following year
10	N-ATF-AFP10	Airline Fleet Planning	Andy Foster	25		10	Y	12/03/18	12/03/18	14/03/18	40	ICW	100				14/05/18	At the next available opportunity which may not be until the course runs the following year
11	N-ATF-RPA10	Regulatory Policy and Air Law	Dr Keith Mason	25		10	Y	16/10/17	16/10/17	20/10/17	40	EX	100				27/10/17	At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Type of Assessment	Weighting within module15 (%) of Independent assessments	Weighting within module of multi-part assessments[16](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[17]	Assessment Submission and/or exam date[18]	Assessment / Exam Retake date
12	N-ATF-ATN10	Air Transport and the Environment	Dr Chika Miyoshi	25		10	Y	29/01/18	29/01/18	02/02/18	40	ICW	100				19/03/18	At the next available opportunity which may not be until the course runs the following year
13	N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Cengiz Turkoglu	30		10	Y	12/02/18	12/02/18	16/02/18	40			100 MULTI	EX ICW	30 70	16/04/18	At the next available opportunity which may not be until the course runs the following year
14	N-APM-APO10 Occ B	Airport Operations	Richard Moxon	30		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				18/12/17	At the next available opportunity which may not be until the course runs the following year
15	N-APM-AEP10	Airport Environmental Planning	Dr Thomas Budd	24		10	Y	29/01/18	29/01/18	02/02/18	40 40	ICW GPRES	75 25				19/03/18 02/02/18	At the next available opportunity which may not be until the course runs

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
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																		the following year
16	N-APM-ASP10	Airport Strategic Planning	Mr Richard Moxon	30		10	Y	15/01/18	15/01/18	19/01/18	40	ICW	100				05/03/18	At the next available opportunity which may not be until the course runs the following year
17	N-SAI-ISMS	Aviation Safety Management	Dr Simon Mitchell/Mr David Barry	30		10	Y	12/02/18	12/02/18	16/02/18	40	ICW	100				03/04/18	At the next available opportunity which may not be until the course runs the following year
18	N-APM-ADE10	Airport Design	Mr Henrik Rothe	30		10	Y	19/02/18	19/02/18	23/02/18	40 40	ICW GPRES	90 10				09/04/18	At the next available opportunity which may not be until the course runs the following year
19	N-AEX-ACR	Airport Commercial Revenue Development	Dr Romano Pagliari	20		10	N	30/10/17	30/10/17	03/11/17	40	ICW	100				12/01/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[14] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
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20	N-AEX-AM	Aviation Marketing	Dr Keith Mason	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year
21	N-AEX-ATEM	Air Transport in Emerging Markets	Dr Frankie O'Connell	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year
22	N-AEX-BTM	The Business Travel Market	Dr Keith Mason	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available opportunity which may not be until the course runs the following year
23	N-AEX-ATRR	Air Transport in Remote Regions	Dr Romano Pagliari	10		5	N	01/02/18	N/A	01/07/18	40	ICW	100				01/07/18	At the next available

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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																		opportunity which may not be until the course runs the following year
24	N-AEX-GP	Group Project	Andy Foster	10		20	N	11/09/17	11/09/17	22/09/17	50	GCW GPRES ICW	40 40 20				08/12/17 22/09/17 08/09/17	
25	N-ATF-THES10	Individual Research Project	Dr Romano Pagliari	10		80	Y	15/07/18	15/07/18	Aug 2019		THESIS OR	80 20				Aug 2019	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

MSc in Air Transport Management (Executive) - Muscat

Module Number	Module code	Title	Module Leader	Contact hours[19]	Total hours delivered by Visiting Lecturers[20]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[21] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[22] (%) of Independent assessments	Weighting within module of multi-part assessments[23] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[24]	Assessment Submission and/or exam date[25]	Assessment / Exam Retake date
1	N-AEX-TALB Occ C	The Airline Business	Dr Keith Mason	20		10	Y	10/09/17	10/09/17	14/09/17	40 40	EX ICW	50 50				14/09/17 26/10/17	At the next available opportunity which may not be until the course runs the following year

[19] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[20] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[21] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[22] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[23] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[24] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[25] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[19]	Total hours delivered by Visiting Lecturers[20]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[21] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module22 (%) of Independent assessments	Weighting within module of multi-part assessments[23](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[24]	Assessment Submission and/or exam date[25]	Assessment / Exam Retake date
2	N-AEX-TAPB Occ C	The Airport Business	Dr Romano Pagliari	20		10	N	22/10/17	22/10/17	26/10/17	40	ICW	100				07/12/17	At the next available opportunity which may not be until the course runs the following year
3	N-AEX-SFS Occ C	Strategies for Success	Dr Frankie O'Connell	20		10	N	03/12/17	03/12/17	07/12/17	40	ICW	100				18/01/18	At the next available opportunity which may not be until the course runs the following year
4	N-AEX-PPD Occ C	Professional and Personal Development	Graham Clark	18		10	N	17/09/17	17/09/17	19/09/17	40	ICW	100				30/11/17	At the next available opportunity which may not be until the course runs the following year
5	N-AEX-ATEFM	Air Transport Economics and	Dr Robert Mayer	25		10	N	15/10/17	15/10/17	19/10/17	40	EX	100				10/12/17	At the next available opportunity

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[19]	Total hours delivered by Visiting Lecturers[20]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[21] - 40% or 50%	Type of Assessment	Weighting within module22 (%) of Independent assessments	Weighting within module of multi-part assessments[23](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[24]	Assessment Submission and/or exam date[25]	Assessment / Exam Retake date
	Occ C	Financial Management																which may not be until the course runs the following year
6	N-AEX-RM Occ C	Research Methods	Dr Nicola Volta	24		10	N	10/12/17	10/12/17	14/12/17	40	ICW	100				25/01/18	At the next available opportunity which may not be until the course runs the following year
7	N-APM-RMF10	Air Transport Market Analysis and Forecasting	Dr Chikage Miyoshi	25		10	Y	11/02/18	11/02/18	15/02/18	40	ICW	100				29/03/18	At the next available opportunity which may not be until the course runs the following year
8	N-AEX-CMBC	Crisis Management and Business Continuity	Dave Barry	24		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				08/01/18	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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												Type of Assessment	Weighting within module22 (%) of Independent assessments	Weighting within module of multi-part assessments[23](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[24]	Assessment Submission and/or exam date[25]	Assessment / Exam Retake date
																		following year
9	N-ATF – ATM10 Occ C	Air Transport Marketing	Dr Keith Mason	20		10	Y	04/02/18	04/02/18	08/02/18	40	ICW	100				22/03/18	At the next available opportunity which may not be until the course runs the following year
10	N-ATF-AFP10	Airline Fleet Planning	Andy Foster	25		10	Y	15/04/18	15/04/18	19/04/18	40	ICW	100				31/05/18	At the next available opportunity which may not be until the course runs the following year
11	N-ATF-RPA10	Regulatory Policy and Air Law	Dr Keith Mason	25		10	Y	16/10/17	16/10/17	20/10/17	40	EX	100				27/10/17	At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[19]	Total hours delivered by Visiting Lecturers[20]	Credits	Is the module shared? Y/N	Calendar			Assessment							
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								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[21] - 40% or 50%	Type of Assessment	Weighting within module22 (%) of Independent assessments	Weighting within module of multi-part assessments[23](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[24]	Assessment Submission and/or exam date[25]	Assessment / Exam Retake date
12	N-ATF-ATN10	Air Transport and the Environment	Dr Chika Miyoshi	25		10	Y	29/01/18	29/01/18	02/02/18	40	ICW	100				19/03/18	At the next available opportunity which may not be until the course runs the following year
13	N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Cengiz Turkoglu	30		10	Y	12/02/18	12/02/18	16/02/18	40			100 MULTI	EX ICW	30 70	16/04/18	At the next available opportunity which may not be until the course runs the following year
14	N-APM-APO10 Occ C	Airport Operations	Richard Moxon	30		10	Y	08/04/18	08/04/18	12/04/18	40	ICW	100				24/05/18	At the next available opportunity which may not be until the course runs the following year
15	N-APM-AEP10	Airport Environmental Planning	Dr Thomas Budd	24		10	Y	29/01/18	29/01/18	02/02/18	40 40	ICW GPRES	75 25				19/03/18 02/02/18	At the next available opportunity which may not be until the course runs

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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																		the following year
16	N-APM-ASP10	Airport Strategic Planning	Mr Richard Moxon	30		10	Y	15/01/18	15/01/18	19/01/18	40	ICW	100				05/03/18	At the next available opportunity which may not be until the course runs the following year
17	N-SAI-ISMS	Aviation Safety Management	Dr Simon Mitchell/Mr David Barry	30		10	Y	12/02/18	12/02/18	16/02/18	40	ICW	100				03/04/18	At the next available opportunity which may not be until the course runs the following year
18	N-APM-ADE10	Airport Design	Mr Henrik Rothe	30		10	Y	19/02/18	19/02/18	23/02/18	40 40	ICW GPRES	90 10				09/04/18	At the next available opportunity which may not be until the course runs the following year
19	N-AEX-ACR	Airport Commercial Revenue Development	Dr Romano Pagliari	20		10	N	30/10/17	30/10/17	03/11/17	40	ICW	100				12/01/18	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[19]	Total hours delivered by Visiting Lecturers[20]	Credits	Is the module shared? Y/N	Calendar			Assessment							
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																		may not be until the course runs the following year
20	N-AEX-AM	Aviation Marketing	Dr Keith Mason	10		5	N	MODULE NOT AVAILABLE			40	ICW	100					
21	N-AEX-ATEM	Air Transport in Emerging Markets	Dr Frankie O'Connell	10		5	N	MODULE NOT AVAILABLE			40	ICW	100					
22	N-AEX-BTM	The Business Travel Market	Dr Keith Mason	10		5	N	MODULE NOT AVAILABLE			40	ICW	100					
23	N-AEX-ATRR	Air Transport in Remote Regions	Dr Romano Pagliari	10		5	N	MODULE NOT AVAILABLE			40	ICW	100					
24	N-AEX-GP	Group Project	Andy Foster	10		20	N	23/06/18	23/06/18	05/07/18	50	GCW GPRES ICW	40 40 20				19/07/18 05/07/18 23/06/18	
25	N-ATF-THES10	Individual Research Project	Dr Romano Pagliari	10		80	Y	02/01/17	None	None		THESIS OR	80 20				Aug 2018	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Type for The Aviation Management Programme

Module number	Module Code	MSc & PgDip Air Transport Management (Executive) *(Singapore: MSc only)*	MSc Air Transport Management (Executive) – *(Muscat only)*	PgCert Aviation Management		Shared module?
1	N-AEX-TALB	C	C	C		Y
2	N-AEX-TAPB	C	C	C		N
3	N-AEX-SFS	C	C	C		N
4	N-AEX-PPD	C	C	C		N
5	N-AEX-ATEFM	C	C	C		N
6	N-AEX-RM	C	C	C		N
7	N-APM-RMF10	E	E	-		Y
8	N-AEX-CMBC	E	E	-		Y
9	N-ATF-ATM10	E	E	-		Y
10	N-ATF-AFP10	E	E	-		Y
11	N-ATF-RPA10	E	E	-		Y
12	N-ATF-ATN10	E	E	-		Y
13	N-AW-ATEMO	E	E	-		Y
14	N-APM-APO10	E	E	-		Y
15	N-APM-AEP10	E	E	-		Y
16	N-APM-ASP10	E	E	-		Y
17	N-SAI-ISMS	E	E	-		Y
18	N-APM-ADE10	E	E	-		Y
19	N-AEX-ACR	E	E	-		N
20	N-AEX-AM	E	-	-		N
21	N-AEX-ATEM	E	-	-		N
22	N-AEX-BTM	E	-	-		N
23	N-AEX-ATRR	E	-	-		N
24	N-AEX-GP	C	C	-		N
25	N-ATF-THES10	C (MSc)	C (MSc)	-		Y

C - Compulsory; E – Elective

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-AEX-TALB	The Airline Business	Air Transport Management (Executive)	Business and Strategic Leadership[26]
N-APM-RMF10	Air Transport Market Analysis and Forecasting	Airport Planning and Management	F-T Air Transport Management
N-AEX-CMBC	Crisis Management and Business Continuity	Air Transport Management (Executive)	Safety and Accident Investigation (Air Transport)
N-ATF-ATM10	Air Transport Marketing	F-T Air Transport Management	Air Transport Management (Executive)
N-ATF-AFP10	Airline Fleet Planning	F-T Air Transport Management	Air Transport Management (Executive)
N-ATF-RPA10	Regulatory Policy and Air Law	F-T Air Transport Management	Airport Planning and Management Air Transport Management (Executive)
N-ATF-ATN10	Air Transport and the Environment	F-T Air Transport Management	Air Transport Management (Executive)
N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Airworthiness	Air Transport Management (Executive) F-T Air Transport Management Military Aerospace and Airworthiness Safety and Human Factors in Aviation
N-APM-APO10	Airport Operations	F-T Airport Planning and Management	Air Transport Management (Executive)

[26] Different assessment pattern hence different module with same syllabus

N-APM-ASP10	Airport Strategic Planning	F-T Airport Planning and Management	Air Transport Management (Executive)
N-APM-AEP10	Airport Environmental Planning	F-T Airport Planning and Management	Air Transport Management (Executive)
N-APM-ADE10	Airport Design	F-T Airport Planning and Management	Air Transport Management (Executive)
N-AFT-THES10	Thesis	F-T Air Transport Management	Air Transport Management (Executive) F-T Airport Planning and Management

7. How are the ILOs assessed?

The course uses a range of assessment types. Overall, the programme has **three** distinct but interrelated elements: the taught modules, a group project, and an individual research project.

The group project is assessed by a group oral presentation and a written report; individual contribution will be taken into account as well.

The individual research project is assessed by consideration of the written thesis submission and an oral presentation on the research findings.

Taught modules will include assessment by coursework and examination. Whilst we expect to focus on traditional assignments and exams for summative assessment of learning in year one, coursework assessment can also include:

- Online tests
- Oral presentations in class
- In-class quizzes/tests
- In-class or remote group work

We continue to consider our strategy in this regard for the optional modules in year two.
Module assignments are set to be challenging and to encourage the student to study the module topic areas in more depth. The objectives of the assignments are for the students to:

- Acquire the skill to efficiently search literature
- Acquire an in-depth knowledge of contemporary air transport management issues
- Apply skills and knowledge to solve specific problems
- Develop the capability to critically analyse data
- Compile succinct and informative reports to a high standard
- Formulate responses to specific questions against a time limit

This approach has been adopted in order to facilitate the completion of the course by part-time students, often from abroad, without the need to return only for examinations. However, two modules will be examined at Cranfield and it is our intention to combine this with a scheduled visit to attend other taught modules. For those continuing to MSc level, a thesis based on the individual research project has to be presented at the end of the registration period and must demonstrate competency in literature review, methodology, data analysis, conclusion forming and presentation. Students will also be asked to give a formal oral presentation on their research findings.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

(nb – common to MSc Air Transport Management (Executive) – Cranfield / MSc Air Transport Management (Executive) – Singapore / MSc Air Transport Management (Executive) - Muscat)

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4
1) N-AEX-TALB	EX ICW			ICW
2) N-AEX-TAPB	ICW			
3) N-AEX-SFS	ICW			ICW
4) N-AEX-PPD			ICW	
5) N-AEX-ATEFM	EX	EX		
6) N-AEX-RM		ICW		

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

(nb – common to MSc Air Transport Management (Executive) – Cranfield / MSc Air Transport Management (Executive) – Singapore / MSc Air Transport Management (Executive) – Muscat (excluding Modules 20-23))

Award ILOs / Module No.	ILO5	ILO6	ILO7
7) N-APM-RMF10	ICW		
8) N-AEX-CMBC	ICW	ICW	
9) N-AEX-ATM10	ICW	ICW	
10) N-AEX-AFP10	ICW	ICW	
11) N-ATF-RPA10	EX		
12) N-ATF-ATN10		ICW	
13) N-AW-ATEMO		ICW	
14) N-APM-APO10	ICW	ICW	
15) N-APM-AEP10		ICW	
16) N-APM-ASP10		ICW	
17) N-SAI-ISMS	ICW		
18) N-APM-ADE10	ICW		GPRES
19) N-AEX-ACR		ICW	
20) N-AEX-AM	ICW		
21) N-AEX-ATEM	ICW		
22) N-AEX-BTM	ICW		
23) N-AEX-ATRR	ICW		

Award ILOs / Module No.	ILO5	ILO6	ILO7
24) N-AEX-GP	GCW GPRES ICW	GCW GPRES ICW	GCW GPRES ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

(nb – common to MSc Air Transport Management (Executive) – Cranfield / MSc Air Transport Management (Executive) – Singapore / MSc Air Transport Management (Executive) - Muscat)

Award ILOs / Module No.	ILO8	ILO9
25) N-AEX-THS	THESIS	THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known

as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

Students taking the Air Transport Management course will be equipped with the skills required to either enhance their present career or to allow them to pursue a new career path with airlines, airport authorities, civil aviation departments, air transport consultancies or aerospace companies.

Cranfield students are also well prepared to undertake research leading to the award of a PhD.

COURSE SPECIFICATION

Cranfield University: Course Specifications
Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Aircraft Engineering

Date of first publication/latest revision: September 2017

1. What is the course?

Course information

Course Title	MSc in Aircraft Engineering
Course code	MSAENPTC, PDAENPTC, PCAENPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Aeronautics
Course Director	Dr Irfan Madani
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Part-time MSc - up to three years, Part-time PgDip - two years, Part-time PgCert - two years

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Course Start Month(s)	February

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Aeronautics where the research interests include:

- A wide range of aerospace design topics, from conceptual to detail design of civil, military and Uninhabited Aerial Vehicles. It is also leading research into advanced technologies, such as laminar flow, avionics, more electric aircraft and advanced metallic and composite airframe structures.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Royal Aeronautical Society (RAeS) and Institution of Mechanical Engineers (IMechE). Current accreditation is for intake years 2015 up to and including 2019.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- To educate and train engineers to acquire and then exercise a broad range of design and manufacturing skills, knowledge and business awareness of the aircraft design cycle.
- To apply the knowledge that has been acquired to a group project, and to develop team working and management skills through the project work.
- To develop research skills and independent learning through the individual research project.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Aerospace Engineers working in the aerospace industry who wish to broaden their knowledge of aircraft engineering for career development in technical, leadership and integration roles.
- Aerospace Engineers working towards chartered engineer status.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a critical understanding of the aircraft development lifecycle and the major disciplines of aircraft engineering.
ILO 2. Apply their acquired knowledge of aircraft engineering to solve real world aircraft design and manufacturing problems.
ILO 3. Effectively use computer based tools (such as Computer Aided Design) to support design tasks.

ILO 4. Select appropriate technologies and methodologies to suit particular projects.
ILO 5. Critically evaluate current design and analysis techniques and where appropriate adapt them to new applications.
ILO 6. Use a variety of information sources including networked information sources.
ILO 7. Clearly present results and conclusions both orally and in writing.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 8. Plan and execute a complex multi-disciplinary design task as part of a team.
ILO 9. Work effectively as a member of a multi-disciplinary team.
ILO 10. Make informed judgements in the absence of complete data.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 11. Undertake independent research on subjects relevant to aircraft engineering and demonstrate originality in the application of knowledge.
ILO 12. Demonstrate self-direction and originality in solving aircraft engineering problems.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Support from GDP chairman and industrial co-chair (MSc and PgDip only).
- Informal teaching support from module lecturers related to taught course material.
- Informal and pastoral support from the Course Director.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1-3	30
ELECTIVE MODULES:	
Any three modules chosen from: 4-15	30

TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1-3 Group Design Project: 16	30 60
ELECTIVE MODULES:	
Any three modules chosen from: 4-15	30
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Modules:1-5 Group Design Project: 16 Individual Research Project: 17	50 60 60
ELECTIVE MODULES:	
Any three modules chosen from: 6-15	30
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Part-time students register for the course in February and are expected to complete the course within 3 years for MSc, 24 months for PgDip and 18 months for PgCert.

The majority of the modules are taught over one week residential at Cranfield University. Some modules are taught over two weeks.

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-AEN-IAVD	Introduction and Initial Aerospace Vehicle Design	Prof Howard Smith	40		10	N		05/02/18	16/02/18	40	ICW	100				13/04/18	At the next available opportunity which may not be until the course runs the following year
2	N-AEN-TIPD	Tools for Integrated Product Development	Dr Adrian Clarke	25		10	N		18/06/18	22/06/18	40	ICW	100				17/08/18	At the next available opportunity which may not be until the

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		course runs the following year
3	N-AEN-MCDSL	Major Component Design and Manufacture	Dr Ioannis Giannopoulos	25		10	N		26/11/18	30/11/18	40	ICW	100				11/02/19	At the next available opportunity which may not be until the course runs the following year
4	N-AEN-MIPD	Methodologies for Integrated Product Development	Prof Marin Guenov	27		10	N		5/2/19	9/2/19	40	EX	100				04/19	At the next available opportunity which may not be until the course runs the following year
5	N-AEN-M	Manufacturing	Dr Kostas Salonitis	25		10	Y		14/05/18	18/05/18	40	ICW	100				13/07/18	At the next available opportunity which may not be until the course runs the following year
6	N-AEN-ALAA	Aircraft Loading Actions and Aeroelasticity	Prof Howard Smith / Prof Shijun Guo	20		10	N		4/3/19	8/3/19	40	ICW	100				3/5/19	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
7	N-AEN-APA	Aircraft Performance for Aircraft Engineering	Dr Alastair Cooke	40		10	N		22/10/18	26/10/18	40	ICW	100				7/1/19	At the next available opportunity which may not be until the course runs the following year
8	N-AEN-AMS	Airframe Systems	Dr Craig Lawson	25		10	Y		4/6/18	8/6/18	40 40			MULTI 100	IPRAC ICW	30 70	8/6/18 6/8/18	At the next available opportunity which may not be until the course runs the following year
9	N-AEN-ASC	Introduction to Aircraft Structural Crashworthiness	Dr Hessam Ghasemnejad	25		10	Y		2/7/18	6/7/18	40	ICW	100				3/9/18	At the next available opportunity which may not be until the course runs the following year
10	N-AVD-DSTR	Detail Stressing	Dr Ioannis Giannopoulos	20		10	Y		5/11/18	16/11/18	40	ICW	100				11/1/19	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
11	N-AVD-ASC	Fatigue, Fracture Mechanics and Damage Tolerance	Dr Wenli Liu	20		10	Y		19/11/18	30/11/18	40	EX	100				02/19	At the next available opportunity which may not be until the course runs the following year
12	N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures	Prof Phil Irving	35		10	Y		9/7/18	13/7/18	40	ICW	100				10/9/18	At the next available opportunity which may not be until the course runs the following year
13	N-AEN-FEM	Finite Element Methods for Aircraft Engineering	Dr Ioannis Giannopoulos	35		10	N		14/5/18	18/5/18	40	ICW	100				13/7/18	At the next available opportunity which may not be until the course runs the following year
14	N-AEN-FDP	Flight Dynamics Principles for Aircraft Engineering	Dr Alastair Cooke	28		10	N		26/11/18	7/12/18	40	ICW	100				11/2/19	At the next available opportunity which may not be until the course runs

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		the following year
15	N-AW-IA	Introduction to Avionics	Dr D Zammit-Mangion	30		10	Y		9/4/18	13/4/18	40	ICW	100				4/6/18	At the next available opportunity which may not be until the course runs the following year
16	N-AEN-GP	Group Design Project	Prof Howard Smith	100		60	N		02/19	02/20		IPRES ICW THESIS	10 10 80				02/20	At the next available opportunity which may not be until the course runs the following year
17	N-AEN-THESIS	Individual Research Project	Dr Irfan Madani	50		60			02/20	02/21		IPRES THESIS	10 90				02/21	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-AEN-M	Manufacturing	Aircraft Engineering	Airworthiness
N-AEN-AMS	Airframe Systems	Aircraft Engineering	Airworthiness
N-AEN-ASC	Introduction to Aircraft Structural Crashworthiness	Aircraft Engineering	Military Aerospace and Airworthiness, Airworthiness, Safety Accident & Investigation (Air Transport)
N-AVD-DSTR	Detail Stressing	Aerospace Vehicle Design	Aerospace Vehicle Design, Airworthiness
N-AVD-ASC	Fatigue, Fracture Mechanics and Damage Tolerance	Aerospace Vehicle Design	Aerospace Vehicle Design
N-AW-IA	Introduction to Avionics	Airworthiness	Airworthiness
N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft Structures	Airworthiness	Airworthiness, Military Aerospace and Airworthiness, Advanced Materials, Aerospace Materials

7. How are the ILOs assessed?

The following assessment types are utilised:

- The course uses a range of assessment types. Students can expect to have 1-3 written examinations, 4-7 post module assignments, 2 elements of assessment by presentation or viva and two written theses (group design project and individual research project).

This approach has been adopted in order to provide a range of assessment methods appropriate to develop skills and be of relevance to the taught materials.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5	ILO6	ILO7	ILO8	ILO9	ILO10	ILO11	ILO12
	Postgraduate Certificate							Postgraduate Diploma			MSc	
1	ICW	ICW		ICW	ICW	ICW	ICW			ICW	ICW	ICW
2	ICW	ICW	ICW			ICW				ICW		ICW
3	ICW	ICW			ICW	ICW				ICW		ICW
4	EX	EX		EX	EX					EX		EX
5	ICW	ICW		ICW	ICW	ICW				ICW	ICW	ICW
6	ICW	ICW		ICW	ICW	ICW				ICW	ICW	ICW
7	ICW	ICW				ICW			ICW	ICW	ICW	ICW
8	IPRAC/	IPRAC/		IPRAC/	IPRAC/	IPRAC/	IPRAC/		IPRAC	IPRAC/	ICW	ICW

	ICW	ICW		ICW	ICW	ICW	ICW			ICW		
9	ICW	ICW	ICW	ICW	ICW	ICW				ICW	ICW	ICW
10	ICW	ICW			ICW	ICW				ICW		ICW
11	EX	EX		EX	EX					EX		EX
12	ICW	ICW		ICW	ICW	ICW				ICW	ICW	ICW
13	ICW	ICW	ICW		ICW	ICW				ICW	ICW	ICW
14	ICW	ICW	ICW			ICW				ICW	ICW	ICW
15	ICW	ICW		ICW	ICW	ICW				ICW	ICW	ICW
16	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS	IPRES/ ICW/ THESIS
17	IPRES/ THESIS	IPRES/ THESIS	THESIS	IPRES/ THESIS	IPRES/ THESIS	IPRES/ THESIS	IPRES/ THESIS			IPRES/ THESIS	IPRES/ THESIS	IPRES/ THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
N/A			

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. What opportunities are graduates likely to have on completing the course?

Most delegates on the course are already working in the Aerospace industry when they join the course. The course can aid career progression into technical, integration and leadership roles, and support career change to aerospace from other engineering/ physical science disciplines.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Airport Planning and Management

Date of first publication/latest revision: January 2017

1. What is the course?

Course information

Course Title	MSc in Airport Planning and Management
Course code	MSAPMFTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip
Mode of delivery	Full-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Centre for Air Transport Management
Course Director	Dr Pere Suau-Sanchez
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	1st or upper 2nd class UK honours degree (or non-UK equivalent) in any discipline. A recognised professional qualification plus a number of years' relevant working experience may be accepted as equivalent. For applicants whose first language is not English there is a requirement to achieve the level of 7.0 on IELTS and equivalent grades on other English language qualifications recognised by the University.
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Centre for Air Transport Management where the research interests include:

- Air Transport Economics
- Airline and Airport Planning and Operations
- Safety and Air Accident Investigation

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by the Chartered Institute of Logistics and Transport in the UK until September 2021.

2. What are the aims of the course?

Cranfield University offers this course in order to:

- provide a masters-level programme of learning for existing airport managers to enhance their skills in airport planning and management;
- provide a masters-level programme of learning for graduates seeking to pursue a career in airport planning and management;
- provide a masters-level programme of learning to meet the management training needs of existing airport operators and planning consultants;
- provide the foundation necessary for graduates to undertake doctoral research in airport planning and management.

This programme is intended for the following range of students:

- New graduates seeking to pursue a career in airport planning and management;
- Practitioners in the sector, particularly at junior and middle management levels, who are seeking to expand their knowledge and skills in airport planning and management in order to further develop their careers;
- Practitioners who are not employed in the airport or related sector, who are seeking a career in airport planning and management;
- Both practitioners and new graduates seeking to pursue doctoral research in airport planning and management.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. MSc

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic understanding of relevant international and national regulations and explain their effects on airport business, planning, design, operations and safety management decisions;
ILO 2. Demonstrate a critical awareness of the key issues that affect users of airport facilities (e.g. airlines and retailers) and explain how their commercial pressures, strategic decisions and priorities impact on airport business, planning, design, operations and safety management decisions;
ILO 3. Identify, analyse and design solutions in order to address a given research problem within the context of airport planning and management, having regard to regulatory constraints and commercial and environmental imperatives;
ILO 4. Collaborate and contribute effectively to a group project, and communicating the findings of this exercise coherently to academics and other practitioners;
ILO 5. Collect information from a variety of electronic (internet) and hard copy sources to support a research project;
ILO 6. Appraise and critique the work of other practitioners and specialists;
ILO 7. Communicate effectively, both orally and in written form, research work produced to both practitioner and academic audiences;
ILO 8. Take responsibility for research produced, including, efficient time management, working to set deadlines and targets, demonstrating self-discipline, creative thinking and critical reflections of their own performance;
ILO 9. Undertake and successfully complete a substantial programme of research independently, applying robust methods of data collection and analysis, and communicating the findings coherently.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- lectures and workshops delivered by industry practitioners, demonstrating the application of theory to various examples and case studies;
- training on how to use the library's on-campus and on-line resources undertaken by a Cranfield University librarian;
- training on how to use the OAG airline schedule database;
- a four-day workshop designed to enable students to develop a working competency in the use of CAST airport passenger terminal design software.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 1 to 9 Group project (10)	100 20
ELECTIVE MODULES:	
n/a	
TOTAL:	120

B. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Modules 1 to 9 Group project (10) Individual Research Project (11)	100 20 80
ELECTIVE MODULES:	
n/a	
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 11 calendar months.

Teaching is delivered in one week modules (with the exception of Research Methods and Statistics which is taught over a week and a half). In the first teaching period, students will have completed five modules. During teaching period two, students complete the remaining modules. Students complete a three week group project which concludes just after the Easter break. Students are required to submit a thesis proposal by the end of January. The thesis is handed-in at the beginning of August. Thesis oral examinations are held in early September.

Students are typically granted four weeks to complete course work. Students are required to contribute to a report for their group projects and to participate in a group presentation. Following handing in their thesis, students must deliver a presentation summarising their thesis and be cross-examined on this presentation as part of their thesis viva.

student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ATF-IAT10	Introduction to the Air Transport Industry	Mr Andy Foster	25		10	Y	09/10/17	09/10/17	13/10/17	40	ICW	100				13/11/17	09/05/18
2	N-APM-APO10	Airport Operations	Mr Richard Moxon	30		10	Y	30/10/17	30/10/17	03/11/17	40	ICW	100				04/12/17	09/05/17
3	N-APM-FBM10	Airport Finance and Business Management	Dr Romano Pagliari	50		20	N	13/11/17	13/11/17	24/11/17	40 40 40	EX ICW GPRES	45 45 10				TBC 08/01/18 24/11/17	09/05/18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	ssessment Submissior nd/or exam date[11]	Assessment / Exam Retake date
4	N-ATF-RPA10	Regulatory Policy and Air Law	Dr Keith Mason	25		10	Y	16/10/17	16/10/17	20/10/17	40	EX	100				27/10/17	09/05/18
5	N-APM-STA10	Research Methods and Statistics	Dr Nicola Volta	30		10	Y	27/11/17	27/11/17	08/12/17	40	ICW	100				22/01/18	09/05/18
6	N-APM-RMF10	Air Transport Market Analysis and Forecasting	Dr Chikage Miyoshi	25		10	Y	08/01/18	08/01/18	12/01/18	40	ICW	100				12/02/18	09/05/18
7	N-APM-ASP10	Airport Strategic Planning	Mr Richard Moxon	30		10	Y	15/01/18	15/01/18	19/01/18	40	ICW	100				19/02/18	09/05/18
8	N-APM-AEP10	Airport Environmental Planning	Dr Tom Budd	30		10	Y	29/01/18	29/01/18	02/02/18	40 40	ICW GPRES	75 25				05/03/18 02/02/18	09/05/18
9	N-APM-ADE10	Airport Design	Mr Henrik Rothe	30		10	Y	19/02/18	19/02/18	23/02/18	40 40	ICW GPRES	90 10				26/03/18	09/05/18
10	N-APM-GP20	Group Project	Dr Pere Suau-Sanchez	10		20	N	09/04/18	09/04/18	27/04/18	40 40	GCW GPRES	50 50				27/04/18	
11	N-ATF-THES10	Individual Research Project	Dr Romano Pagliari	10		80	Y	22/01/18	22/01/18	09/09/18		THESIS OR	80 20				01/08/18 31/08/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ATF-IAT10	Introduction to the Air Transport Industry	Air Transport Management	Air Transport Management
N-APM-STA10	Research Methods and Statistics	Airport Planning and Management	Air Transport Management
N-APM-APO10	Airport Operations	Airport Planning and Management	Air Transport Management (Executive)
N-APM-ASP10	Airport Strategic Planning	Airport Planning and Management	Air Transport Management (Executive)
N-ATF-RPA10	Regulatory Policy and Air Law	Air Transport Management	Air Transport Management Air Transport Management (Executive)
N-APM-RMF10	Air Transport Market Analysis and Forecasting	Airport Planning and Management	Air Transport Management Air Transport Management (Executive)
N-APM-AEP10	Airport Environmental Planning	Airport Planning and Management	Air Transport Management (Executive)
N-APM-ADE10	Airport Design	Airport Planning and Management	Air Transport Management (Executive)
N-ATF-THES10	Individual Research Project	Air Transport Management	Air Transport Management Air Transport Management (Executive)

7. How are the ILOs assessed?

The following assessment types are utilised:

Students will be required to complete one form of assessment for each module. There are nine taught modules under the current structure, seven of which have one point of assessment (six modules assessed by Individual Coursework and one by Examination). The remaining two modules are assessed by a mix of Individual Coursework/Group Presentations/Examination/Individual Project.

Students are subject to two forms of assessment with regard to the group project. Firstly, they must submit group coursework and secondly, their group project oral presentation is also assessed. In the latter form of assessment, each presentation is judged on how well their presentation is organised, the quality of their individual presentations and visual aids and how well they are able to answer questions from the audience. Both forms of assessment have an equal weighting with regard to the module mark.

The thesis is assessed using a combination of their written work and an oral presentation. The oral presentation provides an opportunity for each student to present their thesis to members of staff. These oral presentations are judged on the basis of the quality of the presentation in terms of content and visual aids, how well the key findings and other important elements of the research been communicated and how well the student has responded to questions from the audience.

This approach has been adopted in order to ensure that students achieve the intended learning outcomes set out in Section 3.

Assessment and ILO Mapping

A. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO4	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9
1	ICW					ICW		ICW	
2	ICW					ICW		ICW	
3	EX ICW GPRES	EX ICW GPRES	EX ICW GPRES			EX ICW GPRES		EX ICW GPRES	
4	EX							EX	
5					ICW			ICW	
6					ICW			ICW	
7	ICW					ICW		ICW	
8	ICW GPRES		ICW GPRES			ICW GPRES	GPRES	ICW GPRES	
9	ICW	ICW	ICW			ICW		ICW	
10	GCW GPRES			GCW GPRES		GCW GPRES	GPRES	CGW GPRES	
11					THESIS OR	THESIS OR	THESIS OR	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
N/A			

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for

Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the

student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Graduates from this course will be well prepared for employment in the field of airport planning and management. Opportunities for employment will exist in the planning departments of airport authorities or as a planner in one of airport management and planning consultancies that are involved in various airport development projects worldwide. Opportunities are also possible within regulatory organisations both in the UK and worldwide as well as with various other suppliers that have B2B relationships with the airport sector such as IT companies, airlines and aircraft manufacturers. Cranfield students are also well prepared to undertake research leading to the award of a PhD.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Airworthiness

Date of first publication/latest revision: September 2017

1. What is the course?

Course information

Course Title	MSc in Airworthiness
Course code	MSAWOPTC, PDAWOPTC, PCAWOPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	PgDip and PgCert
Mode of delivery	Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Centre for Safety and Accident Investigation
Course Director	Cengiz Turkoglu
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Part-time MSc - up to three years, Part-time PgDip - up to three years, Part-time PgCert - two years,

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Course Start Month(s)	September

Institutions delivering the course

This course is delivered by the School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Centre for Safety and Accident Investigation where the research interests include:

- Aviation Safety
- Reliability
- Aircraft Maintenance
- Risk Management

Industrial visits and technical experts from external institutions play a large part in the course.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by the Institution of Mechanical Engineers (IMechE) and the Royal Aeronautical Society (RAeS) until September 2019 intake Their statement reads "The accredited MSc programme has met the academic requirements (of the Engineering Council) for Further Learning for registration as a Chartered Engineer (CEng) by both the Institution of Mechanical Engineers and the Royal Aeronautical Society. For students with an accredited first degree, this satisfies the requirements of the educational base for CEng registration."

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to provide a wide spectrum of technical knowledge in the context of the related regulatory and safety issues. This is a background that managers in today's aerospace industry must possess. A detailed knowledge of airworthiness issues early in the development stage of a product's design, modification, repair or process helps the downstream business operation and enables a better balance to be struck between cost and safety. Specifically, the course aims to:

- Provide a globally unique course that relates the regulatory background to the technology concerned in the design, production and maintenance of aircraft – the airworthiness issues.
- Establish a centre of excellence that delivers a high technology Masters programme in airworthiness.
- Promote relevant research and development activity in airworthiness within Cranfield University, industry and government agencies.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) entry and exit routes are provided for students who wish to access only parts of the course provided. It is also suggested that the latter two qualifications may be more appropriate for engineers in the aviation industry who have no need for a separate research project (thesis).

This programme is intended for the following range of students:

- Graduate engineers from airlines
- Licensed engineers in aviation industry (PgCert / PgDip possibly extending to MSc)
- Airworthiness engineers working in manufacturing, maintenance and/or operations

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

***A.* Postgraduate Certificate**

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate an understanding of major issues surrounding the design and performance of complex aircraft, engine, their components and associated equipment used in aviation at a level appropriate to airworthiness requirements;

ILO 2. Describe and detail the organisation and nature of airworthiness requirements covering aircraft design, manufacture and maintenance;

ILO 3. Develop an awareness of the analytical, diagnostic and practical skills required for safe operation of aircraft, engines and their components;

ILO 4. Work both independently and as a member of a team towards the solution of complex safety related engineering problems;

ILO 5. Use transferable skills developed through team work, communication and problem-solving to enhance their careers in engineering and technical management;

ILO 6. Understand the roles and significance of compliance, substantiation, validation, certification and approval in the demonstration of airworthiness;

ILO 7. Be cognisant of the application of the studied technologies in other fields besides aerospace.

***B.* Postgraduate Diploma**

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 8. Access and apply the relevant specific requirements in an appropriate way within the technology areas covered by the course and relate the technology to the requirements in such a way that sound engineering judgements can be made.

***C.* MSc**

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 9. Undertake independent research on a topic relevant to airworthiness and safety in aircraft or engine design, manufacture or maintenance utilising the techniques of literature review, data gathering, analysis, results evaluation, and presentation both written and oral.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Lectures from external speakers with expertise in particular aspects of the course;
- Access to library resources;
- Use of class exercises (e.g. group work in AW02, Safety Assessment of Aircraft Systems) to help develop knowledge and techniques;
- Conducting individual research project in a commercial or research organisation to provide a ‘real life’ environment.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1*, 3, 12 and 16 [Previously known as AW00, AW02, AW17, AW22]	40
ELECTIVE MODULES:	
20 credits selected from Modules: 2, 4-11, 14-15, 17-19	20 (10 credits per module)
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1*, 2, 3, 4, 12, 16, 17 [Previously known as AW00, AW01, AW02, AW03, AW17, AW22, AW23] AWD Airworthiness Dossier: 20	70 20
ELECTIVE MODULES:	
30 credits selected from Modules: 5-11, 13-15, 18-19	30 (10 credits per module except for Module 13 which is 20 credits)
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits

* Module MAA03 Airworthiness of Military Aircraft (at Shrivenham) may be claimed as equivalent.

COMPULSORY MODULES:	
Modules: 1*, 2, 3, 4, 12, 16, 17 [Previously known as AW00, AW01, AW02, AW03, AW17, AW22, AW23] AWD Airworthiness Dossier: 20 Individual Research Project: 21	70 20 80
ELECTIVE MODULES:	
Any other modules selected from Modules: 5-11, 13-15, 18-19 to the value of 30 credits	30 (10 credits per module except for Module 13 which is 20 credits)
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.

* Module MAA03 Airworthiness of Military Aircraft (at Shrivenham) may be claimed as equivalent.

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

This course is ONLY offered on a part-time basis. Students should register and start the course in September and are expected to complete the course within three years. The taught phase of a 10 credit module lasts one week, two weeks for a 20 credit module, and it should be noted that most modules are held just once per year.

All MSc and PgDip students must complete the following mandatory modules as part of the course. Students must accumulate an additional 30 credits through the selection of three optional modules in line with their interests.

Module number	Mandatory Modules
1	Airworthiness Fundamentals* (Previously known as AW00)
2	Aircraft Fatigue & Damage Tolerance (Previously known as AW01)
3	Safety Assessment of Aircraft Systems (Previously known as AW02)
4	Gas Turbine Fundamentals (Previously known as AW03)
12	Air Transport Engineering - Maintenance Operations (Previously known as AW17)
16	Aviation Safety Management (Previously known as AW22)
17	Airframe Systems (Previously known as AW23)
20	Airworthiness Dossier (Previously known as AWD)
21	Individual Research Project (Previously known as AWR) - MSc only

Module Number	Optional Modules
5	Mechanical Integrity of Gas Turbines (previously known as AW05)
6	Detail Stressing (previously known as AW06)
7	Practical Reliability (previously known as AW09)
8	Aircraft Accident Investigation & Response (previously known as AW10)
9	Fundamentals of Aircraft Engine Controls (previously known as AW12)
10	Fundamentals of Aerodynamics (previously known AW13)
11	Manufacturing (previously known AW15)
13	Flight Experimental Methods (Airworthiness) (known as AW18-19)
14	Design, Durability & Integrity of Composite Aircraft Structures (previously known as AW20)
15	Introduction to Avionics (Previously known as AW21)
18	Introduction to Aircraft Structural Crashworthiness (preivously known as AW24)
19	Human Factors in Aviation Maintenance (previously known as AW25)

PgCert students must complete Modules 1, 3, 12 and 16 and further two elective modules from those permitted in the table from Section 5A to make up 20 credits. There is no requirement to complete mandatory modules before taking optional modules.

Course modules

The following modules outline all parts of the programme leading to **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within modules[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-AW-AW	(AW00) Airworthiness Fundamentals*	Dr S Place	30	10	10	N	11/9/17	11/9/17	15/9/17	40			100	EX ICW	30 70	15/9/17 13/11/17	At the next available opportunity which may not be until the module runs the following year

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.
* **Module MAA03 Airworthiness of Military Aircraft (at Shrivenham) R-MAA-AMA may be claimed as equivalent**.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
2	N-AW-AFDT	(AW01) Aircraft Fatigue and Damage Tolerance	Dr W Liu	30	10	10	Y	11/6/18	11/6/18	15/6/18	40	ICW	100				13/8/18	At the next available opportunity which may not be until the module runs the following year
3	N-AW-SAAS	(AW02) Safety Assessment of Aircraft Systems	Dr S Place	35	15	10	Y	13/11/17 (Occ A) 25/6/18 (Occ B)	13/11/17 25/6/18	17/11/17 29/6/18	40 40			100 100	GPRES ICW GPRES ICW	30 70 30 70	15/1/18 (Occ A) 28/8/18 (Occ B)	At the next available opportunity which may not be until the module runs the following year
4	N-AW-GTF	(AW03) Gas Turbine Fundamentals	Prof V Pachidis	30	0	10	N	5/3/18	5/3/18	9/3/18	40	ICW	100				8/5/18	At the next available opportunity which may not be until the module runs the following year
5	N-AW-MIGT	(AW05) Mechanical Integrity of Gas Turbines	Dr P Laskaridis	30	0	10	Y	23/4/18	23/4/18	27/4/18	40	ICW	100				25/6/18	At the next available opportunity which may not be until the module runs

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		the following year
6	N-AVD-DSTR	(AW06) Detail Stressing	Mr I Giannopoulos	20		10	Y	6/11/17	6/11/17	13/11/17	40	ICW	100				16/01/17	At the next available opportunity which may not be until the module runs the following year
7	N-AW-RA	(AW09) Practical Reliability	Dr S Place	30	0	10	Y	16/10/17	16/10/17	20/10/17	40	ICW	100				18/12/17	At the next available opportunity which may not be until the module runs the following year
8	N-HFS-AAI	(AW10) Aircraft Accident Investigation and Response	P McCarthy	30	0	10	Y	9/4/18	9/4/18	13/4/18	40	ICW	100				11/6/18	At the next available opportunity which may not be until the module runs the following year
9	N-AW-FAEC	(AW12) Fundamentals of Aircraft Engine	Dr T Nikolaidis	30	0	10	Y	12/3/18	12/3/18	16/3/18	40	ICW	100				14/5/18	At the next available

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Control																opportunity which may not be until the module runs the following year
10	N-AW-FAEA	(AW13) Fundamentals of Aerodynamics	Prof K Garry	30	0	10	N	2/10/17	2/10/17	6/10/17	40	ICW	100				4/12/17	At the next available opportunity which may not be until the module runs the following year
11	N-AEN-M	(AW15) Manufacturing	Dr K Salonitis	25	0	10	y	14/05/18	14/05/17	18/05/17	40	ICW	100				16/07/18	At the next available opportunity which may not be until the module runs the following year
12	N-AW-ATEMO	(AW17) Air Transport Engineering – Maintenance Operations	C Turkolglu	30	0	10	Y	12/2/18	12/2/18	16/2/18	40			100	EX ICW	30 70	16/2/18 16/4/18	At the next available opportunity which may not be until the module runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
13	N-AW-FEM	(AW18-19) Flight Experimental Methods (Airworthiness)	Dr A Cooke	40	0	20	N	9/10/17	9/10/17	20/10/17	40	ICW	100				18/12/17	At the next available opportunity which may not be until the module runs the following year
14	N-AW-ICAS	(AW20) Design, Durability and Integrity of Composite Aircraft Structures	Prof P Irving	35	5	10	Y	9/7/17	9/7/18	13/7/18	40	ICW	100				10/9/18	At the next available opportunity which may not be until the module runs the following year
15	N-AW-IA	(AW21) Introduction to Avionics	Dr D Zammit-Mangion	30	0	10	Y	09/04/18	09/04/18	13/04/18	40	ICW	100				04/06/18	At the next available opportunity which may not be until the module runs the following year
16	N-SAI-ISMS	(AW22) Aviation Safety Management	Dr S Mitchell/Mr D Barry	30	10	10	Y	(Occ A) 4/9/17	4/9/17	8/9/17	40	ICW	100				Occ A 6/11/17	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
								(OccB) 16/4/18	16/4/18	20/4/18	40	ICW	100				Occ B 18/6/18	may not be until the module runs the following year
17	N-AEN-AMS	(AW23) Airframe Systems	Dr C Lawson	25	0	10	Y	04/06/18	04/06/18	08/06/18	40			MULTI 100	IPRAC ICW	30 70	08/06/18 06/08/18	At the next available opportunity which may not be until the module runs the following year
18	N-AEN-ASC	(AW24) Introduction to Aircraft Structural Crashworthiness	Dr H Ghasemnejad	25	10	10	Y	02/07/18	02/07/18	06/07/18	40	ICW	100				03/09/18	At the next available opportunity which may not be until the module runs the following year
19	N-HFS-HFAM	(AW25) Human Factors in Aviation Maintenance	C Turkoglu	30	0	10	Y	19/3/18	19/3/18	23/3/18	40 40	ICW GPRES	90 10				21/5/18 23/3/18	At the next available opportunity which may not be until the module runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
20	N-AW-CD	(AWD) Airworthiness Dossier	Dr S Place	10	0	20	N	2/10/17	2/10/17	4/9/18	40	RP	100				14/9/18	
21	N-AW-RP	(AWR) Individual Research Project	Dr S Place	20	0	80	N	2/10/17	2/10/17	4/9/18	50	THESIS OR	80 20				4/9/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-AW-AFDT	Aircraft Fatigue and Damage Tolerance	Airworthiness	Military Aerospace and Airworthiness
N-AW-SAAS	Safety Assessment of Aircraft Systems	Airworthiness	Military Aerospace and Airworthiness Safety and Accident Investigation (Air Transport) Safety and Human Factors in Aviation
N-AW-MIGT	Mechanical Integrity of Gas Turbines	Airworthiness	Military Aerospace and Airworthiness
N-AVD-DSTR	Detail Stressing	Aerospace Vehicle Design	Aerospace Vehicle Design, Aircraft Engineering
N-AW-RA	Practical Reliability	Airworthiness	Military Aerospace and Airworthiness
N-HFS-AAI	Aircraft Accident Investigation and Response	Safety and Human Factors in Aviation	Airworthiness Forensic Engineering and Science Military Aerospace and Airworthiness
N-AW-FAEC	Fundamentals of Aircraft Engine Control	Airworthiness	Military Aerospace and Airworthiness
N-AEN-M	Manufacturing	Aircraft Engineering	Airworthiness
N-AW-ATEMO	Air Transport Engineering – Maintenance Operations	Airworthiness	F-T Air Transport Management Executive Air Transport Management Military Aerospace and Airworthiness Safety and Human Factors in Aviation
N-AW-ICAS	Design, Durability and Integrity of Composite Aircraft	Airworthiness	Military Aerospace and Airworthiness

	Structures		Advanced Materials Aerospace Materials Aircraft Engineering
N-AW-IA	Introduction to Avionics	Airworthiness	Aircraft Engineering
N-SAI-ISMS	Aviation Safety Management	Safety and Accident Investigation (Air Transport)	Military Aerospace and Airworthiness F-T Air Transport Management Safety and Human Factors in Aviation Airworthiness
N-AEN-AS	Airframe Systems	Aircraft Engineering	Airworthiness
N-AEC-ASC	Introduction to Aircraft Structural Crashworthiness	Aircraft Engineering	Airworthiness Military Aerospace and Airworthiness Safety and Accident Investigation (Air Transport)
N-HFS-HFAM	Human Factors in Aviation Maintenance	Safety and Human Factors in Aviation	Airworthiness Military Aerospace and Airworthiness Safety and Accident Investigation (Air Transport)

7. How are the ILOs assessed?

The following assessment types are utilised:

The MSc in Airworthiness has **two** distinct but interrelated elements: the taught modules (which includes the Course Dossier) and the thesis (Individual Research Project). All modules are assessed by written assignments and (in the case of the thesis) an oral examination, or viva. Short examinations are used on certain modules.

The Post-Modular Assignments are set to be challenging and to promote the student to study the module topic areas in more depth, in particular the relationship of the regulations to the technology issues. The objectives of the assignments are for the students to:

- Acquire the skill to efficiently search literature
- Acquire an in-depth knowledge of Airworthiness regulations

- Apply skills and knowledge to assess the regulatory aspects of a particular technology
- Develop the power to critically analyse data
- Compile succinct and informative reports to a high standard
- Formulate responses to specific questions against a time limit

This approach has been adopted in order to facilitate the completion of the course by external (part-time) students, often from abroad, without the need to return for examinations.

Over the duration of the course each MSc/PgDip student will be asked to complete an Airworthiness Dossier, containing a range of documentation related to each module taken. The dossier is an "Integrative Assessment", which brings together the airworthiness theme of the course, over all taught modules.

This will include relevant airworthiness regulatory and guidance material, published papers, case studies etc. Its preparation will lead students to research each module topic in more depth, building both on the information taught in formal lectures and the material gleaned from the pre-module reading and post-module assignments. The objectives of the dossier are for the students to:

- Obtain and retain an in-depth knowledge of airworthiness regulations and guidance material
- Acquire skills in data gathering and literature searching
- Demonstrate an overall knowledge of the technology of the modules taken
- Demonstrate information organisational and presentational skills

The dossier is to provide a summary of the whole course with a focus on airworthiness and technology issues, showing the linkage between the two. It is up to each student to decide which lectures are fundamental to their interests and airworthiness/safety and select them for inclusion. This will vary from module to module but should cover a representative number of lectures in addition to key references found in background reading and assignment work.

Assessment of the Course Dossier will be undertaken when all taught modules have been completed. However, students should take the opportunity to review it with a course supervisor at an early stage, and also mid-way through the course.

This approach has been adopted because this is the best means to assess the wide-ranging set of subjects.

Assessment and ILO Mapping

A. Postgraduate Certificate

Award ILOs / **Module No.**	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7
1 - 12	ICW	ICW	ICW	ICW	ICW	ICW	ICW
14 - 19	ICW	ICW	ICW	ICW	ICW	ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award / ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8
1-19	ICW	ICW	ICW	ICW	ICW	ICW	ICW	
20								RP

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award / ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9
1-19	ICW	ICW	ICW	ICW	ICW	ICW	ICW		
20								RP	
21									THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
Airworthiness Dossier	Taught Modules to the value of 100 credits selected by the students.	RP	100

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

All students are part-time and therefore most are in full-time employment. However the MSc prepares them for a higher level of responsibility in the airworthiness field. This is often a legal requirement so that they can fulfil customer's obligation as an Approved organisation.

An example is the sponsoring of six students by the MOD to undertake the MSc Airworthiness. They were then appointed to the Airworthiness "Centre of excellence" which advised MOD on matters relating to aircraft safety and regulation. Other course members are part of the Military Aviation Authority, which was set up in 2010.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Applied Bioinformatics

Date of first publication/latest revision: 26/07/16 – 24/03/17

1. What is the course?

Course information

Course Title	Applied Bioinformatics
Course code	MSABIFTC, MSABIPTC, PDABIFTC, PDABIPTC, PCABIFTC, PCABIPTC
Academic Year	2017/18
Valid entry routes	MSc
Additional Exit routes	PgDip, PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield
School(s)	School of Water, Energy and Environment
Theme	Environment & Agrifood
Centre	Cranfield Soil and Agrifood Institute
Course Director	Dr Fady Mohareb
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	NA
Registration Period(s)	Full-time MSc - one year, Part-time MSc - up to three years

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

available	
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by the Bioinformatics Group at Cranfield University, which comprises a team of entirely computer-based researchers who have been involved in several multi-million pound national and international projects, mainly funded by the BBSRC, EPSRC, the Wellcome Trust, the European Commission, and several companies including Unilever, Sanofi Aventis and GlaxoSmithKline. Our research activities include Next-Generation sequencing informatics, genome and transcriptome informatics, plant molecular biology, drug discovery, systems biology and food science. This wide range of research activities and collaborations gives us the opportunity to offer a variety of research projects to our MSc students that suit their individual research interests.

Cranfield University interacts with the following institutions:

Sanger, GlaxoSmithKline, Unilever, Sanofi Aventis, Rothamsted Research, the European Bioinformatics Institute, the Wellcome Trust Institute, University of Athens and Cambridge University. Our teaching team at Cranfield University benefits from the input of a group of world-renowned experts in a range of applied sciences, including bioinformatics. We lead and collaborate in diverse research and consultancy projects, both nationally and internationally.

Cranfield University remains fully responsible for the quality of the delivery of the course.

2. What are the aims of the course?

This course aims to equip graduate scientists with the computational skills and awareness needed to manage, analyse and interpret the vast amounts of genomic, transcriptomic, proteomic and metabolic data now becoming available. On completion of this course, you will be able to apply information technology to the development of new sequencing analysis and diagnostic tools and platforms. Additionally, you will gain the skills to design and implement new software plugins to fulfill the need of the research community, and will be equipped with a diverse set of knowledge and skills that directly meet the requirements of employers in this sector.

This programme is intended for the following range of students:

- The course is aimed both at graduates with degrees in life sciences, biotechnology, food science, natural sciences or medicine and alternatively those with a computational background.
- Scientists in industry in areas such as molecular biology, cell biology, and analytical techniques requiring training, or who wish to acquire skills and expertise in the field of bioinformatics

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate in Applied Bioinformatics

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Define the field of bioinformatics and related disciplines, and demonstrate a critical awareness of current research in the area.

ILO 2. Use various programming languages to develop tailored bioinformatics applications to achieve specific computational biology tasks

ILO 3. Effectively apply statistical methods and machine learning and pattern recognition algorithms to analyse and classify high throughput data

ILO 4. Demonstrate good communication skills of the relevant concepts, both orally and in writing, to academics and practitioners from bioinformatics and related disciplines.

B. **Postgraduate Diploma in Applied Bioinformatics**

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Apply automation tools for various bioinformatics tasks by integrating existing bioinformatics resources and tools

ILO 6. Integrate various research platforms and programming languages in order to build bioinformatics solutions

ILO 7. Demonstrate the ability to organise and manage a programme of software development

ILO 8. Integrate knowledge, understanding and skills from the taught modules in a real-life situation

ILO 9. Effectively work in a small project team to identify project objectives and select appropriate methodologies to address problems faced by industrial clients; collaborating with other team members to communicate findings in a professional manner in written, oral and visual forms

C. **MSc in Applied Bioinformatics**

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 10. Define a research question, develop aim(s) and objectives, select and execute a methodology, analyse data, and evaluate findings and draw appropriate conclusions.

ILO 11. To communicate their findings successfully via a thesis, written in an approved School style and in an oral presentation.

4. <u>How is the course taught?</u>

Students will be supported in their learning and personal development by:

- Provision of lectures from external speakers to strengthen teaching in selected areas from academia and industry outside the University's area of expertise.
- Access to library resources, both on-campus and online, which are introduced at the beginning of the course by the Library Information Specialist

- Computational teaching in well-equipped facilities typical of those available to bioinformatics research scientists
- Timetabling designed to allow plenty of opportunity to assimilate information and seek further academic guidance where necessary
- Provision of a personal development programme as a self directed activity of reflection and action planning, designed to encourage independent development of transferrable skills such as oral presentation, written communication and project management.
- The potential to carry out a research project in another organisation so alternative research environments can be experienced.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
ELECTIVE MODULES:	
60 Credits from the following modules:	
Introduction to Bioinformatics Using Perl	10
Exploratory Data Analysis and Essential Statistics Using R	10
Next Generation Sequencing Informatics	10
Proteome Informatics	10
Informatics for Metabolimbics	10
Programming Using java	10
Data Integration and Interaction Networks	10
Advanced Sequencing Informatics and Systems Biology	10
TOTAL:	**60**

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Introduction to Bioinformatics Using Perl	10
Exploratory Data Analysis and Essential Statistics Using R	10
Next Generation Sequencing Informatics	10
Proteome Informatics	10

Informatics for Metabolimbics Programming Using java Data Integration and Interaction Networks Advanced Sequencing Informatics and Systems Biology Group project	10 10 10 10 40
ELECTIVE MODULES:	
N/A	N/A
TOTAL:	**120**

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Introduction to Bioinformatics Using Perl Exploratory Data Analysis and Essential Statistics Using R Next Generation Sequencing Informatics Proteome Informatics Informatics for Metabolimbics Programming Using java Data Integration and Interaction Networks Advanced Sequencing Informatics and Systems Biology Group project Thesis	10 10 10 10 10 10 10 10 40 80
ELECTIVE MODULES:	
N/A	N/A
TOTAL:	**200**

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months.

Part-time students register for the course in **October** and are expected to complete the course within **3** years.

Each module is taught over two weeks, with the second week largely free of structured teaching to allow time for more independent learning and reflection.

Teaching methods:

- Lectures, usually 1-2 hours in length, which will include visiting lecturers / external speakers.
- Interactive sessions including workshops and hands-on tutorials.
- Practical elements including computer lab classes, demonstrations and site visits.

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-AGF-INWK	Induction module	A Medina Vaya	33	0	0	Y		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	I-BIX-PRL	Introduction to Bioinformatics Using Perl	F Mohareb	25	0	10	N		09/10/17	13/10/17	40	ICW	100				FT 21/10/2017 PT 04/11/2017	Week 9 - 4-8 June 2018
3	I-BIX-STS	Exploratory Data Analysis and Essential Statistics Using R	F Mohareb	25	20	10	N		23/10/17	27/10/17	40	ICW	100				FT 04/11/2017 PT 18/11/2017	Week 9 - 4-8 June 2018

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

4	I-BIX-NGS	Next Generation Sequencing Informatics	F Mohareb	25	5	10	N		06/11/17	10/11/17	40	ICW	100				FT 18/11/2017 PT 02/12/2017	Week 9 - 4-8 June 2018
5	I-BIX-PRO	Proteome Informatics	F Mohareb	25	20	10	N		20/11/17	24/11/17	40	ICW	100				FT 02/12/2017 PT 16/12/2017	Week 9 - 4-8 June 2018
6	I-BIX-MET	Informatics for Metabolomics	F Mohareb	25	20	10	N		04/12/17	08/12/17	40	ICW	100				FT 16/12/2017 PT 06/01/2018	Week 9 - 4-8 June 2018
7	I-BIX-JAV	Programming Using Java	Tomaz Kurowski	25	0	10	N		08/01/18	12/01/18	40	ICW	100				FT 20/01/2018 PT 03/02/2018	Week 9 - 4-8 June 2018
8	I-BIX-DAT	Data Integration and Interaction Networks	T Kurowski	25	3	10	N		22/01/18	26/01/18	40	ICW	100				FT 03/02/2018 PT 17/02/2018	Week 9 - 4-8 June 2018
9	I-BIX-SIM	Advanced Sequencing Informatics and Systems Biology	F Mohareb	25	5	10	N		05/02/18	09/02/18	40	ICW	100				FT 17/02/2018 PT 03/03/2018	Week 9 - 4-8 June 2018
10	I-BIX-GRPP	Group Project: Building Bioinformatics Solutions	F Mohareb	50		40	N		19/02/18	04/05/18	50	GPROJ ICW	80 20				GPROJ - FT/PT 01/05/2018 ICW - FT/PT 05/05/2018	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

11	I-AGF-THESIS	Individual Thesis Project	Individually assigned	20		80	N		01/05/18	07/09/18	50	THESIS OR	90 10				03/09/2018	

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**

7. How are the ILOs assessed?

The following assessment types are utilised:

Students on the MSc can typically expect to have eight pieces of individual assessment by submitted work, one piece of group project work, and one element assessed by a thesis and an oral presentation.

This approach has been adopted in order to assess the ability of the student to demonstrate their ability in a range of environments.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Applied Bioinformatics – Postgraduate Certificate

Award ILOs / Module No.	ILO 1.	ILO 2.	ILO 3.	ILO 4.
2	ICW	ICW		
3		ICW	ICW	ICW
4	ICW			ICW
5	ICW			ICW
6		ICW	ICW	
7		ICW		ICW
8	ICW	ICW		
9	ICW	ICW		

B. Applied Bioinformatics – Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 5.	ILO 6.	ILO 7	ILO 8.	ILO 9.

Award ILOs / Module No.	ILO 5.	ILO 6.	ILO 7	ILO 8.	ILO 9.
10	GPROJ	GPROJ	GPROJ ICW	GPROJ	GPROJ ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 10.	ILO 11.
11	THESIS/ OR	THESIS/ OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Our MSc opens doors to careers in industry, public research establishments and university research. The multidisciplinary nature of our course has allowed our students to follow diverse career paths in various medical-related sectors including:

- Pharmaceutical and Biotech companies
- Plant research institutes
- Food sector
- Public Institutions
- Bioinformatics research institutes
- IT companies.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: Applied Mathematics and Operational Research Programme (AMOR)

Date of first publication/latest revision: 10/05/2017

1. What is the course?

Course information

Course Title	**Applied Mathematics and Operational Research Programme (AMOR)**, encompassing courses: I. Defence Simulation and Modelling (DSM) II. Military Operational Research (MOR)
Course code	I. **(DSM)** MSDSMFTR - PCDSMFTR - PDDSMFTR - MSDSMPTR - PCDSMPTR – PDDSMPTR, II. **(MOR)** MSMORFTR – PCMOR-FTR – PDMORFTR - MSMORPTR – PCMOR-PTR – PDMORPTR iii. SPAMRPTR
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert (both DSM and MOR)
Additional exit routes	PgDip, PgCert (both DSM and MOR)
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Shrivenham
School(s)	Cranfield Defence and Security
Theme	Defence and Security
Centre	Centre for Simulation and Analytics
Course Director	Mr J R Searle
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	DSM : Yes MOR : No
Teaching Institution	Cranfield University
Admissions body	Cranfield University

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Entry requirements	Standard University entry requirements. Minimum IELTS of 6.5
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	N/A
Registration Period(s) available	Full time students: 12 months Maximum part time registrations of: MSc 5 years, PgDip 4 years, PgCert 3 years.
Course Start Month(s)	Full time: September Part time : September, January or by arrangement

Institutions delivering the course
This course is delivered by the Centre for Simulation and Analytics, Cranfield Defence and Security, where the research interests include the modelling and simulation of defence systems for analysis, experimentation and training.

Cranfield University interacts with the following institutions and in the following ways:

- A range of industrial partners provide software to the SSEL
- The course is supported by external visiting speakers in order to illustrate the real-world application and relevance of the material being taught
- The topics for student research projects are often suggested by external agencies and companies.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to provide graduates with the technical qualities, transferable skills and independent learning ability necessary to make them effective in organisations that design, develop and use modelling and simulation in a defence context.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) entry and exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Recent graduates wishing to acquire knowledge and skills in either modelling and simulation or military operational research or in order to obtain employment in the defence industry;
- Members of the Armed Forces working in or preparing to take up appointments in the area of modelling and simulation or of operational research;
- Graduates working in defence research organisations wishing to extend their knowledge of either modelling and simulation or operational research.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Defence Simulation and Modelling Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Appraise some of the issues involved in the design, development and application of models, simulations and Synthetic Environments (SEs)

ILO 2. Demonstrate an understanding of the broad principles of simulation software and how to apply this knowledge in creating and using a synthetic environment

ILO 3. Compare and critically evaluate some of the issues involved in procuring and using models and simulations for applications including training and analysis

For part-time PG Cert students, where a flexible path is available, note that some aspects may be limited by the elective module choices made.

B. Defence Simulation and Modelling Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 4. Explain the fundamentals of models and simulations and Synthetic Environments (SEs) and their place in procurement, training, the development of future force structures and the efficient use of defence resources

ILO 5. Critically evaluate different methodologies used in modelling and simulation and SEs and compare their strengths and weaknesses and understand how to select an appropriate methodology for a given need or situation

ILO 6. Demonstrate knowledge of issues and trade-offs that must be considered when using models, simulations and SEs for analysis and training

ILO 7. Demonstrate understanding of the practical application of models, simulations and SEs in government and the defence industry

ILO 8. Plan, specify, configure and utilise a distributed simulation or synthetic environment system

ILO 9. Appraise and critically evaluate the appropriate hardware in creating and running models, simulations and SEs

C. Defence Simulation and Modelling MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 10. Demonstrate technical expertise, independent learning abilities and critical appraisal skills, by completing a modelling and simulation related project

D. Military Operational Research Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Understand the basic philosophy and methodologies of operational research

ILO 2. Appreciate examples of the practical application of operational analysis in government and defence industry

ILO 3. Distinguish between a limited range of the different modelling methodologies used in operational analysis and evaluate their strengths and weaknesses

ILO 4. Explain the reasons for using models and describe how operational analysis is applied to support defence decision making

ILO 5. Show transferable skills through an ability to communicate findings and issues to a subject specific audience

For part-time PG Cert students, where a flexible path is available, note that some aspects may be limited by the elective module choices made.

E. Military Operational Research Postgraduate Diploma

In addition to the intended learning outcomes outlined in D. above, a diligent student would also be expected to achieve the following in a topic relevant to their named award:

ILO 6. Explain the fundamental principles of modelling in operational analysis (military operational research) and be aware of the contribution of modelling in procurement, training, the development of future force structures and the efficient use of defence resources

ILO 7. Demonstrate an in-depth understanding of a wide range of the modelling methodologies used in operational analysis and to critically evaluate their strengths and weaknesses

ILO 8. Demonstrate knowledge of the detailed design issues and trade-offs that must be considered when specifying, developing or choosing model components

ILO 9. Demonstrate an understanding of knowledge of the issues involved in the design, development, verification, validation and application of operational analysis models and in the interpretation and communication of the results

ILO 10. Show understanding of examples of the practical application of operational analysis in government and defence industry

ILO 11. Explain the reasons for using models and describe how operational analysis is applied to support defence decision making

ILO 12. Demonstrate an ability to communicate subject specific findings to both a specialist and general audience

F. Military Operational Research MSc

In addition to the intended learning outcomes outlined in D. and E. above, a diligent student would also be expected to achieve the following in a topic relevant to their named award:

ILO 13. Demonstrate technical expertise, independent learning abilities and critical appraisal skills by completing an Operational Research related project.

4. How is the course taught?

Teaching methods:

- lectures from Cranfield staff and visiting speakers
- participative sessions, including tutorials and group exercises
- practical application elements, e.g. computer based demonstrations and practical sessions
- for the MSc: individual research project, with academic supervision

In addition to the teaching methods outlined above, students will be supported in their learning and personal development by:

- coursework involving investigation into a technical subject area and presentation to their peers
- participation on the modules by practitioners who are able to raise current issues and comment on the latest developments
- access to the Simulation and Synthetic Environment Laboratory (SSEL)
- an Academic Advisor (Personal Tutor) who gives advice on academic and other matters, acts as a link between students and the University academic authorities and monitors progress

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

Defence Simulation and Modelling

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

PgCert in Defence Simulation and Modelling – Full-time	**Credits**
COMPULSORY MODULES:	
Introductory Studies	0
Foundations of Modelling and Simulation	10
Discrete & Continuous Simulation	10
Computer Graphics	10
War Gaming and Combat Modelling	10
Advanced Module #1	10
Advanced Module #2	10
ELECTIVE MODULES:	
N/A	
TOTAL:	**60**

PgCert in Defence Simulation and Modelling – Part-time	Credits
COMPULSORY MODULES:	
Introductory Studies Foundations of Modelling and Simulation)	0 10
ELECTIVE MODULES:	
5 modules chosen from: Discrete & Continuous Simulation Computer Graphics War Gaming and Combat Modelling Experimentation Analysis & Trials for Simulation Weapon Systems Performance Assessment Intelligent Systems Networked and Distributed Simulation Advanced Module #1 Advanced Module #2 Networked and Distributed Simulation Exercise	50 (10 credits per module)
TOTAL:	**60**

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

PgDip in Defence Simulation and Modelling (Full-time and Part-time)	Credits
COMPULSORY MODULES:	
Introductory Studies Foundations of Modelling and Simulation Discrete and Continuous Simulation Computer Graphics War Gaming and Combat Modelling Experimentation Analysis & Trials for Simulation Weapon Systems Performance Assessment Intelligent Systems Networked and Distributed Simulation Advanced Module #1 Advanced Module #2 Advanced Module #3 Networked and Distributed Simulation Exercise	0 10 10 10 10 10 10 10 10 10 10 10 10
ELECTIVE MODULES:	
N/A	
TOTAL:	**120**

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

MSc in Defence Simulation and Modelling	Credits

(Full-time and Part-time)	
COMPULSORY MODULES:	
Introductory Studies Foundations of Modelling and Simulation Discrete and Continuous Simulation Computer Graphics War Gaming and Combat Modelling Experimentation Analysis & Trials for Simulation Weapon Systems Performance Assessment Intelligent Systems Networked and Distributed Simulation Advanced Module #1 Advanced Module #2 Advanced Module #3 Networked and Distributed Simulation Exercise MSc Research Project	0 10 10 10 10 10 10 10 10 10 10 10 10 80
ELECTIVE MODULES:	
N/A	
TOTAL:	**200**

<u>Military Operational Research</u>

A. Postgraduate Certificate MOR

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

PgCert in Military Operational Research – Full-time	**Credits**
COMPULSORY MODULES:	
Introductory Studies Introduction to Operational Research Techniques Discrete and Continuous Simulation Decision Analysis War Gaming and Combat Modelling Advanced Module #1 Advanced Module #2	0 10 10 10 10 10 10
ELECTIVE MODULES:	
N/A	
TOTAL:	**60**

PgCert in Military Operational Research – Part-time	**Credits**
COMPULSORY MODULES:	
Introductory Studies Introduction to Operational Research Techniques	0 10
ELECTIVE MODULES:	
5 modules chosen from: Discrete and Continuous Simulation Decision Analysis War Gaming and Combat Modelling Statistical Analysis and Trials Weapon System Performance Assessment	50 (10 credits per module)

Intelligent Systems Logistics Modelling Advanced Module #1 Advanced Module #2 Advanced Module #3	
TOTAL:	**60**

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

PgDip in Military Operational Research (Full-time and Part-time)	**Credits**
COMPULSORY MODULES:	
Introductory Studies	0
Introduction to Operational Research Techniques	10
Discrete and Continuous Simulation	10
Decision Analysis	10
War Gaming and Combat Modelling	10
Statistical Analysis and Trials	10
Weapon System Performance Assessment	10
Intelligent Systems	10
Logistics Modelling	10
Advanced Module #1	10
Advanced Module #2	10
Advanced Module #3	10
Advanced Module #4	10
ELECTIVE MODULES:	
N/A	
TOTAL:	**120**

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

MSc in Military Operational Research (Full-time and Part-time)	**Credits**
COMPULSORY MODULES:	
Introductory Studies	0
Introduction to Operational Research Techniques	10
Discrete and Continuous Simulation	10
Decision Analysis	10
War Gaming and Combat Modelling	10
Statistical Analysis and Trials	10
Weapon System Performance Assessment	10
Intelligent Systems	10
Logistics Modelling	10
Advanced Module #1	10
Advanced Module #2	10
Advanced Module #3	10
Advanced Module #4	10
MSc Research Project	80

ELECTIVE MODULES:	
N/A	
TOTAL:	**200**

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

6. How is the course structured?

Full-time students register for the course in September and are expected to complete the course within 12 months.

The courses are also offered on a part-time basis. Part-time students normally register for their course in September or January, but if they have an appropriate background, it may be possible to register at a different time.

The maximum registration period for part-time students is:

- MSc – 5 years
- PgDip – 4 years
- PgCert – 3 years.

The full-time PgCert requires successful completion of 4 standard taught modules and 2 self-study 'Advanced' modules. More flexibility is however available for part-time PgCert students, who may choose from a range of elective modules in order to arrange their studies with respect to their other commitments over the shorter period of registration available to them.

Building on this, the PgDip then also requires successful completion of an additional set of 4 standard taught modules and a further 2 self-study 'Advanced' modules.

For the MSc students are also required to successfully complete a dissertation.

Each standard taught module consists of a one week course of lectures, tutorials and practical work, followed by directed study coursework, involving private study equivalent to a further week of full-time work, allowing time for more independent learning and reflection.

A limited number of these standard taught modules are approved for delivery by non-residential distance e-learning using the on-line Cranfield Moodle Virtual Learning Environment (VLE). A 10-week block period for part time students to complete such on-line modules is typically offered once in each standard academic term.

The two-week self-study Advanced modules are 'mini-projects' with unique topics agreed individually for each student, which build on material covered in the standard modules and offer students the opportunity to explore selected topics in more depth. Depending on the nature of the topic selected, and excepting the 'Networked and Distributed Simulation Exercise' for the DSM Course, advanced modules typically may not involve any additional classroom attendance.

Course Modules

The following modules outline all parts of the programme which lead to an **MSc**. Other awards associated with the courses include some or all of these modules.

Module Number	Module code	Related Award	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
													Independent Assessment		Multi-part Assessment			Submission dates	
									Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	R-AMOR-INTRO	DSM MOR	Introductory Studies A & B		30	0	0	Y	A:04/09/17 B:08/01/18	04/09/17 08/01/18	08/09/17 12/01/18	N/A	AO	N/A				N/A	N/A
2	R-AMOR-FMS	DSM	Foundations of Modelling & Simulation A & B		30	0	10	Y	A:11/09/17 B:15/01/18	11/09/17 15/01/18	15/09/17 19/01/18	40	ICW	100				A FT: 25/09/17 A PT: 23/10/17 B PT: 26/02/18	A FT: 02/01/18 A PT: 30/07/18 B PT: 30/07/18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

3	R-AMOR-IORT	MOR	Introduction to Operational Research Techniques*		30	0	10	N	[11/09/17]	[11/09/17]	[15/09/17]	50	EX	100				[06-10/11/17]	23-27/04/18]
4	R-AMOR-DCS	DSM MOR	Discrete & Continuous Simulation		30	0	10	Y	[25/09/17]	[25/09/17]	[29/09/17]	40	ICW	100				[FT: 09/10/17 PT: 06/11/17]	FT: 02/01/18 PT: 30/07/18]
5	R-AMOR-CG	DSM	Computer Graphics A Computer Graphics B, C and D **		30	0	10	N	[A:09/10/17 B:09/10/17 C:29/01/18 D:21/05/18]	[09/10/17 09/10/17 29/01/18 21/05/18]	[13/10/17 15/12/17 06/04/18 27/07/18]	40	ICW	100				[A FT: 23/10/17 A PT: 20/11/17 B:18/12/17 C:09/04/18 D:30/07/18]	A FT:02/01/18 A PT:30/07/18 B, C, D PT: Next 10-week VLE module block.]
6	R-AMOR-DA	MOR	Decision Analysis A and B		30	0	10	Y	[A:09/10/17 B:12/02/18]	[09/10/17 12/02/18]	[13/10/17 16/02/18]	50	ICW	100				[A FT: 23/10/17 A PT: 20/11/17 B PT: 25/03/18]	A FT 02/01/18 A PT: 30/07/18 B PT: 30/07/18]
7	R-AMOR-WGC	DSM MOR	War Gaming & Combat Modelling A War Gaming & Combat Modelling B, C and D **		30	0	10	Y	[A:23/10/17 B:09/10/17 C:29/01/18 D:21/05/18]	[23/10/17 09/10/17 29/01/18 21/05/18]	[27/10/17 15/12/17 06/04/18 27/07/18]	40	ICW	100				[A FT: 06/11/17 A PT: 04/12/17 B:18/12/17 C:09/04/18 D:30/07/18]	A FT: 02/01/18 A PT: 30/07/18 B, C, D PT: Next 10-week VLE module block.]
8	R-AMOR-SAT	MOR	Statistical Analysis & Trials*		30	0	10	N	[15/01/18]	[15/01/18]	[19/01/18]	40	EX	100				Wb 23/04/18	Wb 11/06/18]
9	R-AMOR-EATS	DSM	Experimentation Analysis and Trials for Simulation		30	0	10	N	[08/01/18]	[08/01/18]	[12/01/18]	40	ICW	100				FT: 22/01/18 PT: 19/02/18]	FT: 29/05/18 PT: 30/07/18]

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

10	R-AMOR-WSAP	DSM MOR	Weapon System Performance Assessment		30	0	10	Y	[12/02/18]	[12/02/18]	[16/02/18]	40	ICW	100				FT: 26/02/18 PT: 26/03/18]	FT: 29/05/18 PT: 30/07/18]
11	R-AMOR-IS	DSM MOR	Intelligent Systems		30	0	10	Y	[29/01/18]	[29/01/18]	[02/02/18]	40	ICW	100				FT: 12/02/18 PT: 12/03/18]	FT: 29/05/18 PT: 30/07/18]
12	R-AMOR-NDS	DSM	Networked & Distributed Simulation		30	0	10	Y	[26/02/18]	[26/02/18]	[02/03/18]	40	ICW	100				FT: 12/03/18 PT: 09/04/18]	FT: 29/05/18 PT: 30/07/18]
13	R-AMOR-LM	MOR	Logistics Modelling A Logistics Modelling B, C & D**		30	0	10	N	[A: 26/02/18 B: 9/10/17 C: 9/01/18 D:21/05/18	[26/02/18 09/10/17 29/01/18 21/05/18]	[02/03/18 15/12/17 06/04/18 27/07/18]	40	ICW	100				A FT: 12/03/18 A PT: 0904/18 B:18/12/17 C:09/04/18 D:30/07/18]	A FT: 29/05/18 A PT: 30/07/18 B, C, D PT: Next 10-week VLE module block.]

* This module is assessed by examination; it also has an element of coursework which is formative only (i.e. it is not summatively assessed), but submission is still mandatory.

** Subject to approval by the Course Director, this module may be available for non-residential, on-line distance learning study using the Cranfield Moodle Virtual Learning Environment (VLE). A 10-week block period for part time students to complete such on-line modules is typically offered once in each standard academic term and relates to occurrences B, C and D.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

ADVANCED MODULES AND PROJECT

Module Number	Module code	Related Award	Title	Module Leader	Contact hours[12]	Total hours delivered by Visiting Lecturers[13]	Credits	Is the module shared? Y/N	Calendar			Assessment							
									Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark14 - 40% or 50%	Independent Assessment		Multi-part assessment			Submission dates	
													Type of Assessment	Weighting within module15 (%) of Independent assessments	Weighting within module of multi-part assessments 16(100%)	Type of Assessment	Weighting of individual elements of multi-part assessment17	Assessment Submission and/or exam date18	Assessment / Exam Retake date
14	R-AMOR-AD1	DSM MOR	Advanced Module #1 A (FT) Advanced Modules #1 B, C & D (PT)	Mr J R Searle	5	0	10	Y	[A:13/11/17 B:09/10/17 C:29/01/18 D:21/05/18	[13/11/17 09/10/17 29/01/18 21/05/18]	[24/11/17 15/12/17 06/04/18 27/07/18]	40	ICW	100				[A:27/11/17 B:18/12/17 C:09/04/18 D:30/07/18]	[A FT: 30/07/18 B, C, D PT: Next 10-week VLE module block.]
15	R-AMOR-AD2	DSM MOR	Advanced Module #2 A (FT)	Mr J R Searle	5	0	10	Y	[A:04/12/17 B: 9/10/17	[04/12/17 09/10/17	[15/12/17 15/12/17	40	ICW	100				[A: 8/12/17 B:18/12/17	[A FT: 30/07/18 B, C, D PT:

[12] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[13] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[14] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[15] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[16] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[17] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[18] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

			Advanced Modules #2 B, C & D (PT)						C: 9/01/18 D: 1/05/18	29/01/18 21/05/18	06/04/18 27/07/18							C:09/04/18 D:30/07/18	Next 10-week VLE module block.
16	R-AMOR-AD3	DSM MOR	Advanced Module #3 A (FT) Advanced Modules #3 B, C & D (PT)	Mr J R Searle	5	0	10	Y	A:12/03/18 B:09/10/17 C:29/01/18 D:21/05/18	12/03/18 09/10/17 29/01/18 21/05/18	23/03/18 15/12/17 06/04/18 27/07/18	40	ICW	100				A:26/03/18 B:18/12/17 C:09/04/18 D:30/07/18	A FT: 30/07/18 B, C, D PT: Next 10-week VLE module block.
17	R-AMOR-NDSE	DSM	Networked & Distributed Simulation Exercise (Advanced Module #4)	Mr J R Searle	10	0	10	N	09/04/18	09/04/18	20/04/18	40	ICW	100				23/04/18	30/07/18
18	R-AMOR-AD4	MOR	Advanced Module #4 A (FT) Advanced Modules #4 B, C & D (PT)	Mr J R Searle	5	0	10	N	A:09/04/18 B:09/10/17 C:29/01/18 D:21/05/18	09/04/18 09/10/17 29/01/18 21/05/18	20/04/18 15/12/17 06/04/18 27/07/18	40	ICW	100				A:23/04/18 B:18/12/17 C:09/04/18 D:30/07/18	A FT: 30/07/18 B, C, D PT: Next 10-week VLE module block.
19	R-AMOR-DISS	DSM MOR	MSc Research Project	Mr J R Searle	N/A	N/A	80	Y	02/01/18	02/01/18	31/08/18	50	THESIS	100				FT:31/08/18 PT: Dates vary	By arrange-ment

Most Advanced Modules (except NDSE) comprise self-study, mini-project coursework, equivalent to 10 days effort for a full-time residential student (Occurrence A).. For a part-time student the equivalent work will normally be conducted non-residentially over a block period of 10 weeks which is typically offered once in each standard academic term (Occurrences B, C and D). NDSE for the DSM Course however typically requires group-based self-study work and is therefore normally undertaken residentially at Shrivenham Campus alongside the full-time students.

Advanced Module Topics will typically be proposed individually by students to follow-on from previous studies in one or more standard taught modules as pre-requisites. Topics require the approval of the relevant Module Manager(s) and Course Director. NDSE is an exception to this, where the topic will be provided and students will work as a group.

Part-time students requiring to re-take Advanced Modules will complete the activity in the next scheduled 10-week block.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
R-AMOR-FMS	Foundations of Modelling and Simulation	AMOR	MESE SEDC share teaching in their R-SEDC-SSE module
R-AMOR-NDS	Networked and Distributed Simulation	AMOR	SEDC (as NDS)
R-AMOR-DA	Decision Analysis	AMOR	SEDC share teaching in their R-SEDC- DAMS module.

7. How are the ILOs assessed?

The following assessment types are utilised:

With some exceptions for the MOR course (discussed below), most standard taught modules are assessed 100% by written individual coursework assignments. The coursework is normally issued at the beginning of the taught module. Full-time students are normally required to submit the coursework approximately one week after the end of the module. Part-time students are normally required to submit the coursework approximately 5 weeks after the end of the module. It is felt that this mode of assessment best suits the practical and applied nature of the disciplines involved.

Two of the standard taught modules in the MOR course are assessed 100% by formal examinations – with one being an open book and open notes exam, while the other is a closed book exam. For these modules, the requirement to submit coursework will therefore be formative (but still compulsory), not summative. Past examination papers are made available.

Advanced modules are 100% assessed by written individual coursework, which may include an optional viva. An individual presentation is also normally required, although this is a formative part of the learning experience and does not contribute to the summative assessment.

The MSc research project is assessed by a written dissertation and may include an optional viva.

This approach has been adopted in order that the individual elements of the courses can be assessed by the most appropriate method and that students can demonstrate their understanding in a number of different ways.

Assessment and ILO Mapping

DEFENCE SIMULATION AND MODELLING

A. Postgraduate Certificate

Award ILOs **Module No.**	**ILO 1.**	**ILO 2.**	**ILO 3**
2. FMS	CW	CW	CW
4. DCS	CW	CW	CW
5. CG	CW		CW

7. WGC	CW	CW	CW
9. EATS	CW	CW	CW
10.WSAP	CW		CW
11. IS	CW	CW	
12. NDS	CW	CW	CW
14. AM#1	CW	CW	CW
15. AM#2	CW	CW	CW
17. NDSE	CW	CW	CW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs Module No.	**ILO 4.**	**ILO 5.**	**ILO 6.**	**ILO 7**	**ILO 8.**	**ILO 9.**
2. FMS	CW	CW	CW	CW	CW	CW
4. DCS	CW	CW	CW	CW		
5. WGC	CW	CW	CW	CW		
7. CG	CW	CW	CW	CW		CW
9. EATS	CW	CW	CW	CW	CW	
10. WSAP	CW	CW		CW		
11. IS	CW	CW		CW		
12. NDS	CW	CW	CW	CW	CW	CW
14. AM#1	CW	CW	CW	CW	CW	CW
15. AM#2	CW	CW	CW	CW	CW	CW
16. AM#3	CW	CW	CW	CW	CW	CW
17. NDSE	CW	CW	CW	CW	CW	CW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs Module No.	***ILO 10.***
19 DISS	THESIS

MILITARY OPERATIONAL RESEARCH

D. Postgraduate Certificate

Award ILOs Module No.	**ILO 1.**	**ILO 2.**	**ILO 3**	**ILO 4.**	**ILO 5**
3. IORT	EX		EX	EX	EX
4. DCS		CW	CW		
6. DA	CW	CW	CW		
7. WGC	CW	CW			

8. SAT	EX	EX	EX	EX	
10. WSAP		CW		CW	
11. IS			CW		
13. LM			CW	CW	CW
14. ADV#1	CW	CW	CW	CW	CW
15. ADV#2	CW	CW	CW	CW	CW
16. ADV#3	CW	CW	CW	CW	CW

E. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	**ILO 6.**	**ILO 7.**	**ILO 8.**	**ILO 9**	**ILO 10.**	**ILO 11.**	**ILO 12.**
3. IORT	EX			EX	EX		
4. DCS			CW	CW			
6. DA			CW	CW	CW		
7. WGC		CW		CW	CW	CW	
8. SAT		EX		EX	EX		
10. WSAP	CW		CW			CW	
11. IS				CW			
13. LM					CW		
14. ADV#1		CW	CW	CW	CW	CW	CW
15. ADV#2		CW	CW	CW	CW	CW	CW
16. ADV#3		CW	CW	CW	CW	CW	CW
18. ADV#4		CW	CW	CW	CW	CW	CW

F. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessment:

Award ILOs / Module No.	***ILO 10.***
19 DISS	THESIS

<u>CROSS-MODULAR ASSESSMENT</u> (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
N/A	N/A		

8. <u>How will the University assure the quality of the provision?</u>

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of

professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and

operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Students on this course are generally either sponsored by their existing employer as preparation for specific roles in Training, Analysis, Acquisition and Experimentation in the Military, Defence Organisations or Defence Industry, or else are seeking employment in those areas.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Applied Nanotechnology

Date of first publication/latest revision: May 2017

1. What is the course?

Course information

Course Title	MSc in Applied Nanotechnology
Course code	MSANAFTC, MSANAPTC, PDANAFTC, PDANAPTC, PCANAFTC, PCANAPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Manufacturing
Centre	Surface Engineering and Nanotechnology Institute
Course Director	Dr Zhaorong Huang
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	One year full-time, two-five years part-time

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Course Start Month(s)	Full-time: October. Part-time: throughout the year.

Institutions delivering the course
This course is delivered by The School of Aerospace, Transport and Manufacturing, Manufacturing Theme, Surface Engineering and Nanotechnology Institute where the research activities extend from the development of new functional materials through to the prototyping of micro electromechanical system (MEMS) devices. The work is multidisciplinary, encompassing diverse fields such as micro engineering, nanotechnology, biology, materials science, physics and chemistry.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Institution of Mechanical Engineers (IMechE) up to and including Academic year 2019-20, Institution of Engineering and Technology (IET) up to and including Academic year 2019-20, Royal Aeronautical Society (RAeS) up to and including Academic year 2019-20 and Institute of Materials, Minerals and Mining (IOM3) up to and including Academic year 2018-19.

2. <u>What are the aims of the course?</u>

The aim of the course is to provide a comprehensive knowledge and the skills necessary for a technically-based career in the new high-tech industries, in which the manufacture of multi-functional devices with dimensions in the micron or nanometre range is fundamental to wealth creation. This MSc course covers the technologies to design, realise and analyse micro and nano-scale materials, devices and systems.

The objectives of the course are to:

1. Provide students with a good working knowledge and understanding of:
   - The science of the functional materials commonly used in microsystems technology (MST), and the methods and processes that are used to manipulate them into the forms required and to characterise their properties.
   - How the processes interact with each other in a manufacturing environment, how to use the modern software tools to design devices and processes, to link functional materials, microstructures and electronics into complete working microsystems.
   - The applications potential for, and manufacturing of, MST devices.
   - The use of the scanning probe microscope as a tool for both characterisation and molecular surface manipulation.
   - The science, technology and applications potential of nanotechnology.

2. Develop the management/transferable skills necessary for a successful career in industry, including the ability to:
   - Communicate effectively, both orally and in writing.
   - Plan, execute and manage projects.
   - Operate effectively in a team, working and communicating in a group environment.

Provide students with an introduction to the microsystems and nanotechnology environments, providing familiarity with fabrication and testing methods, practical approaches to problem solving, critical evaluation of data and the use of information technology.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exist routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Recent graduates wishing to extend their knowledge and skills in the above areas.
- Qualified scientists and engineers wishing to apply their skills into new area.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a good working knowledge and systematic understanding of the science of the functional materials commonly used in microsystems and nanotechnology (MSN), and the methods and processes that are used to manipulate them into the forms required and to characterise their properties.
ILO 2. Demonstrate a good working knowledge and systematic understanding of how the processes interact in a manufacturing environment.
ILO 3. Use modern software tools to design devices and processes, to link functional materials, microstructures and electronics into complete working microsystems.
ILO 4. Demonstrate a critical awareness and understanding of the applications potential for, and manufacturing of, MSN devices.
ILO 5. Demonstrate a good working knowledge and understanding of the science, technology and applications potential of nanotechnology.
ILO 6. Make effective use of information technology.
ILO 7. Prepare effective written reports of their work.
ILO 8. Communicate effectively both orally and in writing.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 9. Demonstrate a good working knowledge and understanding of the use of microscopes as a tool for both characterisation and surface modification.
ILO 10. Demonstrate a knowledge of some key general management, personal management and project management techniques and awareness of some of the less science-dependent aspects of technology.
ILO 11. Undertake an appraisal of technical and/or commercial literature.
ILO 12. Discuss the work conducted and relate it to the work of others.
ILO 13. Work effectively under time pressure.
ILO 14. Operate effectively in a team working and communicating in a group environment.
ILO 15. Critically appraise data.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 16. Demonstrate a critical awareness of current research/development in selected topics in microsystems and nanotechnology.
ILO 17. Carry out substantial scientific programmes of study.
ILO 18. Plan, execute and manage projects.
ILO 19. Demonstrate an ability in practical approaches to problem solving.

ILO 20. Demonstrate originality in the application of knowledge in relation to an extended individual project.

4. How is the course taught?

Students will be supported in their learning and personal development by:

Comprehensive course materials are provided, as well as a web-site using the Blackboard™ Virtual Learning Environment (VLE). Students are guided through the use of interactive exercises, group and individual discussion. Students engage in class activities to practise the techniques taught.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 3, 6, 7	30
ELECTIVE MODULES:	
Modules 2, 4, 5, 8, 9 Chose three modules from five	30
RECOMMENDED MODULE	
Introduction	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 2-9 Group Project for full-time students (10b) or Dissertation for part-time students (10a)	80 40
ELECTIVE MODULES:	
None	
RECOMMENDED MODULE	

Introduction	0
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules 2-9 Group Project for full-time students (10b) or Dissertation for part-time students (10a) Individual Research Project (11)	80 40 80
ELECTIVE MODULES:	
None	
RECOMMENDED MODULE	
Introduction	0
TOTAL:	**200**

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does <u>not</u> have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment <u>on the first attempt</u> for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **<u>up to 30 learning credits</u>**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **<u>any additional learning credits</u>** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
- it is <u>not</u> permissible for you to fail an elective module and then proceed to take a different elective module in its place.

- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. <u>How is the course structured?</u>

The course has been structured through discussions with Industrial Advisors from the field of Nanotechnology. The course comprises an introductory week and eight one week modules which are assessed, and an assessed group and individual projects. The course is structured to initially provide the student with the fundamental principles of Nanotechnology, before moving on to where the two areas overlap and merge. Specialisation is provided though suitable group and individual projects.

Full-time students register for the course in October and are expected to complete the course within 11 calendar months. This course is also offered on a part-time basis. Students would instead complete the course over a 24 month period with the Group Project component replaced by a dissertation.

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-MAT-INWK	Introduction	Dr Sue Impey	26		0	Y		02/10/17	06/10/17	n/a	AO	n/a				n/a	
2	I-MNU-A1018	General Management	Dr Yuchun Xu	32		10	Y		13/11/17	17/11/17	40	EX	100				05/01/18	Manufacturing resit exams will be during week commencing 18/09/17
3	I-MSN-A1046	Foundation in Materials for	Dr Paul Jones	32		10	N		09/10/17	13/10/17	40	ICW	100				30/10/17	Re-assessment date to be set by

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Nanotechnology																agreement of Course Director and Module Leader as/when required.
4	I-MSN-A1048	Engineering Microdevices	Dr Paul Kirby	32		10	Y		23/10/17	27/11/17	40	ICW	100				20/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
5	I-MSN-A1049	Nano and Microscale Rapid Prototyping Manufacture	Dr Paul Jones	28		10	Y		08/01/17	12/01/17	40	ICW	100				29/01/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
6	I-MSN-A1047	Nano and Micro Technologies for Energy	Dr Qi Zhang	27		10	Y		20/11/17	24/11/17	40	ICW	100				11/12/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
7	I-MAT-A1014	Finite Element Analysis	Dr Glenn Leighton/ Dr Renaud Jourdain	35		10	Y		04/12/17	08/12/17	40			100 MULTI	ICW ICW	40 60	19/01/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
8	I-MSN-A1068	Nanotechnology	Dr Zhaorong Huang	28		10	Y		30/10/17	03/11/17	40	ICW	100				10/11/17	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
9	I-UPT-A1186	Functional Coatings and Thin Films	Dr Jose Endrino Armenteros	32		10	Y		22/01/18	26/01/18	40	ICW	100				09/02/18	Re-assessment date to be set by agreement of Course Director and Module Leader as/when required.
10a	I-MAT-DISS	Dissertation for Part Time Students	Dr Sue Impey/ Dr David Ayre	20		40	Y		01/02/18	30/08/18		ICW	100				30/08/18	
10b	I-MAT-GRPP	Group Project for Full Time Students	Dr David Ayre	20		40	Y		05/02/18	20/04/18				80 MULTI	GPRES GPROJ	16 64	04/05/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
														20 MULTI	ICW observed behaviour	10 10		
11	I-MNU-THESIS	Individual Research Project	Dr Yuchun Xu	20		80	Y		30/04/18	03/09/18		THESIS OR	90 10				03/09/18	

* Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
I-MAT-INWK	Introduction	Manufacturing Technology and Materials Programme	Welding Engineering, Advanced Materials, Aerospace Materials
I-MNU-A1018	General Management	Engineering & Management of Manufacturing Systems	Advanced Materials, Manufacturing Technology and Management, Global Product Development and Management, Management and Information Systems, Knowledge Management for Innovation (not currently running), Engineering & Management of Manufacturing Systems
I-MAT-A1014	Finite Element Analysis	Advanced Materials	Advanced Materials, Manufacturing Technology and Management, Aerospace Materials
I-UPT-A1186	Functional Coatings and Thin Films	Applied Nanotechnology	Manufacturing Technology and Management
I-MSN-A1048	Engineering Microdevices	Applied Nanotechnology	Manufacturing Technology and Management
I-MSN-A1049	Nano and Microscale Rapid Prototyping Manufacture	Applied Nanotechnology	Manufacturing Technology and Management
I-MSN-A1047	Nano and Micro Technologies for Energy	Applied Nanotechnology	Manufacturing Technology and Management
I-MSN-A1068	Nanotechnology	Applied Nanotechnology	Manufacturing Technology and Management
I-MAT-GRPP	Group Project for Full Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Aerospace Materials, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Cyber-Secure Manufacturing, Welding Engineering
I-MAT-DISS	Dissertation for Part Time Students	Manufacturing Technology and Materials Programme	Advanced Materials, Aerospace Materials, Manufacturing Technology and Management, Aerospace Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge

			Management for Innovation (not currently running), Management and Information Systems, Cyber-Secure Manufacturing, Welding Engineering
I-MNU-THESIS	Individual Research Project	Aerospace Manufacturing	Cyber-Secure Manufacturing, Engineering and Management of Manufacturing Systems, Global Product Development and Management, Knowledge Management for Innovation (not currently running), Management and Information Systems, Advanced Materials, Aerospace Materials, Manufacturing Technology and Management, Welding Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have either written examinations, assessment by submitted work and elements of assessment by presentation or viva.

This approach has been adopted in order to ensure that students demonstrate their understanding through a wide range of learning techniques, but are not disadvantaged through any one approach.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / **Module No.**	ILO 1	ILO2	ILO 3	ILO4	ILO 5	ILO 6	ILO 7	ILO 8
2						EX	EX	EX
3	ICW			ICW	ICW	ICW	ICW	ICW
4	ICW	ICW		ICW	ICW	ICW	ICW	ICW
5	ICW	ICW	ICW	ICW	ICW	ICW	ICW	ICW
6	ICW	ICW		ICW			ICW	ICW
7			ICW			ICW	ICW	ICW
8	ICW			ICW	ICW	ICW	ICW	ICW
9	ICW	ICW		ICW	ICW		ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 9	ILO 10	ILO 11	ILO 12	ILO 13	ILO 14	ILO 15
10a	ICW				ICW		ICW
10b	GPROJ GPRES ICW	GPROJ GPRES ICW	GPROJ GPRES ICW	GPROJ GPRES ICW	GPROJ GPRES ICW	GPROJ GPRES ICW	GPROJ GPRES ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 16	ILO 17	ILO 18	ILO 19	ILO 20
11	THESIS OR	THESIS OR	THESIS OR	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

With a wide portfolio of technical and transferable skills students can expect to advance to senior positions in research, development, design, engineering, consultancy, and management in sectors such as space, aerospace, optics, medical and health, energy generation, sensors, displays, and micro electromechanical systems.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Astronautics and Space Engineering

Date of first publication/latest revision: July 2017

1. What is the course?

Course information

Course Title	MSc in Astronautics and Space Engineering with variants in: MSc in Astronautics and Space Engineering (extended thesis) MSc in Astronautics and Space Engineering (Spacemaster) – *full-time option only*
Course code	MSASEFTC, MSASEPTC, MSASMFTC
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Autonomous and Cyber-physical Systems
Course Director	Dr Jenny Kingston
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	Not Applicable
Registration Period(s) available	One year full-time, two-three years part-time (up to five years by extended thesis)
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Autonomous and Cyber-physical Systems where the research interests include:

- The design and development of both space and aeronautical systems.

Cranfield University interacts with the following institutions and in the following ways:

- The Erasmus Mundus (Spacemaster) variants of the course are two year programmes taught jointly with other European institutions. The SpaceMaster involves prior learning and teaching for the first year from Julius Maximilian University Wurzburg (Germany) and Lulea Technical University (Sweden).

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Royal Aeronautical Society (RAeS) until October 2016 intake. Renewal of accreditation will be sought for 2017 intake onwards.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- Equip students from backgrounds in engineering or physical science with the knowledge, understanding and skills required to enable them to contribute to the European space industry or to space-related research.
- Develop students' specialist technical skills and to give students an awareness of space system engineering so that their specialist skills can be most effectively applied.
- Develop the transferable skills of students for a professional career in the space industry or research.

This programme is intended for the following range of students:

- New graduates seeking to pursue a career in the space industry.
- Practitioners in the sector, particularly at junior and middle management levels, who are seeking to expand their knowledge and skills in space systems engineering in order to further develop their careers.
- Practitioners who are not employed in the sector, who are seeking a career in the space industry.
- Both practitioners and new graduates seeking to pursue doctoral research in the area of spacecraft engineering.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. MSc

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a systematic knowledge, understanding and critical evaluation of the key principles of the main spacecraft disciplines (propulsion, orbits, communications, structure, data handling, etc.) and be competent to analyse performance quantitatively.
ILO 2. Demonstrate a critical judgement of their specialist subject area(s) at a level appropriate to new recruits to the space industry such that they are able to contribute directly without significant further training.
ILO 3. Demonstrate a systematic knowledge of the organisation of the space industry and typical space projects, within the wider economic, legal, social, ethical and environmental context.
ILO 4. Be able to apply their knowledge and understanding practically to the design and analysis of space systems.
ILO 5. Write a technical report to communicate their work clearly to others.
ILO 6. Give an oral presentation to describe the execution and results of a technical project.
ILO 7. Plan, execute and manage a small research project.
ILO 8. Work effectively as a member of a team on a technical project.
ILO 9. Undertake independent study and research.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Lectures and workshops delivered by industry practitioners, demonstrating the application of theory to various examples and case studies.
- Industry visits to demonstrate industry practice and facilities.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. MSc

The accumulation of 200 credits (or more) through the assessment of taught modules and the successful completion of the Thesis as detailed below:

Astronautics and Space Engineering (standard course)

Description	Credits
COMPULSORY MODULES:	
Modules: 1 and 4 Modules: 2 and 3 Group Design Project: 11 Individual Research Project: 12	10 20 60 90
ELECTIVE MODULES:	
2 modules chosen from: 5-10	20
TOTAL:	200

Astronautics and Space Engineering (extended thesis option)

Description	Credits
COMPULSORY MODULES:	
Modules: 1 and 4 Modules: 2 and 3 Extended Individual Research Project: 13	10 20 150
ELECTIVE MODULES:	
2 modules chosen from: 5-10	20
TOTAL:	200

Astronautics and Space Engineering (Spacemaster variant)

Description	Credits
COMPULSORY MODULES:	
Accredited prior learning at Julius Maximilian University Wurzburg and Lulea Technical University Module: 3 Individual Research Project: 12	120 10 90
ELECTIVE MODULES:	
2 modules chosen from: 5-10	20
TOTAL:	240

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are normally expected to complete the course within 11 calendar months.

Part-time students usually register for the course in October and are normally expected to complete the course within 2 - 3 years. For those taking the extended thesis route registration is available for up to 5 years.

The majority of lecture modules take place between October and March and run in parallel with the Group Design Project which concludes by early May. The Individual Research Project Component runs from January through to the end of the programme in September. An Extended Thesis variant of the course offers a longer more in-depth Individual Research Project Component that runs from November to the end of the programme instead of participation in the Group Design Project. This is generally aimed at students who have already had significant group project experience (for example in prior work in industry).

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

This course is also offered on a part-time basis. Students would instead complete the extended thesis variant of the course over a 2 to 5 year period, firstly completing the taught element of the programme before starting the individual research project.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ASE-AMA	Astrodynamics and Mission Analysis	Dr Joan Pau Sanchez	12	0	5	N		20/11/17	24/11/17	40	EX	100				12/17	06/2018
2	N-ASE-SSE	Space Systems Engineering	Dr Jenny Kingston	26	0	10	N		02/10/17	20/10/17	40	EX	100				01/18	06/2018
3	N-ASE-SP	Space Propulsion	Dr Jenny Kingston	22	22	10	N		09/10/17	27/10/17	40	EX	100				01/18	06/2018

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
4	N-ASE-SCO4	Space Communications	Dr Jenny Kingston	12	12	5	N		30/10/17	03/11/17	40	EX	100				12/17	06/2018
5	N-ASD-CS	Control Systems	Dr James Whidborne	28		10	Y		/11/17	/11/17	40			100 MULTI	ICW EX	50 50	16/12/16 01/18	06/2018
6	N-AVD-FEA	Finite Element Analysis	Ioannis Giannopoulos	22	22	10	Y		07/11/16	18/11/16	40	EX	100				09/01/17	06/2018
7	N-AVD-FRP	Design and Analysis of Composite Structures	Dr Shijun Guo	20	0	10	Y		/17	/17	40			100 MULTI	EX ICW	75 25	001/181 2/17	06/2018
8	N-ASD-MVCAA	Multivariable Control Systems for Aerospace Applications	Dr James Whidborne	30	0	10	Y		/18	/18	40	EX	100				04/18	At the next available opportunity which may not be until the course runs the following year
9	N-ASE-SADC	Spacecraft Attitude Dynamics and Control	Dr Joan Pau Sanchez	22	22	10	N		12/02/18	19/03/18	40	EX	100				/04/17	At the next available opportunity which may not be until the course runs the following year
10	N-ASE-GPS	Aerospace Navigation and Sensors	Dr Stephen Hobbs	26		10	Y		26/02/18	13/03/18	40			100 MULTI	EX ICW	50 50	04/18 06/04/18	At the next available opportunity which may not be until the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		course runs the following year
11	N-ASE-GP	Group Design Project	Dr Jenny Kingston	40-60	0	60	N		09/10/17	30/03/18	50 50 50	GPROJ IPRES GCW	90 5 5				23/03/18	
12	N-ASE-THESIS	Individual Research Project	Dr Jenny Kingston	20	0	90	N		26/02/18	29/08/18	50	THESIS	100				29/08/18	
13	N-ASE-EIRP	Extended Individual Research Project	Dr Jenny Kingston	40	0	150	N		27/11/17	29/08/18	50	THESIS	100				29/08/18	
14	N-ASD-LRA	Launch and Re-entry Aerodynamics	Dr Simon Prince	10		0	Y		01/18	01/18	n/a	AO	n/a				n/a	n/a
15	N-ASE-ELS	Environmental Control and Life Support	Prof David Cullen	5		0	N		14/02/18	15/02/18	n/a	AO	n/a				n/a	n/a
16	N-AVD-MDS	Modelling of Dynamics Systems	Dr James Whidborne	13		0	Y		10/17	/10/17	n/a	AO	n/a				n/a	n/a
17	N-ASE-ODH	On Board Data Handling and Software Development	Dr Stephen Hobbs	10		0	N		09/10/17	13/10/17	n/a	AO	n/a				n/a	n/a

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates		
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
18	N-ASE-SE	Space Environment	Dr Jenny Kingston	10		0	N		05/03/18	0903/18	n/a	AO	n/a				n/a	n/a
19	N-ASE-PEI	Payload Engineering and Instrumentation	Dr Stephen Hobbs	15		0	N		16/10/17	20/10/17	n/a	AO	n/a				n/a	n/a
20	N-ASE-EOE	Earth Observation and the Environment	Dr Stephen Hobbs	10		0	N		29/01/18	0202/18	n/a	AO	n/a				n/a	n/a
21	N-ASE-RS	Research Skills	Dr Stephen Hobbs	6		0	N		15/11/17	1511/17	n/a	AO	n/a				n/a	n/a
22	N-ASE-SM	Structural Mechanics	Dr Jason Brown	20		0	N		02/10/17	20/10/17	n/a	AO	n/a				n/a	n/a
23	N-ASE-ISP	Impact Dynamics and Spacecraft Protection	Dr Jason Brown	15		0	N		23/10/17	27/10/17	n/a	AO	n/a				n/a	n/a
24	N-AVD-SD	Structural Dynamics	Dr Shijun Guo	20		0	Y		19/02/18	23/02/18	n/a	AO	n/a				n/a	n/a
25	N-ASE-CAD	Introduction to Computer Aided Design (CAD)	TBC	10		0	N		26/02/18	02/03/18	n/a	AO	n/a				n/a	n/a
26	N-ASE-TDS	Thermal Analysis and Design Software	Dr Jenny Kingston	10		0	N		12/02/18	16/02/18	n/a	AO	n/a				n/a	n/a

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ASD-CS	Control Systems	Aerospace Dynamics	Aerospace Dynamics, Aerospace Vehicle Design, Autonomous Vehicle Dynamics and control
N-AVD-FEA	Finite Element Analysis	Aerospace Vehicle Design	Aerospace Vehicle Design
N-AVD-FRP	Design and Analysis of Composite Structures	Aerospace Vehicle Design	Aerospace Vehicle Design
N-ASD-MVCAA	Multivariable Control for Aerospace Applications	Aerospace Dynamics	Aerospace Dynamics, Flight Test and Flight Dynamics
N-ASE-GPS	Aerospace Navigation and Sensors	Astronautics and Space Engineering	Aerospace Dynamics, Flight Test and Flight Dynamics
N-ASD-LRA	Launch and Re-Entry Aerodynamics	Aerospace Dynamics	Aerospace Dynamics
N-AVD-MDS	Modelling of Dynamics Systems	Aerospace Dynamics	Aerospace Dynamics, Aerospace Vehicle Design, Autonomous Vehicle Dynamics and control
N-AVD-SD	Structural Dynamics	Aerospace Vehicle Design	Aerospace Vehicle Design

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. In the standard course, students can expect to have 6 written examinations, 3-4 pieces of assessment by submitted work and 2 elements of formative or summative assessment by presentation or viva.

This approach has been adopted in order to ensure all students achieve the intended learning outcomes of the programme.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. MSc

Award ILOs / **Module No.**	ILO 1.	ILO 2.	ILO 3.	ILO 4.	ILO 5.	ILO 6.	ILO 7.	ILO 8.	ILO 9.
1	EX	EX							
2	EX	EX	EX	EX					
3	EX	EX							

Award ILOs / Module No.	ILO 1.	ILO 2.	ILO 3.	ILO 4.	ILO 5.	ILO 6.	ILO 7.	ILO 8.	ILO 9.
4	EX	EX							
5	EX	EX							
6	EX	EX							
7	EX	EX							
8	EX	EX							
9	EX	EX							
10	EX	EX							
11	GPROJ IPRES GCW	GPROJ IPRES GCW	GPROJ IPRES GCW	GPROJ IPRES GCW	GPROJ IPRES GCW	IPRES		GPROJ IPRES GCW	
12	THESIS	THESIS		THESIS	THESIS		THESIS		THESIS
13	THESIS	THESIS		THESIS	THESIS		THESIS		THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)
N/A	N/A	N/A	N/A
		N/A	N/A

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

The vast majority of our graduates are recruited by both the space industry and space-related academic groups. The positions cover a wide range of engineering disciplines all with the requirement for the broad space systems understanding that the course provides.

COURSE SPECIFICATION

Cranfield University: Course Specifications
Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: Automotive Programme

Date of first publication/latest revision: May 2017

1. What is the course?

Course information

Course Title	MSc in Automotive Engineering MSc in Automotive Mechatronics
Course code	MSAEGFTC, PDAEGFTC, PCAEGFTC (Automotive Engineering) MSAMCFTC, PDAMCFTC, PCAMCFTC (Automotive Mechatronics)
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PGDip, PGCert
Mode of delivery	Full-Time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Transport Systems
Centre	Advanced Vehicle Engineering Centre
Course Director	Dr Glen Sherwood (Automotive Engineering) Dr Stefano Longo (Automotive Mechatronics)
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year
Course Start Month(s)	October

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Institutions delivering the course
This programme is delivered by the School of Aerospace, Transport and Manufacturing, Transport Systems Theme, Advanced Vehicle Engineering Centre where the research interests include:

- Vehicle Electrification
- Advanced Control
- Multi-domain Modelling
- Novel Engine Technology
- Vehicle Braking Systems

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

The Automotive Engineering course is accredited formally by the Institution of Mechanical Engineers (IMechE) until October 2015.

The Advanced Vehicle Engineering Centre will seek to accredit the award of MSc in Automotive Mechatronics with the IET by 2016.

2. What are the aims of the course?

Cranfield University offers this Automotive programme in order to:

- Meet employer demand for post graduate engineers who have strong applied analytical skills in all areas of vehicle system and component design to meet the challenging market and legislative demands for vehicle safety, Performance and sustainability.
- Provide a primary training and dissemination route for Cranfield University's increasing research portfolio in the area of low carbon vehicle technologies and design methods.
- Supply to the automotive industry (and associated supply chain) high calibre post graduate engineers with the technical qualities, transferable skills and independent learning ability to make them effective in organisations that design and develop automotive products.

Postgraduate Diploma (PGDip) and Postgraduate Certificate (PGCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- EU or international students with a 1st class or 2nd class UK honours degree (or equivalent) in an engineering related discipline.
- Qualifying Double Degree students from the EU.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

ILO 1. Demonstrate the ability to work in a team and act as team leader on problem solving when making decisions in complex and unpredictable situations.
ILO 2. Employ reduced order models to analyse vehicle system or component dynamics as a pre-requisite to the design and evaluation of a vehicle control algorithm.
ILO 3. Critically evaluate the dynamics of a system and be able to formulate the design of a Single-Input-Single-Output controller that will satisfy vehicle level performance targets.

ILO 4. Critically evaluate the vehicle ride and handling subjective requirements and, through the use of simplified vehicle dynamic models, demonstrate an understanding of objective requirements for vehicle ride and handling.

ILO 5. Evaluate and design fundamental vehicle concepts, taking into account the interdependencies that exist between vehicle structure, powertrain, suspension, steering and braking systems.

ILO 6. Evaluate and be able to match the characteristics of powertrain systems and components to demonstrate a critical understanding of vehicle noise vibration and harshness (NVH), refinement and driveability.

ILO 7. To critically evaluate the structure of different vehicle types and to assess the impact of different load path faults within the vehicle.

ILO 8. Assess, evaluate and design vehicle systems, assemblies and components taking into account typical vehicle requirements and the constraints of packaging, ergonomics, active and passive safety, legislation and regulation.

ILO 9. Develop a critical understanding of the physical processes at work during the preparation of the fuel & air mixture and its subsequent combustion and emission. to demonstrate a knowledge of the performance and emissions requirements of engines in road vehicles.

ILO 10. Explain the importance of instrumentation within the vehicle development life-cycle, including the ability to review, evaluate and select the most appropriate technology, method of integration and data-processing techniques that are required to support system and component testing.

ILO 11. Assess and critically evaluate various suspension and steering systems, including the selection of the most appropriate criteria for comparison, and the ability to design new suspension concepts to satisfy vehicle ride and handling requirements.

ILO 12. Evaluate the different methods and technologies available that aid in the global decarbonisation and life-cycle sustainability of the automotive sector.

ILO 13. Critically evaluate different hybrid electric vehicle and electric vehicle architectures, including their usage requirements, designs, and the integration of different subsystem technologies.

ILO 14. Critically evaluate and formulate physical models of vehicle mechatronic systems using various modelling methodologies.

ILO 15. Critically evaluate the design of a multi-input-multi-output system and be able to select an appropriate design method to realise an implementable control system with appropriate performance and robustness.

ILO 16. Critically evaluate existing control system structures and be able to formulate alternative solutions to existing and future applications of vehicle control technology across the powertrain, transmission, chassis and body domains of the vehicle.

ILO 17. Analyse the functional and non-functional requirements of the vehicle mechatronic system and be able to formulate appropriate hardware implementation and verification strategies.

ILO 18. Demonstrate the ability to independently evaluate and apply the results of scholarly research.

ILO 19. Independently plan and implement a programme of individual research including the effective written and oral dissemination of the research outcomes

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

Automotive Engineering:

Depending upon the modules completed, a subset of the following ILOs would be applicable:

- ILO 1 (compulsory)
- ILOs 5-13, 16

Automotive Mechatronics:

Depending upon the modules completed, a subset of the following ILOs would be applicable:

- ILO 1 (compulsory)
- ILOs 2-6, 8, 9 13-15, 17

B. **Postgraduate Diploma**

In completing this course, and achieving the associated award, a diligent student should be able to:

Automotive Engineering:

- ILOs 1, 5-13, 16

Automotive Mechatronics:

- ILOs 1-6, 8, 9, 13-15, 17

C. **MSc**

In completing this course, and achieving the associated award, a diligent student should be able to:

Automotive Engineering:

- ILOs 1, 5-13, 16, 18, 19

Automotive Mechatronics:

- ILOs 1-6, 8, 9, 13-15, 17-19

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Provision of lectures from academics from selected UK Universities to support the programme in areas outside the technical expertise of Cranfield University.
- Provision of lectures from leading industry experts and practitioners highlighting the practical implementation and constraints associated with the theoretical principles introduced on the programme.
- All course material is available via the web-based learning environment Black Board.
- The course is timetabled as a series of modules thereby allowing diligent students to effectively manage the assessment requirements of the course.
- The provision of non-assessed study-skills training covering areas such as; academic report writing, presentation skills, research skills and working with University facilities (IT, library, Student Support Services).
- The extensive use of tutorial sessions and computer aided engineering exercises employing software packages commonly utilised in industry, including Matlab, WAVE and CATIA.
- The opportunity to complete an individual Research Project, which may be sponsored by industry and using industry scale laboratory facilities and software packages.
- Provision of a Personal Development Programme integrated throughout the Taught Modules and an individual Research Project that encourages the development of transferable skills (such as oral and written communication skills, independent learning and project management).

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out

in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Automotive Engineering

Description	Credits
COMPULSORY MODULES:	
Module 13 and to accumulate 40 credits from the following taught modules: 1, 2, 3, 4, 5, 10, 11, 12,	60
ELECTIVE MODULES:	
n/a	
TOTAL:	60

Automotive Mechatronics

Description	Credits
COMPULSORY MODULES:	
Module 14 and to accumulate 40 credits from the following taught modules: 1, 2, 3, 5, 6, 7, 8, 9, 10	60
ELECTIVE MODULES:	
n/a	
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Automotive Engineering

Description	Credits
COMPULSORY MODULES:	
Modules 1, 2, 3, 4, 5, 10, 11, 12, 13	120
ELECTIVE MODULES:	
n/a	
TOTAL:	120

Automotive Mechatronics

Description	Credits
COMPULSORY MODULES:	
Modules 1, 2, 3, 5, 6, 7, 8, 9, 10, 14	120
ELECTIVE MODULES:	
n/a	
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Automotive Engineering

Description	Credits
COMPULSORY MODULES:	
Modules 1, 2, 3, 4, 5, 10, 11, 12, 13, 15	200
ELECTIVE MODULES:	
n/a	
TOTAL:	200

Automotive Mechatronics

Description	Credits
COMPULSORY MODULES:	
Modules 1, 2, 3, 5, 6, 7, 8, 9, 10, 14, 15	200
ELECTIVE MODULES:	
n/a	
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout

the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months. This programme is not offered on a part-time basis.

The taught modules are preceded by an introductory, non-assessed, study skills module. The taught modules are delivered in a modular format and will typically last for one week. Throughout terms one and two, sufficient non-structured learning and teaching time is scheduled to facilitate independent learning, the completion of assessed work and for personal reflection.

Within the first term, all students participating on the automotive programme will attend the combined (core) automotive modules. During the second term, students will attend those modules defined for their respective specialism (Automotive Engineering / Automotive Mechatronics). For the duration of the 3rd term, students will have the opportunity to undertake their individual Research Project. There are no elective elements within the individual courses.

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-APE-VDP	Vehicle Design Powertrain and Performance	Dr Marko Tirovic	60		20	Y		02/10/17	26/01/18	50	EX	100				23/04/18	Sept 2018
2	N-AP-AE02	Engine Fuels and Lubrication	Dr Glenn Sherwood	30		10	Y		02/10/17	08/12/17	50	EX	100				04/01/18	Sept 2018
3	N-AP-AE03	Automotive Control and Simulation	Dr Daniel Auger	30		10	Y		16/10/17	20/10/17	50	ICW	100				13/11/17	31/08/18
4	N-APE-VSC	Vehicle Structures and	Dr Rishi Abhyankar	70		20	N		05/02/18	16/02/18	50	ICW	100				21/03/18	31/08/18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice

[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)

[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.

[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.

[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.

[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.

[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO- Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Crashworthiness																
5	N-AP-AE05	Vehicle Dynamics, Ride and Handling	Dr Efstathios Velenis	30		10	Y		27/11/17	01/12/17	50	EX	100				10/01/18	Sept 2018
6	N-AP-AM01	Mechatronic Modelling for Automotive Systems	Dr Stefano Longo	30		10	N		29/01/18	02/02/18	50	EX	100				18/04/18	Sept 2018
7	N-AP-AM02	Advanced Control and Optimisation	Dr Daniel Auger	30		10	N		12/02/18	16/02/18	50	ICW	100				12/03/18	31/08/18
8	N-AP-AM03	Automated Driving Applications	Dr Dongpu Cao	30		10	N		12/03/18	16/03/18	50	EX	100				20/04/18	Sept 2018
9	N-AP-AM04	Embedded Automotive Control Systems	Dr Stefano Longo	30		10	N		26/02/18	02/03/18	50			100 MULTI	GPRES ICW	10 90	26/03/18	August 2018
10	N-AP-AM05	Vehicle Electrification and Hybridisation	Dr Amir Soltani	40		10	Y		13/11/17	17/11/17	50	ICW	100				11/12/17	August 2018
11	N-AP-AE08	Engine Simulation and Performance	Dr Glenn Sherwood	30		10	N		26/02/18	02/03/18	50	GCW	100				29/03/18	August 2018
12	N-AP-AE09	Vehicle Dynamics and Suspension	Dr Efstathios Velenis	30		10	N		19/03/18	23/03/18	50	EX	100				19/04/18	Sept 2018

Assessment Types: AO- Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Design																
13	N-AP-AE11	Automotive Engineering Design Project	Dr Marko Tirovic	60		20	N		26/10/17	08/03/18	50 50			MULTI 50 MULTI 50	**Individual:** Computer Aided Design Intellectual Property CANBus Individual Project Overview **Group:** First Presentation Report Final Presentation	 20 15 5 10 15 25 10	23/02/18	August 2018
14	N-AP-AE12	Automotive Mechatronics Group Project	Dr Amir Soltani	60		20	N		26/10/17	08/03/18	50 50			MULTI 50 MULTI 50	**Individual:** Computer Aided Design Intellectual Property Individual Project Overview **Group:** First Presentation Report	 25 15 10 15 25	23/02/18	August 2018

Assessment Types: AO- Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
															Final Presentation	10		
15	N-AP-AE13	Individual Research Project	Dr Efstathios Velenis	10		80	Y		08/03/18	31/08/18		ICW THESIS OR	10 80 10				17/05/18 16/08/18 29/08/18 to 31/08/18	No Retake

Assessment Types: AO- Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	Module title	Course that owns the module	Other course(s)/ programme(s) that use the module
N-APE-VDP	Vehicle Design Powertrain and Performance	Automotive Engineering	Automotive Engineering Automotive Mechatronics
N-AP-AE02	Engines Fuels and Lubrication	Automotive Engineering	Automotive Engineering, Automotive Mechatronics
N-AP-AE03	Automotive Control and Simulation	Automotive Engineering	Automotive Engineering, Automotive Mechatronics
N-AP-AE05	Vehicle Dynamics, Ride and Handling	Automotive Engineering	Automotive Engineering, Automotive Mechatronics
N-AP-AM05	Vehicle Electrification and Hybridisation	Automotive Mechatronics	Automotive Engineering, Automotive Mechatronics
N-AP-AE13	Individual Research Project	Automotive Engineering	Automotive Engineering, Automotive Mechatronics

7. How are the ILOs assessed?

The following assessment types are utilised:

- Within the subset of core automotive modules taught in term 1 are assed via written examinations that will be set early in term 2. Conversely, module 4 will be assessed via an individual assignment. It is noteworthy that this assignment will be aligned to the respective ILOs and may include elements of computer based analysis, model development and simulation.

- The specialised stream modules (4, 11, 12) and (6-9) are all assessed using a combination of written assignment and examination. Written Examinations are scheduled for the end of Term 2 / early Term 3. As with the core modules, the nature of the summative assignments in all cases will be constructively aligned to the respective module ILOs and may include an element of written work, oral presentation, numerical analysis and experimentation.

- Modules 13 and 14, represent an extended open-ended Group Project Activity for both streams and are assessed via a combination of written and presentation

- The individual Research Project is assessed via a written thesis and oral examination.

This approach has been adopted because:

The Automotive Engineering course has been running since 1960 and the experience of the course teaching team feel that this is the most appropriate blend of assessments to fulfil the ILO's.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate and Postgraduate Diploma

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5	ILO6	ILO7	ILO8	ILO9	ILO 10	ILO 11	ILO 12	ILO 13	ILO 14	ILO 15	ILO 16	ILO 17
1					EX	EX		EX		EX	EX						
2									EX			EX					
3		ICW	ICW														
4							ICW										
5				EX													
6														EX			
7															ICW		
8																EX	
9																	MULTI
10													ICW				
11									GCW								
12											EX						
13	MULTI				MULTI												
14	MULTI															MULTI	

B. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO18	ILO19
15	THESIS	THESIS

<u>CROSS-MODULAR ASSESSMENT</u> (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. <u>How will the University assure the quality of the provision?</u>

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to

ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

The following patterns have emerged with regard to the future career paths for those graduates who have successfully studied automotive engineering:

- Continued higher education – PhD Research, both within Cranfield University or within other high ranking UK/EU Universities
- Employment within internationally leading vehicle manufacturers, including:
    - Toyota Europe (Belgium)
    - PSA (France)
    - Jaguar Cars / Land Rover (UK)
    - Bentley Motors (UK)
    - Ford (UK)
- Employment within internationally leading engineering consultancies and system suppliers to the automotive industry, including:
    - AVL (UK and Europe)
    - Ricardo Consulting Engineers (UK)
    - TRW (UK)
    - Bosch (Germany)

Graduands will typically take-up a graduate / senior engineering roles, within the respective product development or research departments of the employing organisations and which are often linked to an accelerated promotion scheme.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Autonomous Vehicle Dynamics and Control

Date of first publication/latest revision: October 2017

1. What is the course?

Course information

Course Title	MSc in Autonomous Vehicle Dynamics and Control
Course code	MSAVCFTC, MSAVCPTC, PDAVCFTC, PDAVCPTC, PCAVCFTC, PCAVCPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Cyberphysical Systems
Course Director	Professor Rafal Zbikowski
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s)	Full-time MSc - one year, Part-time MSc - up to three years, Full-time

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

available	PgDip - one year, Part-time PgDip - two years, Full-time PgCert - one year, Part-time PgCert - two years
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Cyberphysical Systems where the research interests include:

- Autonomous Systems
- Flight Dynamics
- Decision making in Autonomous Systems
- Autonomous Systems Technology and Operations
- Guidance and Navigation of Air/Ground and Underwater Vehicles
- Control Systems Computational Engineering and Design
- Computational Fluid Dynamics with the applications in aerospace, automotive, environmental, energy, sensor technology, data and information fusion.

Teaching and/or assessment is conducted at the two campuses: in the School of Aerospace, Transport and Manufacturing and Cranfield Defence and Security at Shrivenham.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

2. <u>What are the aims of the course?</u>

Vehicle autonomy is predicted to be one of the defining technologies of the next few decades. At present there is no explicit provision for such technologies at Masters Level in the United Kingdom. In Europe, a masters programme in “Intelligent Autonomous Systems” has been launched at Aalborg University, Denmark. A computer science based masters course runs at Bonn-Rhein-Sieg University of Applied Science, Germany. MIT, Princeton and other leading US universities have started to provide modules on autonomous systems on their masters programs.

These programmes address the predicated future needs of industry and research for personnel with the fundamental knowledge and enabling skills required for the advance of the technologies of autonomous vehicles. The programme reflects the burgeoning research interests of the staff within the Centre and compliments other activities in autonomous air vehicle engineering within the School.

The course provides a unique opportunity for cross-disciplinary education and knowledge transfer for candidates interested in working in the area of autonomous system and understand their operations and integration covering a broad range of applications from defence to health care.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Engineers wishing to apply their skills into new areas.
- Qualified engineers working with autonomous systems in a particular area and wishing to move to a different application area, for example, from ground robots to unmanned air-vehicles.
- Recent graduates wishing to extend their knowledge and skills in the above areas.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate an appreciation of the issues involved with the deployment of autonomous vehicle systems.

ILO 2. Construct and analyse dynamic models of either an air, marine or ground vehicle.

ILO 3. Analyse, design and simulate control systems for the stability, performance, navigation and autonomous operation of an air, marine or ground vehicle.

ILO 4. Demonstrate a systematic understanding of some of the fundamental principles of vehicle dynamics, control systems and autonomous decision making, and a systematic understanding of the nature of the relationship between the dynamics, control and decision-making subsystems within the autonomous vehicle system.

ILO 5. Demonstrate an awareness of the nature of the autonomy and decision making under uncertainty.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 6. Define problems and develop methods and strategies for solving them.

ILO 7. Utilise manual and computer based information retrieval systems and correctly reference their use.

ILO 8. Work independently and/or in a group environment.

ILO 9. Plan and execute a short piece of research or design study (i.e., dissertation)

ILO 10. Critically evaluate their own work and manage their time.

ILO 11. Communicate effectively verbally or in writing to suit a range of audiences.

ILO 12. Program and drive leading mathematical and engineering software packages.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 13. Demonstrate independent learning by planning, conducting and critically evaluating an individual programme of extended research into some aspect of autonomous vehicle systems and presenting the work both in the form of presentations and written thesis.

4. How is the course taught?

The course is delivered through a combination of lectures, tutorials and hands-on lab sessions. The majority of the modules feature a strong interactive element.

Written coursework assignments take the form of technical reports, laboratory reports and traditional style essays. The students can have up to 9 written assignments depending on the choice of modules they undertake, 6 of which are compulsory. Some modules are 100% assessed on the written report while others feature 50-50 split (assignment and exam).

The learning support builds on the standard mechanisms provided by the University including library facilities, specialised IT provision, etc. The course uses the Blackboard learning environment with all materials delivered in electronic form.

In addition to standard learning support facilities the course utilises a number of specialised facilities, namely:

- Wind-tunnel facilities used for demonstrations/labs – in the first two weeks of the course the students have several sessions and demonstrations using the wind tunnel facilities.
- The Introduction to Aerodynamics, Aircraft Performance, Stability and Control which is a compulsory module uses the NLFC Jetstream plane for in-flight data recording and measurements. The students are divided into groups and use the data collected from the flight for the flight lab assignment. In addition, the students are given 2-hours in the Bulldog where they can experience and get a better understanding of aircraft handling, limitations and performance. The student have this unique opportunity at Cranfield to be taught the theoretical component of the course then go out flying with the Jetstream and experience and collect the data in flight for the written report.
- The course collaborates with CDS.
- Currently working on expanding the experimental part to include the airport and tower to give the students the understanding of ground/air-operations, aerodrome traffic movement and rules of the air.
- Individual Research Projects are proposed by industrial partners (not sponsored). Each year a limited number of industry internships become available to students.

Group assignments and lab sessions are utilised in order to enhance the transferable skills related to teamwork and communication.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1, 2, 5, 6, 7, 8, 9,10	55
ELECTIVE MODULES:	
Modules selected from: 3, 4, 11, 12, 13, 14, 16	5 or 10
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1-10 Dissertation: 18	80 20
ELECTIVE MODULES:	

Modules selected from: 11-16, to the value of 20 credits	20
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules: 1-10 Individual Research project: 17	80 100
ELECTIVE MODULES:	
Modules selected from: 11-16, to the value of 20 credits	20
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months.

This course is also offered on a part-time basis. Students are recommended to register in October but they can also register in January. However, depending on the student background and their knowledge in control systems it is advisable that the Autonomous Vehicle Control Systems, which is an optional module, be taken in the second year. The course takes 2 or 3 years to complete and selecting the modules to be taken each year is done in consultation with the Course Director.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-ASD-FDP	Flight Dynamics Principles	Dr Alastair Cooke	20		10	Y		20/11/17	01/12/17	40	ICW	100				14/02/18	06/2018
2	N-ASD-CS	Control Systems	Dr James Whidborne	28		10	Y		06/11/17	24/11/17	40			100 MULTI	ICW EX	50 50	15/12/17 10/01/18	06/2018
3	N-AVC-DAMS	Decision Making for Autonomous Systems	Prof Rafal Zbikowski	14		5	N		26/02/18	27/02/18	40	ICW	100				27/03/18	06/2018

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
4	N-ASD-GFTR[12]	Flight Experimental Methods (Group Flight Test Report)	Dr Alastair Cooke	50		20	Y		09/10/17	27/10/17	40			100 MULTI	GPRAC OR	70 30	22/11/17	06/2018
5	N-AVC-GNS	Guidance and Navigation for Autonomous Systems	Dr Hyo-sang Shin	28		10	N		05/02/18	09/02/18	40	EX	100				/04/18	09/2018
6	N-AVD-MDS	Modelling of Dynamic Systems	Dr James Whidborne	13		0	Y		23/10/17	27/10/17	N/A	AO	N/A				N/A	N/A
7	N-ASD-AMS	Air-Vehicle Modelling and Simulation	Dr James Whidborne/ Dr Mudassir Lone	28		10	Y		22/01/18	26/01/18	40	GCW	100				05/03/18	At the next available opportunity
8	N-AVC-SF	Sensor Fusion: Architectures, Algorithms and Applications	Dr Hyo-sang Shin	30		10	N		13/11/17	17/11/17	40			100 MULTI	EX ICW	70 30	01/18 26/01/18	06/2018
9	N-AVC-IA	Introduction to Aerodynamics	Prof Kevin Garry/ Dr Nick Lawson	22		0	N		02/10/17	06/10/17	n/a	AO	n/a				n/a	n/a

[12] Assessment Group 40

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
10	N-AVC-ASO	Autonomous Systems and Operations	Dr Al Savvaris	14		5	N		28/02/18	01/03/18	40	ICW	100				31/03/17	06/2018
11	N-AVC-DIF	Data and Information Fusion	Prof Rafal Zbikowski	30		10	N		29/01/18	02/02/18	40	EX	100				04/18	06/2018
12	N-ASD-FRPSC	Fundamentals of Rotorcraft Performance, Stability and Control	Dr Alastair Cooke	10		5	Y		20/11/17	24/11/17	40	EX	100				01/18	06/2018
13	N-AVC-VPP	Vehicle Power and Propulsion	Dr Al Savvaris	28		10	N		12/02/18	16/02/18	40 40	ICW ** EX	50 50				16/03/18 04/17	09/2018
14	N-AVC-FDHM	UAS Fault Diagnosis and Health Management	Dr Al Savvaris	28		10	N		05/03/18	09/03/18	40	EX	100				04/17	09/2018
15	N-AVC-AVCS	Autonomous Vehicle Control Systems	Dr Hyo-sang Shin	28		10	N		22/01/18	26/01/18	40	ICW	100				16/03/18	06/2018
16	N-AVC-CSN	UAS Communication Systems and Networks	Dr Al Savvaris	14		5	N		12/03/18	16/03/18	40	ICW	100				12/04/18	06/2018

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
17	N-AVC-THESIS	Individual Research Project	Prof Antonios Tsourdos	20		100	N		01/05/18	08/09/18		THESIS OR	85 15				22/08/18 04/09/18	
18	N-AVC-DISS	Dissertation***	Prof Antonios Tsourdos	30		20	N		01/05/17	08/09/17		THESIS	100				04/09/18	

***Laboratory case study based assessment*
****Please note that Dissertation for PgDip is examined 100% by thesis. However, the candidate will be required to give a non-assessed presentation in order to demonstrate that learning outcomes have been achieved.*

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-ASD-FDP	Flight Dynamics Principles	Aerospace Dynamics	Aerospace Dynamics
N-ASD-CS	Control Systems	Aerospace Dynamics	Aerospace Dynamics, Aerospace Vehicle Design, Astronautics and Space Engineering
N-ASD-GFTR	Flight Experimental Methods (Group Flight Test Report)	Aerospace Dynamics	Aerospace Dynamics
N-AVD-MDS	Modelling of Dynamic Systems	Aerospace Dynamics	Aerospace Vehicle Design Astronautics and Space Engineering, Aerospace Dynamics
N-ASD-AMS	Air-Vehicle Modelling and Simulation	Aerospace Dynamics	Aerospace Dynamics, Flight Test and Flight Dynamics
N-ASD-FRPSC	Fundamentals of Rotorcraft Performance, Stability and Control	Aerospace Dynamics	Aerospace Dynamics

7. How are the ILOs assessed?

The following assessment types are utilised:

For the taught course part of the programme, the ratio between examination and assessed coursework is approximately 3:2, but depends on the chosen options.

The examinations will generally take a traditional form and enable the students to demonstrate their fundamental knowledge and understanding and to apply the knowledge in a critical way to problems. This ensures that successful students have achieved the learning outcomes, in particular ILOs 1 to 4.

Written coursework assignments take the form of technical reports, laboratory reports and traditional style essays. Such assignments will demonstrate skills in information retrieval, literature citation, critical evaluation and written presentation skills to suit a variety of formats and audiences. Problem solving activities will also be incorporated in such assignments. This will ensure that successful students have achieved the ILOs 1 to 5.

Where appropriate as part of the learning process, some modules will include an element of group work, but this ill not form part of the formal assessment procedure.

The research project is examined for the MSc by thesis (85%) and by Presentation (15%). For the Postgraduate Diploma it is examined 100% thesis, however, the candidate will be expected to give a presentation but will not be formally assessed. Within the project, other learning outcomes will be demonstrated to have been achieved.

In all instances, assessment will be based on the demonstration of appropriate knowledge, an appropriate mode of presentation, interpretation within the correct context, critical discussion and the use and citation of appropriate sources of information.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

For Example:

Award ILOs ***Module No.***	***ILO 1.***	***ILO 2.***	***ILO 3.***	***ILO 4.***	***ILO 5.***	***ILO 6.***	***ILO 7.***	***ILO 8.***	
98	*ICW*				*EX*	*EX*	*ICW*		
99	*ICW1*		*ICW1*	*ICW2*					

A. Postgraduate Certificate

Award ILOs **Module No.**									

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs **Module No.**									

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.									

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

The knowledge and skills the graduates gain following the successful completion of the course enables them to work in a broad range of industries. The first group of graduates from this course went on to work in the aerospace sector and automotive industry, while 2 graduates pursued careers in academic through PhD Programmes.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Battlespace Technology

Date of first publication/latest revision: 17/05/16

1. What is the course?

Course information

Course Title	Battlespace Technology (BTC11)
Course code	MSBTCPTR - PDBTCPTR
Academic Year	2016-17
Valid entry routes	MSc, PgDip
Additional Exit routes	PgDip
Mode of delivery	Part time
Location(s)[1] of Study	Shrivenham
School(s)	Cranfield Defence and Security
Theme	Defence and Security
Centre	Head of School
Course Director	Mr N D Manners
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	Yes
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University academic entry requirements
UK Qualifications Framework Level	QAA FHEQ level 7 (Masters)
Benchmark Statement(s)	N/A
Registration Period(s)	A student who registers for the PgDip will have a registration period

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

available	of 4 years and for the MSc, 5 years.
Course Start Month(s)	May

Institutions delivering the course
This course is delivered by Cranfield Defence and Security where the research interests include a wide range of Defence related topics. The military context of the taught material is reinforced by experienced Military Directing Staff and visiting lecturers including experts from industry, research establishments and Government departments, particularly MoD.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

2. What are the aims of the course?

Cranfield University offers this course in order to:

Provide a broad understanding of fundamental technologies, their acquisition and support, and a deeper understanding of a particular sub-set of battlespace technologies and capability integration, to enable graduates to contribute most effectively to the delivery of defence capability.

The Postgraduate Diploma (PgDip) exit route is provided for students who not wish to undertake a research project on successful completion of the taught phase of the course.

This programme is intended mainly for selected non-specialist UK Army Officers.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Diploma in Battlespace Technology

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Understand and critically evaluate those fundamental technologies under-pinning defence equipment capability and their integration in weapon and vehicle systems

ILO 2. Analyse the role of information superiority in enhancing operational effectiveness

ILO 3. Demonstrate an ability to think conceptually within a defined area of battlespace technology

ILO 4. Describe and critically evaluate the role of systems engineering and project management in defence acquisition and equipment support

ILO 5. Analyse and critically compare potential solutions to meet a capability requirement within a particular area of battlespace technology

ILO 6. Express knowledge and critical deduction both orally and in writing

ILO 7. Work to agreed timelines and milestones, establishing clear aims, objectives and specifications

ILO 8. Apply appropriate methods, tools, techniques, processes and knowledge acquired during the course

ILO 9. Demonstrate an ability to play an effective part as a member of a project team in the formulation and communication of a design solution to a system requirement

B. MSc in Battlespace Technology

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 10. Plan and undertake a defence related research project in a technical subject or having a technical implication

ILO 11. Acquire, critically evaluate, synthesise and correctly reference literature relating to a specific project topic

ILO 12. Effectively communicate their findings and the associated technical information

ILO 13 Defend their approach to the project and their conclusions

4. How is the course taught?

Students will be supported in their learning and personal development by:

- lectures, tutorials and practical demonstrations
- independent and group research exercises
- technical investigations
- presentations to and from their peers
- small group and whole class guided discussions
- guidance from experienced Military Directing Staff
- visits to industry and MoD establishments
- learning and teaching resources and course material on the Virtual Learning Environment

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Module 1 Module 11	20 20

Module 12 Module 13	10 30
ELECTIVE MODULES:	
Four from modules 3-10 or module 2 plus two from modules 5, 8 and 9	40
TOTAL:	**120**

B. MSc

The accumulation of 200 credits (or more) through the assessment of taught modules as detailed below:

Description	**Credits**
COMPULSORY MODULES:	
Module 1 Module11 Module 12 Module 13 Module 14 - Project	20 20 10 30 80
ELECTIVE MODULES:	
Four from modules 3-10 or module 2 plus two from modules 5, 8 and 9	40
TOTAL:	**200**

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Students start the BTC in May/June and complete all of the residential, PgDip, taught phase of the course by the end of December, except the Capability Integration module. They then complete their Staff Course from January to August, but are released to complete the BTC Capability Integration module during March.

Those students wishing to complete the MSc are then expected to complete the research project during their two year BTC related employment posting.

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	R-BT-IBT	Introduction to Battlespace Technologies		120		20		30/05/17	30/05/17	14/07/17	40	GCW	100				06/07/17	N/A
12	R-BT-ECN	Achieving Information Superiority		50		10		17/07/17	17/07/17	28/07/17	40	ICW	100				31/07/17	N/A

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
SUMMER BREAK																		
2	R-BT-MS	Defence Modelling &Simulation (Sim ET)		165		20		21/08/17	21/08/17	22/09/17	40 40	OR ICW	50 50				22/09/17 25/09/17	N/A
3	R-BT-BM(M)	Mobility (Battlespace Manoeuvre Stream)		55		10		31/07/17	31/07/17	22/09/17	40	ICW	100				25/09/17	N/A
4	R-BT-IS(CI)	Communication Infrastructure (Information Manoeuvre Stream)		45		10		31/07/17	31/07/17	22/09/17	40			100	IPRES ICW	60 40	20/09/17 25/09/17	N/A
7	R-BT-BM(L	Lethality (Battlespace		45		10		04/09/17	04/09/17	22/09/17	40	ICW	100				25/09/17	N/A

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
	)	Manoeuvre Stream)																
6	R-BT-IS(SS)	Sensor Systems (Information Manoeuvre Stream)		45		10		04/09/17	04/09/17	22/09/17	40	ICW	100				25/09/17	N/A
5	R-BT-BM(PA)	Precision Attack (Battlespace Manoeuvre Stream		50		10		25/09/17	25/09/17	27/10/17	40	ICW	100				30/10/17	N/A
8	R-BT-IS(N)	Network Infrastructure (Information Manoeuvre Stream)		45		10		25/09/17	25/09/17	27/10/17	40	ICW	100				30/10/17	N/A

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
9	R-BT-BM(S)	Survivability (Battlespace Manoeuvre Stream)		55		10		09/10/17	09/10/17	27/10/17	40	ICW	100				30/10/17	N/A
10	R-BT-IS(CS)	Cyber and Electromagnetic Activities		45		10		09/10/17	09/10/17	27/10/17	40	ICW	100				30/10/17	N/A
11	R-BT-DAPM	Defence Acquisition & Project Management (AET)		125		20		06/11/17	06/11/17	01/12/17	40 40	EX ICW	50 50				04/12/17 22/12/17	N/A
13	R-BT-CI	Capability Integration		120		30		04/12/17	04/12/17	23/03/18	50 50	GCW GCW	30 70	30 70	GPRES GCW GCW GPRES	10 20 40 30	18/12/17 22/03/18	N/A
14	R-BT-	MSc Project		20		8		26/03/	N/A	N/A	50	THESIS	100				11/01/21	N/A

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

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												Independent Assessment		Multi-part Assessment			Submission dates	
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	DISS					0		18									Viva to be arranged	

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Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
R-BT-DAPM	Defence Acquisition & Project Management	Acquisition Employment Training (AET)	Acquisition Employment Training (AET)
R-BT-MS	Defence Modelling and Simulation	Simulation Employment Training (Sim ET)	Simulation Employment Training (Sim ET)

7. How are the ILOs assessed?

The following assessment types are utilised:

Modules are assessed by written examination, written coursework or presentation with oral questioning, or a weighted combination.
The Capability Integration team project, which brings together the core elements of the course in a realistic acquisition exercise, is assessed through data packs including outline business cases and presentations with oral questioning.
The MSc research project is assessed through continuous assessment of the project execution, a written thesis and a viva voce examination.

This approach has been adopted in order that the individual elements of the course can be assessed by the most appropriate method but also that the students can demonstrate their learning in a number of different ways.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Diploma

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9
1 IBT	GCW					GCW	GCW	GCW	GCW
2 M&S			ICW1&2		ICW1&2	ICW1&2	ICW1&2	ICW1&2	
3 Mob	ICW		ICW		ICW	ICW	ICW	ICW	
4 CommsI	ICW		ICW		ICW	ICW	ICW	ICW	
5 PA	ICW		ICW		ICW	ICW	ICW	ICW	
6 SS	ICW		ICW		ICW	ICW	ICW	ICW	
7 Leth	ICW		ICW		ICW	ICW	ICW	ICW	
8 NI	ICW		ICW		ICW	ICW	ICW	ICW	
9 Surv	ICW		ICW		ICW	ICW	ICW	ICW	

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9
10 CEMA	ICW	ICW	ICW		ICW	ICW	ICW	ICW	
11 DAPM				ICW & Ex		ICW & Ex	ICW & Ex	ICW & Ex	
12 AIS		ICW	ICW			ICW	ICW	ICW	
13 Cap Int	GCW1& 2		GCW1& 2	GCW1& 2	GCW1& 2	GCW1& 2	GCW1& 2	GCW1& 2	GCW1& 2

B. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3	ILO 4	ILO 5	ILO 6	ILO 7	ILO 8	ILO 9
14 Project			THESIS		THESIS	THESIS	THESIS	THESIS	
	ILO 10	ILO 11	ILO 12	ILO 13					
14 Project	THESIS	THESIS	THESIS	THESIS					

<u>CROSS-MODULAR ASSESSMENT</u> (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)

8. <u>How will the University assure the quality of the provision?</u>

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review. For collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focussed Review which looks at each course in depth. In addition occasional site inspection visits are made.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

Students on this course are sponsored by their employer and have been selected for specific employment posts within the MOD or Defence related establishments.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield Univeristy. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Cleantech Entrepreneurship

Date of first publication/latest revision: 25/04/2016

1. What is the course?

Course information

Course Title	MSc in Cleantech Entrepreneurship
Course code	MSCTEFTC, PCCTEFTC, PDCTEFTC
Academic Year	2017-2018
Valid entry routes	MSc, PgDip, PgCert,
Additional exit routes	PgDip, PgCert
Mode of delivery	Full time
Location(s)[1] of Study	Cranfield University
School(s)	School of Water, Energy and Environment (SWEE) and School of Management (SOM)
Theme	Environmental Technology/Entrepreneurship
Centre	Cranfield Institute for Resilient Futures/Centre for Entrepreneurship
Course Director	Shared by Dr Frederic Coulon (SWEE) and Dr Maarten van der Kamp (SOM)
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirement
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	TBC

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Registration Period(s) available	Full-time (12 months)
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by School of Water, Energy and Environment (SWEE) and School of Management (SOM) with additional contribution from the School of Aerospace, Transport and Manufacturing (SATM). This is a strategic initiative that links the strengths of multiple Schools, and therefore the course is delivered as a fully shared joint venture between SWEE and SOM, where the research interests include clean energy, carbon capture and storage, circular economy, low carbon economy, water-waste-energy nexus challenges, water-soil-food nexus challenges; and entrepreneurship, technology commercialisation, sustainable business.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

Accreditation by the Institute of Environmental Management and Assessment (IEMA), CIWEM and CIWM is sought for this course. It is expected that upon completion students will be able to apply for Chartered Environmentalist (CEnv).

2. <u>What are the aims of the course?</u>

The proposed MSc in Cleantech Entrepreneurship aims to equip learners with an understanding of the opportunities and challenges to develop and commercialise technologies for a more sustainable world, focusing on Renewable Energy and Energy Efficiency, Water Treatment/Management, Waste Management, and Resource Efficiency. The objective is to prepare individuals to create environmental, social and economic value through an entrepreneurial mindset and skills focussed on the innovation of clean technologies.

Aimed at environmental and applied scientists, engineers and business and management students/professionals, foreseen careers upon completion will include Cleantech entrepreneurs serving as CEOs and CTOs, entrepreneurs and R&D managers in industry, and policy makers for the water-energy-resource nexus.

The specific aims are to enable learners to:

- Develop a deeper understanding of the opportunities and challenges involved in the development and management of the water-energy-resource nexus, tailored to specific sectoral needs.
- Obtain an in-depth knowledge of the key challenges in the management of renewable energy and energy efficiency, water treatment and management, waste and resource management. This will cover strategies and technology for resource management, technological trends and challenges, security of supply and quantitative analysis of resource economics.
- Gain an understanding of the entrepreneurial characteristics, entrepreneurial processes, and the entrepreneurial event in different social, economic, political and legal environments. This includes gaining hands-on experience of entrepreneurial opportunity recognition and the processes involved in the commercialisation of clean technologies.
- Evaluate the range of commercialisation opportunities for specific clean technologies, and propose which strategies, such as spin-outs, licensing, partnerships with large strategic players, "lean" product development, or risk-sharing at the proof-of-concept phase, and business models are most likely to create sustainable social, environmental and economic value.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) exit routes are provided for students who wish to access only parts of the course provided.

This programme is intended for the following range of students:

- Learners with a background in environmental management, engineering (environmental, mechanical, electrical, water), or physical sciences.
- Learners with a background in business and management, innovation and entrepreneurship.
- Graduates currently in employment keen to extend their qualifications or to pursue a career change.
- Individuals with other qualifications but who possess considerable relevant experience.

The course does not aim to harmonise these learners into a single model of student; rather, the different backgrounds will be mobilised to enhance the learning of the cohort through peer-assisted learning, and in all likelihood will still be visible when the students complete the course. This means that career options will be slightly different depending on the skills and knowledge upon entry.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Determine and appraise the opportunities and challenges involved in the development and management of the water-energy-resource nexus, tailored to specific sectoral needs.

ILO 2. Evaluate the use of complex concepts and principles in order to commercialise practical integrated clean technologies. This will cover strategies and technologies for resource management, technological trends and challenges, security of supply and quantitative analysis of resource economics.

ILO 3. Evaluate the entrepreneurial characteristics, entrepreneurial processes, and the entrepreneurial event in different social, economic, political and legal environments. This includes entrepreneurial opportunity recognition and the processes involved in the commercialisation of clean technologies.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 4. Integrate knowledge, understanding and skills from the taught modules in a real-life situation to address problems faced by industrial clients; creating new problem diagnoses, designs, or system insights; and communicating findings in a professional manner in written, oral and visual forms.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 5. Define a research question, develop aim(s) and objectives, select and execute a methodology, analyse data, evaluate findings critically and draw justifiable conclusions, demonstrating self-direction and originality of thought.

ILO 6. To communicate their individual research via a thesis and in an oral presentation in a style suitable for academic and professional audiences.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Lectures, observations, workshops and case studies, interactive class group exercise, industry visits, peer to peer discussion and debate, team and independent studies.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6 above. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	**Credits**
COMPULSORY MODULES:	
Entrepreneurship Entrepreneurial Finance Cleantech in Water-Energy-Food Nexus Energy Production, Emissions Control, Carbon Capture & Transport	10 10 10 10
ELECTIVE MODULES:	
Select any TWO of the following remaining taught modules: Advanced Electric Power Conversion Evaluating Sustainability through Life-Cycle Approaches Managing Business Growth Accelerating the Commercialisation of Technology	 10 10 10 10
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	**Credits**
Entrepreneurship Entrepreneurial Finance Cleantech in Water-Energy-Food Nexus	10 10 10

Energy Production, Emissions Control, Carbon Capture & Transport	10
Advanced Electric Power Conversion	10
Evaluating Sustainability through Life-Cycle Approaches	10
Managing Business Growth	10
Accelerating the Commercialisation of Technology	10
Group Project	40
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
Entrepreneurship	10
Entrepreneurial Finance	10
Cleantech in Water-Energy-Food Nexus	10
Energy Production, Emissions Control, Carbon Capture & Transport	10
Advanced Electric Power Conversion	10
Evaluating Sustainability through Life-Cycle Approaches	10
Managing Business Growth	10
Accelerating the Commercialisation of Technology	10
Group Project	40
Individual Thesis Project	80
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does <u>not</u> have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3]

[3] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in 25 September 2017 and are expected to complete the course within 12 calendar months.

The MSc course is taught in three sections: taught modules (40%), a group project (20%), and an individual research project (40%).

The taught programme, delivered between October and February, comprises a structured sequence of modules, each containing a series of lectures and other classroom-based teaching, supplemented by practical work. The taught modules are assessed by assignments and formal written examinations. Each module is taught over one week, usually followed by a week largely free of structured teaching to allow time for more independent learning and reflection.

The Group Project consists of a group-based research programme on behalf of an industry partner, undertaken between February and April. The projects are designed to integrate knowledge, understanding and skills from the taught modules in a real-life situation.

The thesis project, undertaken between May and September, further develops research and project management skills that: provide the ability to think and work in an original way; contribute to knowledge; overcome genuine problems; and communicate through a business plan/thesis and oral exam. Each student is allocated a supervisor, who will guide and assess the student work. The format of any guidance for the deliverables will follow that of the MSc in Management and Entrepreneurship.

To ensure smooth integration of the two target groups of students (either from an engineering/science or management background), the students take part in both orientation weeks of SOM and SWEE to guarantee immersion in the student bodies of both Schools. In the SWEE orientation week an introductory session is delivered to explain a number of core concepts to ensure that the target groups have a common understanding of the joint approach towards the course. Also, the first two modules to be delivered are the introduction to sustainability and to entrepreneurship to facilitate a rapid conversion. To illustrate how the technology, engineering and entrepreneurial aspects of the course is integrated, an overview of the course organisation and module delivery sequence is presented below.

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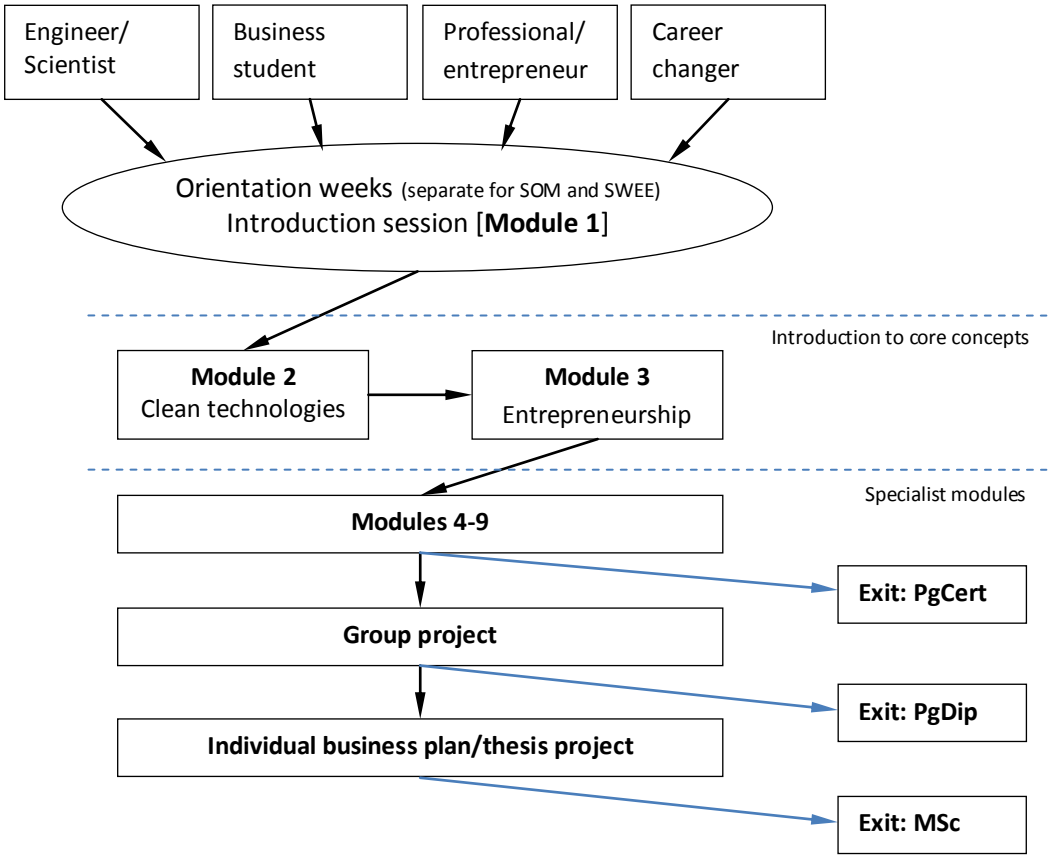
student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).


Engineer/ Scientist
Business student
Professional/ entrepreneur
Career changer
Orientation weeks (separate for SOM and SWEE)
Introduction session [Module 1]
Introduction to core concepts
Module 2
Clean technologies
Module 3
Entrepreneurship
Specialist modules
Modules 4-9
Exit: PgCert
Group project
Exit: PgDip
Individual business plan/thesis project
Exit: MSc

Course modules[4]

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-ENV-INWK	Induction	F Coulon / M van der Kamp	33		0	Y	26/09/17	02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	I-CTE-CWN	Cleantech in Water-Energy-Food Nexus	F Coulon	30		10	N	09/10/17	09/10/17	13/10/17	40	ICW	100				28/10/17	Week 9 - 4-8

[4] Please see Senate Handbook for Setting Up a New Taught Course for guidance on completing this table
[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		June 2018
3	M-T/ENT occurrence B	Entrepreneurship	M van der Kamp	25		10	Y	16/10/17	16/10/17	20/10/17	40	ICW	100				17/11/17	Week 9 - 4-8 June 2018
4	I-CTE-IFS	Advanced Electric Power Conversion	P Luk	35		10	N	06/11/17	06/11/17	10/11/17	40	ICW	100				18/11/17	Week 9 - 4-8 June 2018
5	M-E/ENF	Entrepreneurial Finance	S Hussels	25		10	Y	20/11/17	20/11/17	24/11/17	40 40	GCW EX	50 50				GCW: 06/12/17 EX: Week 1 11-15 December 2017	Week 9 - 4-8 June 2018
6	I-EDI-A1127	Evaluating Sustainability through Lifecycle	P Goglio	30		10	Y	04/12/17	04/12/17	08/12/17	40	ICW	100				FT 2-1-18 PT 13-1-	Week 9 - 4-8

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Approaches															18	June 2018
7	M-E/MBG	Managing Business Growth	S Vyakarnam	25		10	Y	08/01/18	08/01/18	12/01/18	40	ICW	100				26/01/18	Week 9 - 4-8 June 2018
8	I-MES-A2033	Energy Production, Emissions Control, Carbon Capture and Transport	K Patchigolla	30		10	Y	15/01/18	15/01/18	19/01/18	40			100	ICW IPRES	50 50	ICW 10/02/18 IPRES w/c 15/01/18	Week 9 - 4-8 June 2018
9	I-CTE-ACT	Accelerating the Commercialisation of Technology	M van der Kamp	25		10	Y	29/01/18	29/01/18	02/02/18	40 40	GPRES GCW	50 50				GPRES: 2.2.18 GCW 02/02/18	Week 9 - 4-8 June 2018
10	I-ENV-GRPP	Group Project	Supervisors	20		40	Y	19/02/18	19/02/18	04/05/18	50 50	GPROJ ICW	80 20				GPROJ 01/05/18 ICW 05/05/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
11	I-ENV-THESIS	Individual Thesis Project	Supervisors	20		80	Y	07/05/18	07/05/18	07/09/18	50 50	THESIS OR	90 10				03/09/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all course elements that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
M-T/ENT occurrence B	Entrepreneurship	Management	• Cleantech Entrepreneurship
M-E/ENF	Entrepreneurial Finance	Management and Entrepreneurship	• Management • Cleantech Entrepreneurship
I-EDI-A1127	Evaluating Sustainability	Environmental Management for Business	• Advanced Chemical Engineering: Biorefining Route • Cleantech Entrepreneurship • Environmental Engineering
M-E/MBG	Managing Business Growth	Management and Entrepreneurship	• Cleantech Entrepreneurship
I-MES-A2033	Energy Production, Emissions Control, Carbon Capture and Transport	Energy systems and Thermal Processes	• Atmospheric Emission Technology • Cleantech Entrepreneurship • Renewable Energy Technology

6. How are the ILOs assessed?

The following assessment types are utilised:

The taught modules (40%) are assessed by in-module assessment (including coursework, which focuses on application of principles studied and class tests, which support underpinning knowledge). The group project (20%) is assessed by means of a written group report, a reflective exercise, individual contribution and an oral presentation. The research project (40%), is assessed by a thesis and an oral examination

This assessment approach is adopted in accordance with the SWEE and SOM standard assessment model. The overall assessment workload and type used for the course is balanced and appropriate; it covers well the ILOs set out for each module of the course and develops the type of skills required for the students for their future career

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO 1	ILO 2	ILO 3
2	ICW	ICW	
3			ICW
5			GCW EX
8	ICW IPRES	ICW IPRES	
4	ICW	ICW	
6	ICW	ICW	
7			ICW
9			GPRES GCW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 4
10	GPROJ ICW

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO 5	ILO 6
11	THESIS OR	OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

Successful students develop diverse and rewarding careers in environmental technology ventures either as founder, CEO or CTO, or as part of the wider entrepreneurial ecosystem supporting cleantech commercialisation, i.e. government ministries, non-governmental organisations (NGOs), environmental and business consultancies, public sector organisations and the manufacturing and service industries in the private sector.

The specific roles that graduates will take on will in part still depend on the skills and knowledge that the students brought to the course. Students from a science or engineering background are more likely to act as Chief Technology Officer or as R&D manager; students coming in with a business, management or economics background are more likely to end up in CEO or commercial roles.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Community Water and Sanitation

Date of first publication/latest revision: 10/04/17

1. What is the course?

Course information

Course Title	Community Water and Sanitation
Course code	MSCTSFTC, MSCTSPTC, MTCTSFTC, PDCTSFTC, PDCTSPTC, PCCTSFTC, PCCTSPTC
Academic Year	2017/18
Valid entry routes	MSc,PgDip, PgCert
Additional Exit routes	PgDip, PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield Campus
School(s)	School of Water, Energy and Environment
Theme	Water
Centre	Cranfield Water Sciences Institute
Course Director	Dr Paul Hutchings
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Minimum 2nd class UK honours degree or equivalent or relevant industrial experience. Language proficiency for non-UK students: TOEFL: 237 (computer version), 580 (paper version), or TOEIC: 830, or IELTS: 6.5 minimum, or Cambridge Certificate: C or above
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	N/A
Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years, Full-time PgCert - one year, Part-time PgCert - two years, Full-time PgDip - one year, Part-time PgDip - two years
Course Start Month(s)	Full-time: October. Part-time: throughout the year

Institutions delivering the course

This course is delivered by the School of Water, Energy and Environment . Water research in the Cranfield Water Science Institute focuses on the science, engineering and management of water in municipal, industrial and natural environments, encompassing treatment technologies, engineering, irrigation, socioeconomics and policy. Research also focuses on soil and water sciences in the context of land management for food, fibre and bio-energy crops, environmental services and biodiversity, using expertise in biophysical and social sciences and agricultural engineering.

Cranfield University actively engages external speakers from across the water sector to deliver the Community Water and Sanitation course, including from: RedR, Oxfam, Medicin Sans Frontier, Action Contre la Faim, WaterAid, WEDC and CAWST. Cranfield University also actively seeks sponsorship and support for individual thesis projects from water sector employers to provide professional experience and development opportunities for students. Thesis sponsors and supporters include: WaterAid, WSUP,, and Loowatt.

Cranfield University has agreements with a number of top quality European higher education institutions through its European Partnership Programme (EPP). Within these agreements students from partner institutions have the opportunity to take a Master of Science (MSc) at Cranfield University as an alternative to the final year of their home university programme. The EPP provides a feeder stream of European students to Community Water and Sanitation and in doing so contributes to the diversity of the class.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by Chartered Institution of Water and Environmental Management until 2021

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- equip engineers and other development workers to plan and implement water supply and sanitation projects and programmes in any part of the world, particularly in low income countries.

This programme is intended for the following range of students:

- graduates with science, engineering, geography or related degrees keen to pursue careers in water management
- graduates currently in employment keen to extend their qualifications or to pursue a career change
- individuals with other qualifications but who possess considerable relevant experience.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate in Community Water and Sanitation

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Plan and design water sources in rural areas of lower-income countries, so the quality and quantity of water available is sustained

ILO 2. Evaluate water resource management methods

ILO 3. Plan and design sanitation facilities in lower-income countries and appraise different management methods

ILO 4. Explain different management and finance models for water, sanitation and hygiene services and evaluate how these might ensure access for the poorest.

ILO 5. Assess how services might vary in different contexts, specifically rural, urban and emergencies.

ILO 6. Critically evaluate water, sanitation and hygiene programmes, research and technologies.

B. Postgraduate Diploma in Community Water and Sanitation

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 7. Integrate knowledge, understanding and skills from the taught modules in a real-life situation to address problems faced by industrial clients; creating new problem diagnoses, designs, or system insights; and communicating findings in a professional manner in written, oral and visual forms.

C. MSc in Community Water and Sanitation

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 8. Define a research question, develop aim(s) and objectives, select and execute a methodology, analyse data, evaluate findings critically and draw justifiable conclusions, demonstrating self-direction and originality of thought.

ILO 9. To communicate their individual research via a thesis and in an oral presentation in a style suitable for academic and professional audiences.

4. How is the course taught?

Students will be supported in their learning and personal development by:

- Being provided with the opportunity to undertake externally sponsored or supported thesis project research
- Undertaking field and laboratory work to integrate and apply knowledge and skills

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 6. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction	0
ELECTIVE MODULES:	
60 credits from the following modules:	
Surface and Groundwater Hydrology	10
Water and Wastewater Treatment for Development	10
Management and Governance for Water Sanitation	10
Health, Hygiene and Sanitation	10
Communities and Development	10
Water Source Engineering	10
Water in Cities	10
Emergency Water Supply and Environmental Sanitation	10
TOTAL:	**60**

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Induction	0
Surface and Groundwater Hydrology	10
Water and Wastewater Treatment for Development	10
Management and Governance for Water Sanitation	10
Health, Hygiene and Sanitation	10

Communities and Development Water Source Engineering Water in Cities Emergency Water Supply and Environmental Sanitation Group Project (Full Time Students)	10 10 10 10 40
ELECTIVE MODULES:	
Part Time Students: Group Project OR Dissertation	 40 40
TOTAL:	**120**

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Induction Surface and Groundwater Hydrology Water and Wastewater Treatment for Development Management and Governance for Water Sanitation Health, Hygiene and Sanitation Communities and Development Water Source Engineering Water in Cities Emergency Water Supply and Environmental Sanitation Group Project (Full Time Students) Thesis project	0 10 10 10 10 10 10 10 10 40 80
ELECTIVE MODULES:	
Part Time Students: Group Project OR Dissertation	 40 40
TOTAL:	**200**

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that lower award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;

- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Please see the course structure document for details on the individual elements of the course. Each module is taught over two weeks, with one week largely free of structured teaching to allow time for more independent learning and reflection. Group projects are located after the taught modules, between February and May. Individual thesis research projects are run from May till the end of August with thesis submission and oral assessment in early September.

Full-time students register for the course in October and are expected to complete the course within 12 calendar months.

All options are also offered on a part-time basis and such students are expected to complete the course within 2 to 3 years. Part-time students are not restricted to starting in October. Instead they are offered individual guidance on the best sequence of study based on their prior knowledge and availability to attend.

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to an **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	I-WAT-INWK	Induction Week	A Parker	24		0	Y		02/10/17	06/10/17	N/A	AO	N/A				N/A	
2	I-WAM-A1163	Surface and Groundwater Hydrology	I Holman	27		10	Y		09/10/17	13/10/17	40	EX	100				W/C 02/01/18	Sept 18
3	I-WAM-WWTD	Water and Wastewater Treatment for Development	D Barrington	37		10	N		23/10/17	27/10/17	40	ICW	100				FT 04/11/17 PT 18/11/17	June 18

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
4	I-WAM-MGWS	Management and Governance for Water Sanitation	P Hutchings	33		10	N		06/11/17	10/11/17	40			100	ICW ICW	50% 50%	FT 18/11/17 PT 02/12/17	June 18
5	I-WAM-A1162	Health, Hygiene and Sanitation	S Tyrrel	25		10	N	20/11/17	27/11/17	01/12/17	40	ICW	100				FT 09/12/17 PT 02/01/18	June 18
6	I-WAM-A1170	Communities and Development	P Hutchings	33		10	N		04/12/17	08/12/17	40			100	ICW ICW	50% 50%	FT 16/12/17 PT 02/01/18	June 18
7	I-WAM-A1166	Water Source Engineering	D Haro-Monteagudd	25		10	N		08/01/18	12/01/18	40	ICW	100				FT 20/01/18 PT 03/02/18	June 18
8	I-WAM-WC	Water in Cities	H Smith	30		10	Y	22/01/18	29/01/18	02/02/18	40	IPRES	100				FT/PT 01/02/18	June 18
9	I-WAM-A1168	Emergency Water Supply and Environmental Sanitation	T Gould	30		10	N		05/02/18	09/02/18	40	ICW	100				FT 17/02/18 PT 03/03/18	June 18
PROJECTS																		

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers [6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
10	I-WAT-GRPP	Group Project	Supervisors	16		40	Y		19/02/18	07/05/18	50	GPROJ ICW	80 20				0105/18 05/05/18	
11	I-WAT-DISS	Individual Project (PT MSc and PgDip only)	Supervisors	10		40	Y		02/10/17	28/09/18	50	IPROJ IPRES	80 20				28/09/18	
12	I-WAT-THESIS	Individual Thesis	Supervisors	20		80	Y		07/05/18	07/09/18	50	THESIS OR	90 10				03/09/18	Sept 19

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that share the module**
I-WAM-A1163	Surface Water & Groundwater Hydrology	Community Water and Sanitation	Environmental Water Management
I-WAM-WC	Water in Cities	Environmental Water Management	Community Water and Sanitation

7. How are the ILOs assessed?

The following assessment types are utilised:

- the taught modules (40%) are assessed by in-module assessment (including coursework, which focuses on application of principles studied and class tests, which support underpinning knowledge) or examination in January;
- group projects (20%) are assessed by means of a written group report and presentations.
- the research project (40%), is assessed by a thesis and an oral examination

This approach has been adopted because:

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5	ILO6
1						
2		EX				
3	ICW		ICW		ICW	
4				ICW		ICW
5			ICW	ICW	ICW	ICW
6				ICW	ICW	ICW
7	ICW	ICW				
8		IPRES		IPRES		
9	ICW		ICW		ICW	ICW

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO7
10	GPROJ ICW
11	IPROJ IPRES

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO8	ILO9
12	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. What opportunities are graduates likely to have on completing the course?

On completion, graduates have a broader network of global contacts, increased opportunities for individual specialism in their chosen career, and the capability to make an immediate and real contribution to improved water supply and sanitation. Cranfield Community Water and Sanitation graduates are highly sought after by employers. Typical employers include:

- NGOs e.g. CAFOD, Concern Worldwide, ACTED, Pure Water for the World, Unicef, Medair, World Vision, WaterAid, MSF, CARE WSUP, World Toilet Organisation
- Government and pan-government agencies e.g. the European Commission, JICA,
- Small sanitation companies e.g. SOIL, Loowatt
- Water utilities e.g. Anglian Water, United Utilities, Scottish Water
- International engineering consultancies (e.g. Atkins, Mott MacDonald)

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Computational and Software Techniques in Engineering

Date of first publication/latest revision: October 2016

1. What is the course?

Course information

Course Title	MSc in Computational and Software Techniques in Engineering with options in: Computer Aided Engineering (CAE) Computer and Machine Vision (CMV) Software Engineering for Technical Computing (SETC)
Course code	MSCSTFTC, MSCSTPTC, MSSTBFTC (ESTIA variant),
Academic Year	2017/18
Valid entry routes	MSc
Additional exit routes	PgDip, PgCert
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield and Biarritz, France (in respect of the ESTIA variant)
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Computational Engineering Sciences
Course Director	Dr Irene Moulitsas
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Benchmark Statement(s)	Not Applicable
Registration Period(s) available	Full-time MSc - one year, Part-time MSc - up to three years
Course Start Month(s)	September

Institutions delivering the course

This course is delivered by The School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Computational Engineering Sciences where the research interests include:

- Computer Vision
- Vibroacoustics for Condition Monitoring
- Computational Engineering
- High Performance Computing
- Scientific Computing
- Computational Fluid Dynamics

Cranfield University interacts with the following institutions and in the following ways:

A variant of the course is delivered partly at ESTIA, Institute of Technology, an engineering school based in Biarritz, France. ESTIA (École Supérieure des Technologies Industrielles Avancées) has been sending students to study the Cranfield MSc in Computational and Software Techniques in Engineering since 1989. The ESTIA variant allocates 110 credits for the thesis element as opposed to 100 credits for the Cranfield option. This is balanced by ESTIA students not taking the Management for Technology module since the ESTIA thesis option is different requiring the students to undertake industrial internships. Some modules of the course are delivered on-site by Cranfield staff. Students can elect to undertake an individual project locally.

The course has a strong association with a number of EU academic institutions that regularly supply students onto the MSc through the EU Erasmus Programme. Students follow the course as part of a double degree arrangement with their home institution whereby the final year of their five year programme is replaced with the MSc here at Cranfield. Successful completion of the MSc allows the student to graduate from both Universities. The strongest of these associations is with ESTIA. They send typically 30 students each year onto the MSc. ESTIA students can only register for the CAE and CMV options.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is not accredited by any external bodies.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- Equip graduates with the knowledge, understanding and skills required to enable them to meet the demand of an evolving workplace that requires highly qualified engineers possessing core software engineering skills together with competency in mathematical analysis techniques.

- Develop suitably trained and qualified engineers, scientists and mathematicians enabling them to apply the analytical, computational and software skills to the solution of practical engineering IT problems in industrial, commercial and governmental organisations.

This programme is intended for the following range of students:

- UK students with an honours degree in Engineering, Computer Science, Mathematics, Physics.
- Mature students with at least 5 years relevant industrial experience.
- Students studying at recognised EU Universities with at least 4 years of relevant academic study.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 1. Critically evaluate the selection of computer languages, software tools, and technologies and apply them to help solve practical problems of a computational nature in engineering solutions.

ILO 2. Create original software solutions to engineering problems using industry standard libraries, packages, and software engineering tools.

ILO 3. Compose written reports and prepare and deliver oral presentations that effectively communicate proposals, technical developments, and results.

ILO 4. Plan and implement assigned projects under time pressure, and undertake self-directed learning when necessary.

ILO 5. Assemble a body of relevant technical literature and discuss and evaluate each work with respect to a technical problem.

ILO 6. Propose, plan, and implement an independent research project on a relevant technical topic, with limited supervision.

ILO 7. Critically evaluate project results, discuss findings, and relate their contribution to other works in the field.

4. <u>How is the course taught?</u>

Students will be supported in their learning and personal development by:

- A comprehensive set of carefully prepared lecture notes that form the basis for the teaching. This is perhaps the most valuable resource and reference point for the student starting a new module. Secondly, many lectures are given in conjunction with some form of programming. Students are encouraged, given time and practical assistance to develop their software skills.
- The library resources and search facilities here at Cranfield. A thorough introduction to these resources and demonstrations of information retrieval skills is provided at the beginning of the course. The library facilities are extensive and there is a good representative selection of books and periodicals relevant to the course. Where an article, book or periodical is not available, it can usually be obtained elsewhere via inter-library loans. Books, software and other resources are purchased by the group when it is necessary for one of the projects.

- A programme of seminars given by external and internal speakers is also provided for the Cranfield based students. These reflect the course, sponsoring companies and associated research carried out in the group enabling the students to get an appreciation of related work going on in industry and other universities.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Computer Aided Engineering option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
To accumulate 60 credits from Modules 1-7; 9-11	60
ELECTIVE MODULES:	
None	
TOTAL:	60

Computer Aided Engineering option, based at ESTIA

Description	Credits
COMPULSORY MODULES:	
To accumulate 60 credits from Modules 1-7; 9-11	60
ELECTIVE MODULES:	
None	
TOTAL:	60

Computer and Machine Vision option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
To accumulate 60 credits from Modules 1-4, 11-15, 17	60
ELECTIVE MODULES:	
None	
TOTAL:	60

Computer and Machine Vision option, based at ESTIA

Description	Credits
COMPULSORY MODULES:	
To accumulate 60 credits from Modules 1-4, 11-15, 17	60
ELECTIVE MODULES:	
None	
TOTAL:	60

Software Engineering for Technical Computing option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
To accumulate 60 credits from Modules 1-4, 18, 20-24	60
ELECTIVE MODULES:	
None	
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Computer Aided Engineering option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
Core Modules 1-4 CAE Option: Modules 5-11 Dissertation (for PgDip) (25)	35 65 20
ELECTIVE MODULES:	
None	
TOTAL:	120

Computer Aided Engineering option, based at ESTIA

Description	Credits
COMPULSORY MODULES:	
Core modules 1, 2, 4 CAE Option: Modules 5-11 Dissertation ESTIA (for PgDip) (26)	25 65 30
ELECTIVE MODULES:	
None	
TOTAL:	120

Computer and Machine Vision option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
Core modules 1-4 CMV Option: Modules 11-17 Dissertation (for PgDip) (25)	35 65 20
ELECTIVE MODULES:	
None	
TOTAL:	120

Computer and Machine Vision option, based at ESTIA

Description	Credits
COMPULSORY MODULES:	
Core modules 1, 2, 4 CMV option modules 11-17 Dissertation ESTIA (for PgDip) (26)	25 65 30
ELECTIVE MODULES:	
None	
TOTAL:	120

Software Engineering for Technical Computing option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
Core modules 1-4 SETC option modules 18-24 Dissertation (for PgDip) (25)	35 65 20
ELECTIVE MODULES:	
None	
TOTAL:	120

C. MSc

Students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Computer Aided Engineering option, based at Cranfield

Description	Credits
COMPULSORY MODULES:	
Core Modules 1-4 CAE Option: Modules 5-11 Individual Research Project (27)	35 65 100
ELECTIVE MODULES:	

None	
TOTAL:	200

Computer Aided Engineering option, based at ESTIA

Description	**Credits**
COMPULSORY MODULES:	
Core modules 1, 2, 4 CAE Option: Modules 5-11 Individual Research Project (28)	25 65 110
ELECTIVE MODULES:	
None	
TOTAL:	200

Computer and Machine Vision option, based at Cranfield

Description	**Credits**
COMPULSORY MODULES:	
Core modules 1-4 CMV Option: Modules 11-17 Individual Research Project (27)	35 65 100
ELECTIVE MODULES:	
None	
TOTAL:	200

Computer and Machine Vision option, based at ESTIA

Description	**Credits**
COMPULSORY MODULES:	
Core modules 1, 2, 4 CMV Option: Modules 11-17 Individual Research Project (28)	25 65 110
ELECTIVE MODULES:	
None	
TOTAL:	200

Software Engineering for Technical Computing option, based at Cranfield

Description	**Credits**
COMPULSORY MODULES:	
Core modules 1-4 SETC option modules 18-24 Individual Research Project (27)	35 65 100
ELECTIVE MODULES:	
None	

TOTAL:	200

Pass Criteria
The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in September and are expected to complete the course within 11 calendar months. ESTIA students register for the course in September and are expected to complete the course within 11 calendar months.

This course is also offered on a part-time basis. Students would instead take two to three years to complete the MSc.

Each module is taught over a period of one or two weeks. Practical work forms an important part of the teaching and so a significant amount of time is devoted to hands-on sessions with a

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

software package or development environment. This also facilitates independent learning on the part of the student.

Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
											Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date		Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-CST-C++P04	C++ Programming	Dr Irene Moulitsas	32		10	Y	26/09/17	26/09/17	06/10/17	40	Integrated Assessment: ICW	100				18/12/17 (F-T) 03/01/18 (P-T)	At the next available opportunity which may not be until the course runs the following year
2	N-CST-CM	Computational Methods	Dr Irene Moulitsas	31		10	Y	26/09/17	26/09/17	06/10/17								

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
3	G-MTI Occ B16	Management for Technology	Steven Carver	50		10	Y	15/01/17	15/01/17	19/01/18	40 40	EX GCW	50 50				22/01/18 19/03/17	23/03/17
4	N-CST-CG	Computer Graphics *Occ B (ESTIA)*	Dr Karl Jenkins	15		5	N	13/11/17 *22/01/18*	13/11/17 *22/01/18*	15/11/17 *24/01/18*	40	ICW	100				26/01/18 *07/03/18*	At the next available opportunity which may not be until the course runs the following year
5	N-CST-CSM04	Geometric Modelling and Design	Dr Karl Jenkins	35		10	N	16/10/17	16/10/17	20/10/17	40	ICW	100				01/12/17	At the next available opportunity which may not be until the course runs the following year
6	N-CST-CAEA	CAE Applications and PLM	Dr Karl Jenkins	35		10	N	23/10/17	23/10/17	27/10/17	40	ICW	100				20/12/17	At the next available opportunity which may not be until the course runs the following year
7	N-CST-CAEAA	CAE Advanced Applications	Dr Karl Jenkins	35		10	Y	12/02/18 *05/02/18*	12/02/18 *05/02/18*	16/02/18 *09/02/18*	40	ICW	100				10/03/18 *31/03/18*	At the next available opportunity which

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
		Occ B (ESTIA)																may not be until the course runs the following year
8	N-CST-CEDO	Applications of Computational Engineering Design Optimisation (Group Project) *Occ B (ESTIA)*	Dr Karl Jenkins	14		10	N	26/02/18 *29/01/18*	26/02/18 *29/01/18*	02/03/18 *02/02/18*	40			100 MULTI	GCW GPRES	50 50	17/04/18 *17/04/18*	At the next available opportunity which may not be until the course runs the following year
9	N-CST-AEA	Advanced Engineering Analysis	Dr Karl Jenkins	35		10	N	09/10/17	09/10/17	13/10/17	40	ICW	100				12/01/18	At the next available opportunity which may not be until the course runs the following year
10	N-CST-CE	Computational Engineering (Fluids) *Occ B (ESTIA)*	Dr Karl Jenkins	35		10	N	19/02/18 *15/01/18*	19/02/18 *15/01/18*	23/02/18 *19/01/18*	40	ICW	100				06/04/18 *12/02/18*	At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
11	N-CST-AG	Advanced Graphics *Occ B (ESTIA)*	Dr Karl Jenkins	15		5	N	29/01/18 *24/01/18*	29/01/18 *24/01/18*	31/01/18 *26/01/18*	40	ICW	100				21/02/18 *21/02/18*	At the next available opportunity which may not be until the course runs the following year
12	N-CST-SA04	Signal Analysis	Dr Zeeshan Rana	35		10	N	09/10/17	09/10/17	13/10/17	40	ICW	100				06/01/18	At the next available opportunity which may not be until the course runs the following year
13	N-CST-DSP	Digital Signal Processing	Dr Yifan Zhao	35		10	N	16/10/17	16/10/17	20/10/17	40	ICW	100				10/01/18	At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
14	N-CST-DIP1	Image Processing and Analysis	Dr Yifan Zhao	35		10	N	23/10/17	23/10/17	27/10/17	40 40	EX ICW	70 30				12/01/18 15/12/17	At the next available opportunity which may not be until the course runs the following year
15	N-CST-DIP2	Computer Vision *Occ B (ESTIA)*	Dr Zeeshan Rana	35		10	N	15/01/18 *15/01/18*	15/01/18 *15/01/18*	19/01/18 *19/01/18*	40	ICW	100				09/03/18 *09/03/18*	At the next available opportunity which may not be until the course runs the following year
16	N-CST-ADSIP	Applications of Computer Vision for Robotics (Group Project) *Occ B (ESTIA)*	Dr Zeeshan Rana	14		10	N	26/02/18 *29/01/18*	26/02/18 *29/01/18*	02/03/18 *02/02/18*	40			100 MULTI	GCW GPRES	50 50	17/04/18 *17/04/18*	At the next available opportunity which may not be until the course runs the following year
17	N-CST-ML	Machine Learning	Dr Irene Moulitsas	35		10	N	05/02/18	05/02/18	09/02/18	40	ICW	100				11/05/18	At the next available opportunity

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		which may not be until the course runs the following year
18	N-CST-SSPP	Small-scale Parallel Programming	Dr Salvatore Filippone	35		10	N	22/01/18	22/01/18	26/01/18	40	ICW	100				09/03/18	At the next available opportunity which may not be until the course runs the following year
19	N-CST-GPAPHE	Applications in Practical High-End Computing (Group Project) *Occ B (ESTIA)*	Dr Irene Moulitsas	21		10	N	26/02/18 *29/01/18*	26/02/18 *29/01/18*	02/03/18 *02/02/18*	40			100 MULTI	GCW GPRES	50 50	17/04/18 *17/04/18*	At the next available opportunity which may not be until the course runs the following year
20	N-CST-CC	Cloud Computing	Dr Salvatore Filippone	35		10	N	20/11/17	20/11/17	26/11/17	40	ICW	100				12/01/18	At the next available opportunity which may not be until the course runs the

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
																		following year
21	N-CST-HPTC	High Performance Technical Computing	Dr Irene Moulitsas	35		10	N	06/11/17	06/11/17	10/11/17	40	ICW	100				14/01/18	At the next available opportunity which may not be until the course runs the following year
22	N-CST-RASD	Requirements Analysis and System Design	Dr Salvatore Filippone	35		10	N	09/10/17	09/10/17	13/10/17	40	ICW	100				01/12/17	At the next available opportunity which may not be until the course runs the following year
23	N-CST-STQA	Software Testing and Quality Assurance	Dr Salvatore Filippone	35		10	N	18/10/17	18/10/17	22/10/17								At the next available opportunity which may not be until the course runs the following year

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
												Independent Assessment		Multi-part Assessment			Submission dates	
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Type of Assessment	Weighting within module[8] (%) of Independent assessments	Weighting within module of multi-part assessments[9] (100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
24	N-CST-AJ	Advanced JAVA	Dr Irene Moulitsas	15		5	N	19/02/18	19/02/18	21/02/18	40	ICW	100				04/04/18	At the next available opportunity which may not be until the course runs the6following year
25	N-CST-DISS	Dissertation (for PgDip)	Dr Irene Moulitsas	15	0	20	N	03/04/18	03/04/18	17/08/18	50			100 MULTI	IPROJ IPRES	85 15	17/08/18	
26	N-CST-DISSES	Dissertation ESTIA (for PgDip)	Dr Irene Moulitsas	15	0	30	N	03/04/18	03/04/18	17/08/18	50			100 MULTI	IPROJ IPRES	85 15	17/08/18	
27	N-CST-THESIS	Individual Research Project (Cranfield)	Dr Karl Jenkins	20		100	N	03/04/18	03/04/18	17/08/18		THESIS IPRES	90 10				17/08/18	
28	N-CST-THEBAY	Individual Research Project (ESTIA**)**	Dr Karl Jenkins	20		110	N	03/04/18	03/04/18	17/08/18		THESIS IPRES	90 10				17/08/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
G-MTI	Management for Technology	School of Management	MSc in Thermal Power MSc in Food Chain Systems REMS EngD Energy Programme – SWEE
N-CST-C++P04	C++ Programming	Computational and Software Techniques in Engineering	Aerospace Computational Engineering
N-CST-CM	Computational Methods	Computational and Software Techniques in Engineering	Aerospace Computational Engineering
N-CST-CAEAA	CAE Advanced Applications	Computational and Software Techniques in Engineering	Aerospace Computational Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. Students can expect to have between five and seven written examinations, between eight and nine pieces of assessment by submitted work and two to three elements of assessment by presentation or viva.

This approach has been adopted in order to provide the student with a balanced mix of theory and application. Since in this course practical application is key to development of understanding and skills acquisition, the majority of subjects are assessed by a combination of assignment and written exam or purely by assignment. A few subjects that have large theory content are assessed solely by exam. Application of the knowledge and its understanding is also assessed through the thesis project.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. MSc

The Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5	ILO6	ILO7
01	ICW	ICW	ICW		ICW		ICW
02	ICW	ICW	ICW		ICW		ICW
03			GCW	GCW	GCW		
04	ICW	ICW	ICW		ICW		ICW
05	ICW	ICW	ICW		ICW		ICW
06	ICW	ICW	ICW		ICW		ICW
07	ICW	ICW	ICW		ICW		ICW
08	GCW	GCW	GCW	GCW	GCW		GCW
09	ICW	ICW	ICW		ICW		ICW
10	ICW	ICW	ICW		ICW		ICW
11	ICW	ICW	ICW		ICW		ICW
12			ICW	ICW			
13				ICW	ICW		
14				ICW	ICW		EX
15	ICW	ICW	ICW	ICW	ICW		ICW
16	GCW	GCW	GCW	GCW	GCW		GCW
17	ICW	ICW	ICW		ICW		ICW
18	ICW	ICW	ICW		ICW		ICW
19	GCW	GCW	GCW	GCW	GCW		GCW
20	ICW	ICW	ICW		ICW		ICW
21	ICW	ICW	ICW		ICW		ICW
22	ICW	ICW	ICW		ICW		ICW
23	ICW	ICW	ICW		ICW		ICW
24	ICW	ICW	ICW		ICW		ICW
25			IPRES		IPROJ	IPROJ	
26			IPRES		IPROJ	IPROJ	
27	THESIS	THESIS	IPRES	THESIS	THESIS	THESIS	THESIS
28	THEIS	THESIS	IPRES	THESIS	THESIS	THESIS	THESIS

<u>CROSS-MODULAR ASSESSMENT</u> (including any assessment which rests outside an individual module)

Title	**Modules Covered**	**Assessment**	
		Type	Weight (%)
Two modules with an integrated assessment	C++ Programming (1) Computational Methods (2)	ICW	100

Two modules with a combined assessment	Requirements Analysis and System Design (22) Software Testing and Quality Assurance (23)	ICW	100

8. <u>How will the University assure the quality of the provision?</u>

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by

and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

This Masters course in 'Computational and Software Techniques in Engineering', with its blend of skills-based and subject-specific material equips students with the generic hands-on skills and up-to-date knowledge adaptable to the wide variety of applications in the general field of computational engineering.

Typically students seek employment in the engineering software market. Enquiries regarding availability of potential employees are received from many quarters, both in the EU and elsewhere. There is considerable demand for personnel with expertise in engineering software development and for those who have strong technical programming skills in industry standard languages and tools. Graduates of the course, in demand by CAD vendors, commercial engineering software developers, automotive, telecommunications, medical and other industries and research organisations, have been particularly successful in finding long-term employment.

Some students may go on to register for PhD degrees, many, on the basis of their MSc research project. Thesis topics are most often supplied by individual companies on in-company problems with a view to employment after graduation - an approach that is being actively encouraged by a growing number of industries.

COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award of Cranfield University. This version of the course specification has been approved by Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: MSc in Computational Fluid Dynamics

Date of first publication/latest revision: October 2016

1. What is the course?

Course information

Course Title	MSc in Computational Fluid Dynamics
Course code	MSCFDFTC, MSCFDPTC, PDCFDFTC, PDCFDPTC, PCCFDFTC, PCCFDPTC
Academic Year	2017/18
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	Not Applicable
Mode of delivery	Full-time, Part-time
Location(s)[1] of Study	Cranfield University
School(s)	School of Aerospace, Transport and Manufacturing
Theme	Aerospace
Centre	Centre for Fluid Mechanics and Computational Science
Course Director	Dr Antonios Antoniadis
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	**No**
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ Level 7 (Masters)
Benchmark Statement(s)	Not Applicable
Registration Period(s)	Full-time MSc - one year, Part-time MSc - up to three years, Full-time

[1] If any part of this course is delivered at another site, please note which one(s) here
[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

available	PgDip - one year, Part-time PgDip - two years, Full-time PgCert - one year, Part-time PgCert - two years
Course Start Month(s)	October

Institutions delivering the course
This course is delivered by the School of Aerospace, Transport and Manufacturing, Aerospace Theme, Centre for Fluid Mechanics and Computational Science, where the research interests include:

- Fluid dynamics of single phase, multi-phase and multi-species flows.
- Steady and unsteady aerodynamics.
- Transition and turbulence.
- Heat transfer.
- Numerical methods development.
- Scientific and high performance computing.
- Computational fluid dynamics with the applications in aerospace, automotive, environmental, energy, micro and nanotechnology, nuclear, bio-medical, chemical and defence sectors.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

This course is accredited formally by the Institution of Mechanical Engineers (IMechE) until September 2020 and the Royal Aeronautical Society (RAeS) until September 2020.

2. <u>What are the aims of the course?</u>

Cranfield University offers this course in order to:

- Provide a comprehensive training programme in Computational Fluid Dynamics (CFD) which will enhance the skills of the graduate student through a detailed introduction to the fundamentals of CFD together with an insight into the applications of CFD.
- Provide a unique opportunity for cross-disciplinary education and knowledge transfer in the computational fluids engineering via integration of a very broad range of applications into course curriculum.
- Produce graduates capable of solving computational fluid problems in a broad range of engineering areas, delivering high standard of computational expertise to a diverse range of employers.
- Provide a CPD opportunity through the part-time course option for qualified engineers wishing to extend their knowledge of CFD or incorporate CFD into their practice.

Postgraduate Diploma (PgDip) and Postgraduate Certificate (PgCert) are provided for students who wish to access only parts of the course.

This programme is intended for the following range of students:

- Recent graduates wishing to extend their knowledge and skills in the above areas.
- Qualified engineers wishing to apply their skills in new areas.
- Qualified engineers working with CFD in a particular area wishing to extend their knowledge and enhance their practice by knowledge transfer from different application areas.

3. What should students expect to achieve in completing the course?

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO 1. Demonstrate a critical awareness of the governing equations of fluid mechanics, and their mathematical properties, in various formulations for compressible and incompressible inviscid and viscous flows.

ILO 2. Demonstrate a critical awareness of the underlying principles of numerical analysis, concepts of stability, approximation and convergence and the numerical solution of systems of algebraic equations.

ILO 3. Demonstrate a critical awareness of different state-of-the-art CFD methods as used in engineering practice and research and development for both incompressible and compressible flows.

ILO 4. Demonstrate a systematic application of the principles and understanding of limitations of techniques for the simulation of turbulent and transitional flows and thus be able to apply these in a critical manner to practical applications.

ILO 5. Recognise the potential sources of, and discriminate between, error and uncertainty in numerical simulations. Be aware of the tools that are available for the quantification of error and uncertainty in computational simulations. Be able to plan and perform credible computational simulations.

B. Postgraduate Diploma

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 6. Demonstrate a systematic application of the requirements of grid generation for CFD applications and alternative techniques for the visualisation and interpretation of CFD results.

ILO 7. Demonstrate their acquired skills in applying commercial CFD software packages to practical engineering applications.

ILO 8. Demonstrate a systematic application of the use of CFD to practical scientific and engineering fluid flow problems with the focus on planning, conducting and reporting upon a critical analysis of one or more aspects of Computational Fluid Dynamics.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO 9. Demonstrate a systematic approach of research and application, where the challenges associated with a particular topic of research are addressed with novelty arising from the taught material, and through state of the art approaches found in the literature of the corresponding subject.

4. How is the course taught?

Students will be supported in their learning and personal development by:

The course material is delivered through a combination of lectures, tutorials and hands-on lab sessions. Where possible lectures feature a strong interactive element. In addition, several modules have a guest industrial speaker who specialises in that field in industry.

Assignments should be noted separately in the description of the course teaching methods. The assignments the students are required to complete (15 in total) are used not only as means of summative assessment but also as means of formative assessment guiding the students through various aspects of Computational Fluid Dynamics via the application of techniques learned to practical problems.

The learning support builds on the standard mechanisms provided by the University including library facilities, specialised IT provision (Linux workstations) etc. The course uses the Blackboard virtual learning environment with all materials delivered in electronic form and electronic communication tools (e.g. forums) used to enhance the discussion of the course materials.

In addition to standard learning support facilities the course utilises a number of specialised facilities, namely:

- A dedicated HPC cluster used in the taught component and thesis work
- NFLC Jetstream plane used in taught component to illustrate aircraft manoeuvres
- Windtunnel facilities used for demonstrations

Group assignments and lab sessions are designed to enhance transferable skills related to teamwork and communication.

5. What do students need to achieve in order to graduate?

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules 1, 2, 4, 5, 6, 7	60
ELECTIVE MODULES:	
n/a	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1-8 Dissertation (17)	75 20
ELECTIVE MODULES:	
Modules: 9-15 (choice of 5)	25
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	Credits
COMPULSORY MODULES:	
Modules: 1-8 Research Project (16)	75 100
ELECTIVE MODULES:	
Modules: 9-15 (choice of 5)	25
TOTAL:	200

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a

- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full-time students register for the course in October and are expected to complete the course within 12 calendar months. The taught component runs from October until May. Individual research project runs from April until August.

Part-time students register for the course in October and are expected to complete the course within 2 or 3 years selecting the modules to be taken each year in consultation with the Course Director.

A 10 credit module or two 5-credit modules are usually taught over a week leaving the next week free for assignments and independent learning and reflection.

student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Course modules

The following modules outline all parts of the programme leading to **MSc**. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment								
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
1	N-CFD-IFM	Introduction to Fluid Mechanics and Heat Transfer	Dr Laszlo Konozsy	20		10	N		23/10/17	27/10/17	40	ICW	100				27/11/17	
2	N-CFD-NMPDE	Numerical Methods and High Performance Computing	Dr Antonios Antoniadis	30		10	N		06/11/17	10/11/17	40	ICW	100				15/01/18	
3	N-CFD-GG	Grid Generation / CAD	Dr Panagiotis Tsoutsanis	20		10	N		09/10/17	13/10/17	40	ICW	100				15/01/18	

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
4	N-CFD-DAPP	Data Analysis and Uncertainty	Dr Antonios Antoniadis	20		10	N		29/01/18	02/02/18	40	ICW	100				04/03/18	
5	N-CFD-NMCF	Numerical Modelling for Steady and Unsteady Compressible Flows	Dr Panagiotis Tsoutsanis	20		10	Y		15/01/18	19/01/18	40	ICW	100				02/04/18	
6	N-CFD-NMIF	Numerical Modelling for Steady and Unsteady Incompressible Flows	Dr Laszlo Konozsy	20		10	Y		20/11/17	24/11/17	40	ICW	100				05/02/17	
7	N-CFD-CTM	Turbulence Modelling	Dr Laszlo Konozsy	20		10	N		04/12/17	08/12/17	40	ICW	100				31/01/17	
8	N-CFD-RED	The Role of Experimental Data in CFD	Prof Kevin Garry	10		5	N		12/02/18	16/02/18	40	ICW	100				12/03/18	
9	N-CFD-CFDMF	CFD for Multiphase Flows and Combustion	Dr Laszlo Konozsy	10		5	N		26/02/18	28/02/18	40	GCW	100				07/05/18	
10	N-CFD-CFDAE	CFD for Aerospace Applications	Dr Panagiotis Tsoutsanis	10		5	N		26/03/18	28/03/18	40	GCW	100				07/05/18	
11	N-CFD-CFDRW	CFD for Rotating Wings	Dr Antonios Antoniadis	10		5	N		29/03/18	30/03/18	40	GCW	100				07/05/18	
12	N-CFD-CFDMS	CFD for Micro and Nano Flows	Dr Laszlo Konozsy	10		5	N		28/02/18	02/03/18	40	GCW	100				07/05/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
13	N-CFD-CFDEF	CFD for Environmental Flows	Dr Zeeshan Rana	10		5	N		02/04/18	04/04/18	40	GCW	100				07/05/18	
14	N-CFD-CFDAF	CFD for Automotive Flows	Dr Panagiotis Tsoutsanis	10		5	N		12/03/18	14/08/18	40	GCW	100				07/05/18	
15	N-CFD-CFDFI	CFD for Fluid-Structure Interaction	Dr Zeeshan Rana	10		5	N		14/03/18	16/03/18	40	GCW	100				07/05/18	
16	N-CFD-RP	Research Project (for MSc)	Dr Panagiotis Tsoutsanis	10		100			30/04/18	30/08/18				100 MULTI	THESIS OR	85 15	20/08/18 06/09/18	
17	N-CFD-D	Dissertation (for PgDip)	Dr Panagiotis Tsoutsanis	5		20			30/04/18	30/08/18	50			100 MULTI	IPROJ OR	85 15	20/08/18 06/09/18	

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS - thesis

Please list all modules that are used by another existing course.

Module code	**Module title**	**Course that owns the module**	**Other course(s)/ programme(s) that use the module**
N-CFD-NMCF	Numerical Modelling for Steady and Unsteady Compressible Flows	Computational Fluid Dynamics	Aerospace Computational Engineering
N-CFD-NMIF	Numerical Modelling for Steady and Unsteady Incompressible Flows	Computational Fluid Dynamics	Aerospace Computational Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:

The course uses a range of assessment types. In the MSc route, students are assessed through 5 written examinations, 15 assignments and 1 element of assessment by presentation or viva.

This approach has been adopted in order to achieve a careful balance between the delivery of fundamental knowledge which is better assessed through a written examination and development of CFD skills and expertise through practical assignments.

Majority of the assignments utilised in the course are based on practical CFD problems with emphasis on developing CFD skills and critical evaluation capability. Group assignments are designed to facilitate development of team working skills.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5
1	ICW				
2		ICW			
4		ICW			ICW
5	ICW	ICW	ICW		
6	ICW	ICW	ICW		
7	ICW	ICW	ICW	ICW	

B. Postgraduate Diploma

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO1	ILO2	ILO3	ILO4	ILO5	ILO6	ILO7	ILO8
3						ICW		
8		ICW	ICW					
9						ICW	ICW	ICW
10						ICW	ICW	ICW
11						ICW	ICW	ICW
12						ICW	ICW	ICW
13						ICW	ICW	ICW
14						ICW	ICW	ICW
15						ICW	ICW	ICW
17					IPROJ OR	IPROJ OR	IPROJ OR	IPROJ OR

C. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	ILO8	ILO9
16	THESIS OR	THESIS OR

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year

review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

Based on feedback from 2014/15 graduates, 90% of our graduates are in a full-time employment in industry or academia within 6 months of the course completion. Our graduates are employed in a broad range of industries where computational expertise is required. Currently our graduates are employed among others by aerospace, computer hardware, automotive, measurement equipment, mining, process systems and engineering consultancy companies. A proportion of our graduates pursue careers in academia through further PhD studies.

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COURSE SPECIFICATION

Cranfield University: Course Specifications

Course specifications outline the content and structure of a course leading to an award from Cranfield University. This version of the course specification has been approved by the Education Committee and every effort has been made to ensure the accuracy of the information.

COURSE TITLE: Cyber-Secure Manufacturing

Date of first publication/latest revision: 24/02/2017

1. What is the course?

Course information

Course Title	Cyber-Secure Manufacturing
Course code	MSCMIFTC, MSCMIPTC, PDCMIFTC, PDCMIPTC, PCCMIFTC, PCCMIPTC
Academic Year	2017/2018
Valid entry routes	MSc, PgDip, PgCert
Additional exit routes	PgDip & PgCert
Mode of delivery	Full-time / Part-time
Location(s)[1] of Study	Cranfield
School(s)	School of Aerospace, Transport, and Manufacturing
Theme	Manufacturing
Centre	Manufacturing Informatics Centre
Course Director	Dr Hongmei He
Awarding Body	Cranfield University
Is this an AP Contract course?[2]	No
Teaching Institution	Cranfield University
Admissions body	Cranfield University
Entry requirements	Standard University entry requirements
UK Qualifications Framework Level	QAA FHEQ level 7 (Masters)
Benchmark Statement(s)	N/A
Registration Period(s) available	Full-time MSc/PgDip/PgCert - one year Part-time MSc/PgDip – two or three years, Part-time PgCert – two years.
Course Start Month(s)	October (FT and PT)

[1] If any part of this course is delivered at another site, please note which one(s) here

[2] AP Contract courses are provided by Cranfield University to the MoD as part of the Academic Provider contract

Institutions delivering the course
This course is delivered by School of Aerospace, Transport, and Manufacturing, Manufacturing Theme, Manufacturing Informatics Centre where the research interests include:

The research of Manufacturing Informatics Centre focuses on new and emerging Information and Communications Technology (ICT) and methodologies for next-generation manufacturing, enabled by IoT technologies. Cybersecurity for manufacturing is one of our research areas in the Manufacturing theme. Dr Hongmei He, Dr Christos Emmanouilidis, Prof Ashutosh Tiwari, Professor Raj Roy, etc. have been engaging the research of cybersecurity and IoT security, and working with industry for relevant projects. The course team has long experience in applying research results to underpin the teaching. Hence, our research in cybersecurity will also underpin the new MSc course.

Cranfield University remains fully responsible for the quality of the delivery of the course.

Accreditation by Public, Statutory or Regulatory Bodies (PSRBs)

Accreditation will be sought for IET, IMECHE, BCS and RAES which already accredit other Manufacturing courses. There are also plans to seek accreditation from GCHQ and the Institute of Information Security Professionals.

2. <u>What are the aims of the course?</u>

The aim of the course is to develop the next generation of manufacturing engineers who are able to protect manufacturing systems & machines against cyber threats.

The objective is to enable students to use cutting-edge technologies in IoT, Big Data, Cloud Computing and Cybersecurity to

- Identify cyber threats to cyber-physical systems in the manufacturing sector
- Protect manufacturing systems from cyber attacks
- Improve incident response and disaster recovery in manufacturing systems
- Assess the cost of cybersecurity solutions for manufacturing systems

This programme is intended for the following range of students:

Graduates from computer science, manufacturing and engineering and industry professionals who are able to work at Masters Level

Especially, professionals from manufacturing and engineering industry or organisation, who want to update their knowledge and skills in cyber security, data analysis, IoT and cloud manufacturing, may wish to take the part-time study for the MSc course or take some short courses from the MSc courses.

3. <u>What should students expect to achieve in completing the course?</u>

Award intended learning outcomes (ILOs) (skills and knowledge).

A. Postgraduate Certificate (PgCert)

In completing this course, and achieving the associated award, a diligent student should be able to:

ILO1 Analyse traditional and modern manufacturing environments and their operations, and evaluate their engineering challenges with regards to cybersecurity.

ILO2 Analyse hardware and system architectures (e.g. for IoT devices), and create security metrics, including vulnerabilities, threats, risks and solutions to improve the cyber security of manufacturing systems.

ILO3 Evaluate cloud architecture, properties, management services, security challenges and risks associated with different cloud deployment models.

ILO4 Evaluate advanced technologies to retrieve data from cloud and discover new information from big data, and manage data protection in cloud manufacturing.

ILO5 Setup up-to-date technologies and simulations to detect and prevent system intrusion, improve incident response and disaster recovery, assess cyber risks.

ILO6 Estimate the cost of cyber security solutions for the protection of machines and equipment in manufacturing systems.

B. Postgraduate Diploma (PgDip)

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO7 Develop models with cutting-edge data mining technologies to identify cyber threats, and evaluate the performance of the technical models for solving data-driven cyber-security issues.

ILO8 Analyse problems in the real world through investigative methods, systems thinking and anticipating futures to adapt to the fast changes of cyber –secure manufacturing environments.

ILO9 Identify research questions, develop project objectives and deliverables, and plan and execute a work programme with reference to key project management processes.

ILO10 Select and justify methodologies to solve real world problems in manufacturing and/or cyber security for manufacturing, and collect & analyse data, review and critically analyse literature, generate conclusions.

C. MSc

In addition to the intended learning outcomes outlined above, a diligent student would also be expected to:

ILO11 Undertake and present independent research on a relevant topic, demonstrating the ability to conduct original investigations, test ideas, validate results and reach appropriate conclusions.

4. <u>How is the course taught?</u>

The main forms of teaching for the course are lecturing and lab sessions, plus a number of industry seminars. Each module will be assessed through exam or assignment (see the table of course modules in page 8).

In order to help students understand the new concepts and master new techniques, Enquiry-Based Learning (EBL) activities (e.g. group discussion, group poster, group presentation, case

study, etc.) in class is another form of learning activities for selected modules, and the group work will be guided by the module leader.

- Modules will be live on Blackboard two weeks prior to the start date of the module to allow pre-reading
- Group discussion will allow students in groups to explore a specific topic or solve a problem with the learned knowledge, technology and/or methodologies, and the evaluation or comments of the group work will be given by another group. This will help students understand the new technologies.
- Group poster: Each group of students is given a topic or real problem to be solved, and the group work will provide a solution through a poster, and the final evaluation/comments of the poster will be given by other groups.
- Group presentation: Each group of students is required to read the latest research paper in relevant area, and a group presentation will be provided. Other groups of students will question on the presentation. This will require students not only understand the latest research methodology, but also identify possible gaps and possible improvement.
- Case study: given a real problem, the lecturer will demonstrate how to use the introduced knowledge, technologies or methodology to solve the real problem through more interaction with students

For full time students, after completing all 8 modules, they will join a group project and complete an individual research project. All group or individual projects are coordinated with the Manufacturing Systems and Management programme. Each project will be supervised by a member of academic staff, also guided by an industry supervisor if it is an industry project.

For part time PgDip/MSc students, the dissertation module (9-PT) should be taken after completing the three core modules: 01, 04, 07 (see the part-time learning path in page 6), and the individual research project should be taken after completing all the 8 modules.

Support for part-time students

Part-time students will be advised by the course director for scheduling their course study before they start, and during their course study.

The leader(s) of each module will answer PT students' query before and during their module study through meetings, emails, telephone or skype.

Module leader(s) will arrange an accessible tutorial two weeks after the module.

5. <u>What do students need to achieve in order to graduate?</u>

Notwithstanding University Regulations and the authorities and powers exercised by examiners, students will normally need to demonstrate achievement in the elements of the course, as laid out in Section 7. Courses are structured through the accumulation of credit, where 1 credit represents 10 notional learning hours.

In brief, students will normally need to achieve the following in order to be awarded the qualifications:

A. Postgraduate Certificate

The accumulation of 60 credits (or more) through the assessment of taught modules as detailed below:

Description	Credits
COMPULSORY MODULES:	

Modules: 1, 3, 4 and 7	40
ELECTIVE MODULES:	
Select 2 from Modules 2, 5, 6 and 8	20
Recommended	
Module 0: Induction	0
TOTAL:	60

B. Postgraduate Diploma

The accumulation of 120 credits (or more) through the assessment of taught modules as detailed below:

Description	**Credits**
COMPULSORY MODULES:	
Modules: 1-8 Module 9: 9-FT Group Project (or Module 9-PT: Dissertation)	80 40
Recommended	
Module 0: Induction	0
TOTAL:	120

C. MSc

In addition to the requirement for the Postgraduate Diploma outlined above, students must successfully complete the thesis. An MSc will be awarded on successful completion of 200 credits as outlined below:

Description	**Credits**
COMPULSORY MODULES:	
Modules: 1-8 Module 9: 9-FT Group Project (or Module 9-PT: Dissertation) Module 10: Individual Research Project	80 40 80
Recommended	
Module 0: Induction	0
TOTAL:	200

If a student does not meet the required standards for the award, the examiners for the programme may decide to offer a lower award associated with the programme, providing that a lower exit award exists and the student meets the requirements of that award.

Pass Criteria

The University operates standard pass criteria which can be found in the Senate Handbook on Assessment Rules.

In order to achieve your award, you are required to achieve:

- An overall average mark of ≥50%;
- An average mark of ≥50% across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment (as defined in Section 2.3) will be permitted throughout the course of your studies (Please note that the board of examiners does not have discretion to overrule this limit, but can refer a case to Senate's Education Committee);[3] [4]
- **For Taught Assessments,** the minimum mark for each individual taught assessment on the first attempt for the significant majority of the taught assessments, noting that:
  - if you fail to attain the minimum mark for **up to 30 learning credits**, you will be permitted to re-take all of those assessments (except for circumstances where a resit award capped at 50% would be insufficient to achieve an overall average mark of ≥50% across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, you fail to obtain the minimum mark for **any additional learning credits** over the course of your studies you will be disqualified from the right to re-take the assessments: this will normally result in intended award failure. (Please note the board of examiners may at its discretion overrule this limit, but this is not an automatic right);
  - it is not permissible for you to fail an elective module and then proceed to take a different elective module in its place.
- **For Substantial pieces of assessment** (corresponding to ≥40 credits, which are not part of the taught assessment average), the pass mark of ≥50% (where they exist);
- **For the thesis,** a mark of ≥50% in order to receive a pass (where it exists).

6. How is the course structured?

Full time MSc/PgDip/PgCert students register for the course in October of each academic year and are expected to complete the course within 12 calendar months.

The course includes 8 taught modules, group project (for PgDip and MSc students) for F/T students or dissertation for P/T students and an individual research project (for MSc students). Each taught module will be taught over one week with further self-study required, and will be assessed by exam or coursework.

The learning path for the part time students is outlined hereafter.

A. Part-time PgCert

Part-time PgCert students have to complete 6 taught modules as required in Section 5.A over a period of 2 years. Induction is strongly recommended and can alternatively be delivered via the VLE. The learning path of PgCert is illustrated in the following table:

[3] For students who were registered before 1 August 2015, the requirement to obtain a minimum mark for a taught assessment will not apply for taught assessment taken before 31 August 2015 (unless the assessment was designated as a "key assessment" under the previous Assessment Rules).

[4] Providing the minimum mark is met, a mark of 40-49% will be automatically compensated if a student's overall average taught assessment mark (including the failed assessment) is greater than 50%. Students are advised, however, that they retain the right to re-take an assessment with a mark of <40% (but should note that a re-take attempt will be capped at 50%), as long as they haven't failed more than 30 credits. At the discretion of the Board of Examiners or by Board of Examiners Chair's Actions a student may be permitted a re-take attempt of modules in the range of 40-49% only if the average mark of their other taught modules would not allow them to qualify for their award (<50%).

Year 1	Year 2
Successful completion of three modules, including two core modules and an optional module: • 01 Modern Manufacturing and Security Challenges • 03 Secure IoT and System Architecture • A module to be decided with the course director	Successful completion of three modules, including two core modules and one optional module: • 04 Secure Cloud Manufacturing • 07 Security of Machine Tool Systems • A module to be decided with the course director.

B. Part-time PgDip

Part time PgDip students have to complete 8 taught modules and a dissertation as required in Section 5.B over a period of 3 years. Induction is strongly recommended and can alternatively be delivered via the VLE. Two scenarios depending on the length of studies:

2 years study plan	3 years study plan
1st year: Successful completion of four modules (three core and one elective) and a Dissertation: • 01 Modern Manufacturing and Security Challenges • 04 Secure Cloud Manufacturing • 07 Security of Machine Tool Systems • A module to be decided with the course director • Module 9-PT (Feb– Aug) (PgDip)	1st years: Successful completion of three modules: • 01 Modern Manufacturing and Security Challenges • 03 Secure IoT and System Architecture • A module to be decided with the course director. 2nd year: Successfully completion of the two modules and a Dissertation as below: • 04 Secure Cloud Manufacturing • 07 Security of Machine Tool Systems • Module 9-PT (Feb – Aug.) (PgDip)
2nd year: Successful completion of remaining modules as required in Section 5.B for PgDip.	3rd year: Successful completion of the remaining modules as required in Section 5.B for PgDip.

C. Part-time MSc

Part time MSc students have to complete 8 taught modules, dissertation and individual research project as required in Section 5.C over a period of 3 years. Induction is strongly recommended and can alternatively be delivered via the VLE. Two scenarios depending on the length of studies:

2 years study plan	3 years study plan

<table>
<tr>
<td rowspan="2">1st year:

Successful completion of four modules (three core modules and one elective) and a Dissertation :

• 01 Modern Manufacturing and Security Challenges
• 04 Secure Cloud Manufacturing
• 07 Security of Machine Tool Systems
• a module to be decided with the course director
• Module 09-Dissertation (Feb – Aug.) (MSc)</td>
<td>1st years:

Successful completion of four modules:

• 01 Modern Manufacturing and Security Challenges
• 03 Secure IoT and System Architecture
• 07 Security of Machine Tool Systems
• A module to be decided with the course director</td>
</tr>
<tr>
<td>2nd year:

Successful completion of two modules and an individual dissertation:

• 04 Secure Cloud Manufacturing
• 06 Data Mining Technology for Cyber Threat Identification
• Module 09-Dissertation (Feb – Aug.) (MSc)</td>
</tr>
<tr>
<td>2nd year:

Successful completion of remaining modules as required in Section 5.C for MSc.

Completion of individual research project (Feb – Aug) (MSc)</td>
<td>3rd year:

Successful completion of the remaining modules as required in Section 5.C for MSc.

Completion of individual research project (Feb – Aug) (MSc)</td>
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Course modules

The following modules outline all parts of the programme leading to MSc. Other awards associated with the course include some or all of these modules.

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark[7] - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
0	I-MAN-INWK	Induction	Dr Konstantinos Salonitis	22		0	Y	2/10/17	2/10/17	6/10/17	N/A	AO	N/A	N/A	N/A	N/A	N/A	N/A
1	I-CMI-MMSC	Modern Manufacturing and Security Challenges	Prof Tetsuo Tomiyama	32	4	10	N	9/10/17	9/10/17	13/10/17	50	EX	100				w/c 2/1/18	Sept 2018
2	I-MNU-A1034	Operations Management	Dr Charalampos (Harris)	32	0	10	Y	16/10/17	16/10/17	20/10/17	50	EX	100				w/c 7/11/17	Sept

[5] Please note that all contact hours are indicative and represent scheduled teaching, which is subject to minor changes and variation at short notice
[6] Visiting Lecturer = a member of staff (with RTS) but not on a permanent contract (does not include those acting as occasional guest speakers)
[7] A mark of 50% is required to pass the assessment however, where the stated minimum mark is 40%, a mark of 40-49% may be compensated by good performance in other modules providing that the overall average is ≥50%. This will be at the Board of Examiners discretion.
[8] For **independent assessments** please record type and weighting of each separate piece of assessment individually.
[9] For **multi-part assessments** please record the overall weighting of module which should be 100%.
[10] Failure to submit an element of a **multi-part assessment** will **not** require remedial action if the absence of the marks for the assignment still results in a pass for the assessment (whether 40 or 50% as appropriate*)*. If, however, the absence of marks fails to meet the minimum mark for the module then **all** elements of the assessment must be re-taken.
[11] Please ensure you include submission dates for both FT and PT students and that you give details of the submission date for each individual element of a multi-part assessment.

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS – thesis; MULTI – Multi-part Assessment

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments [9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
			Makatsoris															2018
3	I-CMI-SSA	Secure IoT and System Architecture	Dr Christos Emmanouilidis	32	12	10	N	22/01/18	22/01/18	26/01/18	50	ICW	100				22/02/18 (FT) 09/03/18(PT)	Sept 2018
4	I-CMI-SCM	Secure Cloud Manufacturing	Dr Yifan Zhao, Dr Christopher Turner	32	6	10	N	30/10/17	30/10/17	03/11/17	50	ICW	100				30/11/17 (FT) 14/12/17(PT)	Sept 2018
5	I-MNU-A1027	Manufacturing System Engineering	Prof Charalampos (Harris) Makatsoris	32	2	10	Y	20/11/17	20/11/17	24/11/17	50	ICW	100				21/12/17(FT) 09/01/18(PT)	Sept 2018
6	I-CMI-DMT	Data Mining Technology for Cyber Threat Identification	Dr Hongmei He	32	2	10	N	15/01/18	15/01/18	19/01/18	50	EX	100				19/02/18	Sept 2018
7	I-CMI-SMTS	Security of Machine Tool Systems	Dr Hongmei He	33	9	10	N	27/11/17	27/11/17	01/12/17	50	ICW	100				03/01/18(FT) 16/01/18(PT)	Sept 2018

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS – thesis; MULTI – Multi-part Assessment

Module Number	Module code	Title	Module Leader	Contact hours[5]	Total hours delivered by Visiting Lecturers[6]	Credits	Is the module shared? Y/N	Calendar			Assessment							
								Module Start Date (eg Pre-course task)	'Residential' Start Date	'Residential' End Date	Minimum Mark' - 40% or 50%	Independent Assessment		Multi-part Assessment			Submission dates	
												Type of Assessment	Weighting within module8 (%) of Independent assessments	Weighting within module of multi-part assessments[9](100%)	Type of Assessment	Weighting of individual elements of multi-part assessment[10]	Assessment Submission and/or exam date[11]	Assessment / Exam Retake date
8	I-CMI-CTPM	Cyber Thinking & Practice in Manufacturing	Mr Jeremy Hilton, Mrs Lorraine Dodd	32	0	10	N	11/12/17	11/12/17	15/12/17	50			100 MULTI	GPRES ICW	30 70	14/12/17 16/01/18(FT) 30/01/18(PT)	Sept 2018
9-FT	I-MAT-GRPP	Group Project	Group project coordinator (Dr D Ayre)	20	0	40	Y	05/02/18	05/02/18	27/04/18	50			100 MULTI	RP GCW	20 80	04/05/18(FT)	tbc
9-PT	I-MAT-DISS	Dissertation	Dissertation co-ordinator (Dr Charles Wainwright)	20	0	40	Y	05/02/18	05/02/18	03/09/18	50	ICW	100				03/09/2018	tbc
10	I-MNU-THESIS	Individual Research Project (for MSc students)	Individual Project Coordinator (Dr Charles Wainwright)	20	0	80	Y	30/04/18 (FT) 01/02/19 OR 01/02/20 (PT)	30/04/18 (FT) 01/02/19 OR 01/02/20 (PT)	07/09/18 (FT) 07/09/19 OR 07/09/20 (PT)	50 50	THESIS OR	90 10				03/09/18(FT) 03/09/19 OR 03/09/20 (PT)	tbc

Assessment Types: AO – Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRAC – Individual Practical; GPRAC – Group Practical; IPROJ – Individual Project (>20 credits); GPROJ – Group Project (>20 credits); EX – Examination ; RP – Reflective Portfolio; OR- Viva Voce examination; THESIS – thesis; MULTI – Multi-part Assessment

Please list all modules that are shared with another existing course.

Module code	**Module title**	**Course that owns the module**	**Course(s)/programme(s) that share the module**
I-MAN-INWK	Induction	Engineering and Management of Manufacturing Systems	Aerospace Manufacturing Management and Information Systems Global Product Development and Management
I-MNU-A1034	Operations Management	Engineering and Management of Manufacturing Systems	Aerospace Manufacturing Cost Engineering Global Product Development and Management Management and Information Systems Manufacturing Technology and Management
I-MNU-A1027	Manufacturing Systems Engineering	Engineering and Management of Manufacturing Systems	Aerospace Manufacturing
I-MNU-GRPP	Group Project	Advanced Materials	Aerospace Materials Applied Nanotechnology Manufacturing Technology and Management Aerospace Manufacturing Engineering and Management of Manufacturing Systems Global Product Development and Management Knowledge Management for Innovation (not running 2017/18) Management and Information Systems Cyber-Secure Manufacturing Welding Engineering

I-MAT-DISS	Dissertation for Part Time Students	Advanced Materials	Aerospace Materials Applied Nanotechnology Manufacturing Technology and Management Aerospace Manufacturing Engineering and Management of Manufacturing Systems Global Product Development and Management Knowledge Management for Innovation (not running 2017/18) Management and Information Systems Cyber-Secure Manufacturing Welding Engineering
I-MNU-THESIS	Individual Research Project	Aerospace Manufacturing	Cyber-Secure Manufacturing Engineering and Management of Manufacturing Systems Global Product Development and Management Knowledge Management for Innovation (not running 2017/18) Management and Information Systems Advanced Materials Aerospace Materials Applied Nanotechnology Manufacturing Technology and Management Welding Engineering

7. How are the ILOs assessed?

The following assessment types are utilised:
Exam, coursework, group presentation, oral presentation, thesis and group project report or work-based dissertation

This approach has been adopted because:

Question papers are used primarily to assess knowledge, understanding and cognitive skills, such as reasoning, analysing and evaluating, while an assignment is a problem solving task with clear guidelines and structure. The modules are at QAA FHEQ level 7 (Masters), and will be assessed by a combination of question papers and coursework assessments. To assess the ILOs, each module has been assigned different assessment approaches based on the features of modules. For example, the modules of “Modern Manufacturing and Security Challenges”, “Operations Management” and “Data Mining Technology for Cyber Threat Identification” will be assessed through exam. The modules “Secure Cloud Manufacturing”, “Secure IoT and System Architecture”, “Secure Cloud Manufacturing”, “Manufacturing System Engineering”, “Security of Machine Tool Systems” are assessed with coursework, and “Cyber Thinking & Practice in Manufacturing” is assessed through group presentation and individual course work.

Assessment and ILO Mapping

Complete the grid below by inserting in the boxes which assessments from the modules directly assess the Award ILOs.

(Module numbers should correspond with those used in the Course module table above.)

A. Postgraduate Certificate (PgCert) & Postgraduate Diploma (PgDip)

Award ILOs / Module No.	PgCert						PgDip			
	ILO1	**ILO2**	**ILO3**	**ILO4**	**ILO5**	**ILO6**	**ILO7**	**ILO8**	**ILO9**	**ILO10**
1	EX									
3		ICW			ICW	ICW				
4			ICW	ICW			ICW			
7		ICW	ICW		ICW	ICW		ICW		
2	EX									
5	ICW				ICW					
6				EX			EX			
8	MULTI			MULTI		MULTI		MULTI		
9-FT								MULTI	MULTI	MULTI
9-PT								MULTI	MULTI	MULTI

Modules 2,5,6,8 are elective for PgCert students.

PgDip Students should take all 8 modules plus the group project for FT students and the dissertation for PT students.

B. MSc

In addition to those outlined above, the Award intended learning outcomes are assessed by the following module assessments:

Award ILOs / Module No.	**ILO8**	**ILO9**	**ILO10**	**ILO11**
10	THESIS	THESIS	THESIS	OR THESIS

CROSS-MODULAR ASSESSMENT (including any assessment which rests outside an individual module)

Title	Modules Covered	Assessment	
		Type	Weight (%)
N/A	N/A	N/A	N/A
		N/A	N

8. How will the University assure the quality of the provision?

New course proposals are reviewed by a Course Validation Panel, comprising at least the following membership: normally one subject matter expert external to the School or University, at least 3 academic staff not associated with the proposal. The Panel may include 1 member of professional staff. Panels are supported by an appropriately trained Secretary who acts as advisor to the Panel. Proposals are reviewed in line with the Quality Assurance Agency for Higher Education (QAA) Quality Code, in particular Chapter B1 (Programme Design and Approval) and in the case of partnership arrangements in accordance with Chapter B10 (Managing Higher Education with Others). New courses are ultimately approved by the University's Education Committee, on behalf of Senate.

Course changes are approved by the School's Director of Education on behalf of Education Committee and Senate. Significant changes to a course will be referred to a Course Review Panel at the discretion of the Director of Education.

The University has in place regular monitoring procedures for quality assurance including an Annual Reflective Review for each course and an in depth 6 year review of each School's (total) educational provision known as the Senate Review.

Each course has at least one External Examiner who monitors all aspects of the assessment process. This is in line with the guidance provided by the QAA particularly in Chapter B7 (External Examining) which emphasises that external examining is one of the principal means for maintaining UK threshold academic standards within autonomous higher education institutions.

Each course has a formally constituted Examination Board, which includes the External Examiner, and which is responsible for ensuring that awards are made within the Regulations of the University and that students are made awards on the basis of meeting the specified Intended Learning Outcomes of a course at the appropriate standard.

Each course has a formally constituted Course Committee which meets at least twice a year to discuss, inter alia, programme design and planning, the student experience (including feedback) and student progress.

Each course has an Industry Advisory Panel (or similar) which meets at least once a year to engage with external stakeholders on curriculum design and currency of course content.

Student feedback both qualitative and quantitative is collected for each module studied. In addition students are invited to participate in the University's annual New Student Survey and Student Satisfaction Survey along with the annual national Postgraduate Taught Student

Experience Survey. The results of all feedback are considered by the Course Committee and additionally, in respect of the University and national surveys, issues of quality are considered by and acted on where appropriate by the Education Committee, Senate, School and University Executives.

New Partnership arrangements are considered in two stages:

1. The University Executive is responsible for ensuring appropriate due diligence has been undertaken in respect of the University's legal, financial, reputational and ethical responsibilities.
2. A Partnership Delivery Approval Panel then considers whether the proposal meets the expectations and indicators of sound practice of the QAA Quality Code Chapter B10: Managing Higher Education Provision with Others, with regards to the management and operation of the partnership and that the academic standards and the quality of the student experience are assured in line with the remaining chapters of the QAA Quality Code. The delivery of new partnership provision is ultimately approved by the University's Education Committee, on behalf of Senate.

Year one partnership reviews are undertaken one year after the initiation of a new partnership involving academic (award bearing) provision. The aim is to provide a supportive framework to assist the Sponsoring School and its new Partner Institution to work collaboratively to ensure that: the learning and teaching provision and associated student experiences are of a high standard; and that those responsible for delivering the provision are undertaking their respective roles and responsibilities in an appropriate way.

As part of the regular monitoring procedures for established collaborative partnerships, in addition to the Annual Reflective Review there is an Annual Operating Statement and a 5 year review known as a Focused Review which looks at each partnership in depth. Occasional site inspection visits are also made.

9. <u>What opportunities are graduates likely to have on completing the course?</u>

With the capacity and ability, our graduates can undertake the jobs in manufacturing informatics and engineering, cyber security, IoT, Cloud Computing, Big Data Analytics, after the completion of the degree course. For PT students who are already working, such a course could help them change the role in their work, leveraging the knowledge and skills gained on the MSc, to progress in their careers.

Jobs in Manufacturing Informatics and Manufacturing Engineering: conducted by labour market analytics and consulting firm Burning Glass[12], in the future, engineering & advanced manufacturing is one of main job markets that graduates are looking to. On completion of the Master's degree course, our students will be able to protect future manufacturing systems against cyber-attacks.

Jobs in Cybersecurity: With growing concerns about network vulnerability, the demand for cyber security experts is growing at 12 times the overall job market, according to Burning Glass[13]. The Cybersecurity Challenge UK is working with businesses to deliver two pilot schemes – a Cybersecurity mentoring scheme and a series of 'cyber camps', to promote career opportunities in

[13] The demand for cyber security experts is growing at 12 times the overall job market

the businesses involved and the wider cybersecurity profession[14]. The cyber security market size is estimated to grow from USD 122.45 Billion in 2016 to USD 202.36 Billion by 2021, at a Compound Annual Growth Rate (CAGR) of 10.6% during the forecast period. 2015 is considered to be the base year while the forecast period is 2016–2021[15].

Jobs in IoT: While today there are just 300,000 developers contributing to the IoT, a new report from VisionMobile (http://www.visionmobile.com/) projects a market requiring 4.5 million developers by 2020, reflecting a 57% compound annual growth rate and a massive market opportunity[16].

Jobs in cloud computing: One of the most evident effects of the shift to Cloud technologies is that there is a growing demand for a more balanced focus between business development and application development. In job markets, positions for Cloud Specialists "will provide design, engineering and expertise of the cloud environment"; Cloud Computing Architect is "seating in a critical role to drive the architect/design and implementation for cloud-based solutions"[17]

Jobs in Big Data Analytics: Data technology and data science has an incredible rise over the past few years. Enterprise in every industry is investing to be more data-driven in how they do business. This movement has enabled the job market for data tech and data science expertise to grow at an exponential pace. "*By 2018, the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions".*[18]

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[14] http://cybersecuritychallenge.org.uk/education/university-mentoring-and-cyber-camps/

[15] Cyber Security Market by Solutions (IAM, Encryption, DLP, UTM, Antivirus/Antimalware, Firewall, IDS/IPS, Disaster Recovery), Services, Security Type, Deployment Mode, Organization Size, Vertical & Region - Global Forecast to 2021, marketsandmarkets.com, July 2016, Report Code: TC 3485.

[16] MATT ASAY, The Internet Of Things Will Need Millions Of Developers By 2020, 27 Jun, 2014. http://readwrite.com/2014/06/27/internet-of-things-developers-jobs-opportunity.

[17] Andrea Colangelo, How Cloud Computing is changing the job market, February 18, 2014.

[18] Frank Lo, The State of Big Data Recruiting: A closer look into the exploding demand for big data expertise, https://datajobs.com/big-data-jobs-recruiting, 2016.