

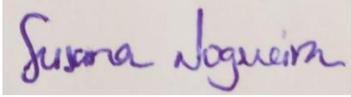


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**Guideline of the AM MSc's Purposes and Strategies Alignment**

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Version	Date	Author	Institution	Status	Change Description
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## 1 Introduction

This document comprises detailed information about the scientific content, teaching, learning and assessment strategies found in the Metal AM MSc, and, consequently, its alignment with the needs analysis performed at the beginning of the ADMIRE project. Such needs analysis is also recapped in Deliverable 1.1. The AM MSc Council members have also been consulted.

This document starts with a description of the structure of the Metal MSc in terms of modules, group project and individual thesis project.

In the Modules section, information on the content, learning method(s) and delivery mode(s), workload, credits, preparation hours needed prior to the module delivery, rationale, intended learning outcomes, syllabus and indicative content, indicative reading, and assessment type(s) are provided.

In the Group Project section, as well as in the Individual Thesis Project one, their scopes illustrated.

Finally, in the Appendix the methodology followed to apply the concepts of blended learning, flipped classroom, and online teaching is provided. A recapitulation of the assessment rules closes that section.

## 2 Structure of the MSc

An MSc is aimed at educating engineers, project development leaders and innovation experts in the emerging field of metal additive manufacturing (metal AM), where experts are lacking and becoming intensively looked after by companies and research and innovation institutions.

The initial Metal AM MSc is structured in 8 modules, each of them comprising specific Learning Outcomes. These learning outcomes have been defined based on the results of the needs analysis recapped in Deliverable 1.1, as well as based on the feedback provided by the AM MSc Council and industry experts.

During project implementation ADMIRE Partners realized that in order to tackle all the adversities (feedback from project stakeholders – industry, standardization bodies, students and teachers) there was the need to develop a European Curriculum that could easily be implemented by different Universities all over Europe (with different strategies, programmes and objectives). Therefore, the Final European Metal AM MSc Curriculum was developed (please check D5.6 to understand the needs that resulted in this change; also check appendix Final MSc Curriculum Guideline for a full overview of the curriculum).

Globally, by the end of both the initial and the final Metal AM MSc learners will:

- Have forefront knowledge on metal additive manufacturing processes and their defects
- Have advanced knowledge on business models and calculation of operation costs
- Demonstrate competency in AM process simulation/optimisation using virtual pre-processing tools
- Be able to troubleshoot process-related issues and define corrective solutions
- Be able to investigate, transfer, and adapt Metal Additive Manufacturing processes, techniques, or methods to new applications.
- Be able to develop and execute project plans for installations of metal additive manufacturing production units from validation of design, development, pre and post processing operations and parts conformity
- Contribute to projects in a teaming environment

## 2.1 Modules

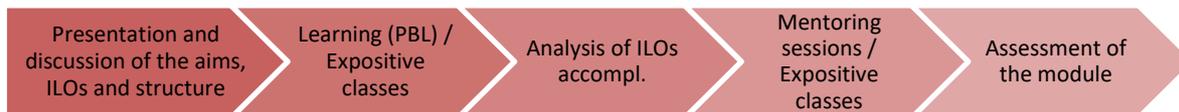
As mentioned on the previous chapter there were two curriculums developed in ADMIRE project. One more focused on the needs and objectives of ADMIRE Partner Universities which can be used as a basis for other European Universities to adopt a similar curriculum (initial curriculum) and one with a broader scope that can be easily implemented in European Universities (final curriculum).

Hereinafter, both curriculums will be briefly described since they are both relevant for Universities that wish to start a Metal AM Eng. MSc.

### Initial European Metal AM MSc Curriculum

All modules have been designed based on the requirements captured in the needs-analysis phase.

The broad structure of the modules will be the following:



### Core modules

The eight core modules are listed below. Contact-lab-independent study hours are recapped with the assessment modalities too.

Module name	Contact	Lab	Indep.	Assessment
Metal AM processes	26	6	74	Written exam
AM metallurgy	26	6	74	Written exam
Design & Simulation	14	21	65	Individual assignment (PBL) + written report
Management of AM quality	18	5	77	Group project, group practical; examination
Economics of AM	26	0	74	Written exam or individual assignment (PBL)
Net-shape manufacturing	30	0	70	Individual assignment + written exam
Post-processing	26	9	74	Individual assignment + group presentation and report
Applications	23	5	77	Individual assignment (PBL)

The module descriptors are provided below.

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<b>Module title:</b> Metal Additive Manufacturing Processes		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>		Yes	<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> REMS			
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>		No	<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here			
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> )  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type Compulsory / Elective</b>	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
				<b>Type</b> <sup>2</sup>	<b>Weighting</b> <sup>3</sup> %	<b>Minimum Mark</b> <sup>4</sup>
Metal Additive Manufacture	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	Ex	100%	40%
<b>Full details of assessment</b>		Exam: 2 hour closed book examination on the subject of Additive Manufacturing Processes.				
<b>Learning Method(s) and Delivery Mode(s)</b>		Flexible (e-learning) course notes. Electronic notes with video animations of processes are provided which contain formative assessment questions. Full-time students are provided with tutorials and lab demonstrations via flipped classroom method. Part-time students online only with previous year's examination provided as a formative assessment.				
<b>Student Workload (Hours)</b>		Contact Time Total		26 Hours		<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
		Of which Practical Work = (Lab/Field/Visits)		6 Hours		
		Independent Learning Time		74 Hours		

<sup>1</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>2</sup> Assessment Methods: 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

<sup>3</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>4</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

	<b>Total Notional Learning Hours</b> 100 Hours
<b>Rationale/Aim</b> <sup>5</sup>	The aim of this module is to provide the student with a description of the physical principles, operating characteristics and practical applications of a variety of metal Additive Manufacturing processes to enable selection of a suitable process for a particular application.
<b>Module Intended Learning Outcomes</b>	On successful completion of this module a student should be able to: <ol style="list-style-type: none"> <li>1. Explain how the different AM processes work and describe the machine architecture.</li> <li>2. Select the best suited AM process for a specific application.</li> <li>3. Propose methods to reduce distortion for a variety of part geometries and processes.</li> <li>4. Propose a suitable tool path for a given part and identify the areas that will need thermal compensation.</li> <li>5. Identify the cause of defects and propose methods for their mitigation.</li> </ol>
<b>Syllabus/Indicative content</b>	Plasma/TIG deposition MIG deposition Laser processing Laser blown powder Laser wire deposition Electron Beam deposition AM process selection Distortion control methods Tool paths including thermal compensation Defects and how to avoid them
<b>Indicative reading</b>	Essential reading: Welding Processes Handbook, 2 <sup>nd</sup> Edition, by Klas Weman, (2011)  Additional reading: Advanced Welding Processes, by John Norrish, (2006)

<sup>5</sup> generic content, skills and relevance to the industry sector

<b>Module title:</b> Additive Manufacturing Metallurgy		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>	No	<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> enter here				
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>	No	<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here				
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>6</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type</b> Compulsory / Elective	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
				Type <sup>7</sup>	Weighting <sup>8</sup> %	Minimum Mark <sup>9</sup>
Metal Additive Manufacture	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	Ex	100%	40%
<b>Full details of assessment</b>	Exam: 2 hour closed book examination on the subject of Additive Manufacturing Metallurgy.					
<b>Learning Method(s) and Delivery Mode(s)</b>	Flexible (e-learning) course notes. Electronic notes are provided which contain formative assessment questions. Full-time students are provided with tutorials and lab demonstrations via flipped classroom method. Part-time students online only with previous year's examination provided as a formative assessment.					
	Contact Time Total	26 Hours				

<sup>6</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>7</sup> Assessment Methods: 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

<sup>8</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>9</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Student Workload (Hours)</b>	Of which Practical Work = (Lab/Field/Visits) 6 Hours Independent Learning Time 74 Hours	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
<b>Total Notional Learning Hours 100 Hours</b>		
<b>Rationale/Aim</b> <sup>10</sup>	The aim of this module is to provide the student with an understanding of the microstructures and metallurgical characteristics of Additively Manufactured (AM) structures in a range of alloys, and how the metal and heat source interaction affects microstructure and strengthening behaviour of different alloys.	
<b>Module Intended Learning Outcomes</b>	On successful completion of this module a student should be able to: <ol style="list-style-type: none"> <li>1. Distinguish the different regimes and processes of failure and describe the factors controlling them and the boundaries and limits between them.</li> <li>2. Apply phase diagrams and continuous temperature transformation diagrams to a range of alloys to explain the microstructural changes that occur.</li> <li>3. Describe the evolution of microstructure during AM and principles of formation of metallurgical phases for a range of alloys.</li> <li>4. Apply physical metallurgy principles to explain the necessary precautions during AM to avoid formation of unwanted phases.</li> <li>5. Relate material microstructure to mechanical performance.</li> <li>6. Select specific materials for different applications to meet the requirements of the design brief.</li> <li>7. Describe the effect of different heat treatments on microstructure, mechanical properties, residual stress and defects.</li> <li>8. Recommend procedures and methods necessary to prevent formation of undesirable phases and defects for dissimilar metallic AM parts.</li> <li>9. Describe the principles of metal corrosion.</li> </ol>	
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• Mechanical properties of metals</li> <li>• Dislocations and strengthening mechanisms</li> <li>• Failure</li> <li>• Grain structure and recrystallisation</li> <li>• Phase Diagrams</li> <li>• Phase transformations: Development of microstructure and alteration of mechanical properties</li> <li>• Principles of metallographic examinations</li> <li>• Steel/Stainless Steels/Nickel</li> </ul>	

<sup>10</sup> generic content, skills and relevance to the industry sector

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	<ul style="list-style-type: none"><li>• Aluminium, copper, and other non-ferrous alloys</li><li>• Titanium</li><li>• Heat treatments</li><li>• Dissimilar AM</li><li>• Corrosion</li></ul>
<b>Indicative reading</b>	<p>Essential reading: Welding Metallurgy, Sindo Kou, 2nd edition, ISBN: 9780471434023 Materials Science and Engineering: An Introduction by William D. Callister, 9<sup>th</sup> edition, ISBN: 9781118319222</p> <p>Additional reading: <a href="#">enter here</a></p>

<b>Module title:</b> Design and Simulation		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>		<b>No</b>		<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> enter here		
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>		<b>No</b>		<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here		
<b>Module used by:</b> <b>List All Courses (Module owner 1<sup>st</sup>)<sup>11</sup></b>  <i>Indicate if Course is AP by inserting AP against the course title<sup>AP</sup></i>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type Compulsory / Elective</b>	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
				<b>Type<sup>12</sup></b>	<b>Weighting<sup>13</sup> %</b>	<b>Minimum Mark<sup>14</sup></b>
Metal Additive Manufacturing	Compulsory (for MSc)		Cranfield	ICW / IPRA C	100%	40%
<b>Full details of assessment</b>	Produce an optimized build job including the following steps: <ul style="list-style-type: none"> <li>- Topology optimisation of a provided geometry</li> <li>- Appropriate orientation and supports for an AM part</li> <li>- Simulation based validation</li> <li>- Hatching strategy</li> </ul> Written Report, max. 10 Pages including graphics, about the performed steps.					
<b>Learning Method(s) and Delivery Mode(s)</b>	Lectures that include example problems, simulation-based labs. Delivery mode class-based (without VLE support).					
<b>Student Workload (Hours)</b>	Contact Time Total	14 Hours		<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>		
	Of which Practical Work = (Lab/Field/Visits)	21 Hours				
	Independent Learning Time	65 Hours				
	<b>Total Notional Learning Hours</b>	<b>100 Hours</b>				

<sup>11</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

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<sup>12</sup> Assessment Methods: 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

<sup>13</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>14</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Rationale/Aim</b> <sup>15</sup>	Through this module, students will learn the basics of topology optimisation, design and simulations for AM while developing technical skills within specialised software for AM and design. This module will enable students to prepare their own optimised build job for a metal part.
<b>Module Intended Learning Outcomes</b>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Demonstrate knowledge and skills in foundational concepts of Topology Optimisation (TO) and Design for AM.</li> <li>2. Describe and apply workflows for Design and TO with the software being used for the course.</li> <li>3. Demonstrate competency in working with CAD and STL file formats.</li> <li>4. Perform basic TO calculations, based on AM-specific restrictions in design and manufacturing.</li> <li>5. Describe and apply workflows for virtual Preprocessing (key items: part orientation, supports).</li> <li>6. Optimise a build-up orientation and support volume.</li> <li>7. Apply finite element analysis and numerical modelling to AM (key items: distortion, residual stresses, hatching).</li> <li>8. Produce an optimised build job for a metal part. Demonstrate significance of simulation software to improve the performance of metal AM.</li> </ol>
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• Topology optimisation.</li> <li>• Design for additive manufacturing</li> <li>• CAD and STL</li> <li>• Virtual preprocessing: part orientation, supports</li> <li>• Simulations for additive manufacturing: distortion, residual stresses, hatching</li> <li>• Optimised build job</li> </ul>
<b>Indicative reading</b>	<p>Essential reading:</p>  <p>Additional reading:  <input type="text" value="enter here"/></p>

<sup>15</sup> generic content, skills and relevance to the industry sector

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<b>Module title:</b> Management of AM quality		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10			
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>		No	<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> enter here				
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>		No	<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here				
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>16</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>		<b>Please give details below on a course by course basis</b>					
		<b>Module Type Compulsory / Elective</b>	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
					<b>Type</b> <sup>17</sup>	<b>Weighting</b> <sup>18</sup> %	<b>Minimum Mark</b> <sup>19</sup>
Metal Additive Manufacture		Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield IST	GPROJ  GPRA C  EX	25% to 40%  15% to 25%  45% to 60%	50%
<b>Full details of assessment</b>		GPROJ – Group Project, GPRAC – Group Practical; EX – Examination; 1. GPROJ - A group case study based on the analysis of the potential of the NDT methods for specific MA parts, considering the complexity of the parts, the materials, the accessibility and the existing codes and standards. 2. GPRAC- A practical group case based on mechanical characterization of MA parts 3. EX- Written examination covering the studied topics. Multiple choice questions (with 1 to 4 answers possible correct answers with discount) and exercises					

<sup>16</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

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<sup>17</sup> Assessment Methods: 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

<sup>18</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>19</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Learning Method(s) and Delivery Mode(s)</b>	Lectures, practical work (lab classes). Delivery mode class-based									
<b>Student Workload (Hours)</b>	<table border="1"> <tr> <td>Contact Time Total</td> <td>23 Hours</td> </tr> <tr> <td>Of which Practical Work = (Lab/Field/Visits)</td> <td>5 Hours</td> </tr> <tr> <td>Independent Learning Time</td> <td>77 Hours</td> </tr> <tr> <td><b>Total Notional Learning Hours</b></td> <td><b>100 Hours</b></td> </tr> </table>	Contact Time Total	23 Hours	Of which Practical Work = (Lab/Field/Visits)	5 Hours	Independent Learning Time	77 Hours	<b>Total Notional Learning Hours</b>	<b>100 Hours</b>	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
Contact Time Total	23 Hours									
Of which Practical Work = (Lab/Field/Visits)	5 Hours									
Independent Learning Time	77 Hours									
<b>Total Notional Learning Hours</b>	<b>100 Hours</b>									
<b>Rationale/Aim <sup>20</sup></b>	<ul style="list-style-type: none"> <li>This module will enable students to understand the Importance of Quality Management, Standards, Quality Control and Measurement in metal Additive Manufacturing</li> </ul>									
<b>Module Intended Learning Outcomes</b>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Identify Understand the concept of part quality;</li> <li>2. Understand how part quality is measured;</li> <li>3. Identify all the factors which can affect part quality;</li> <li>4. Understand the relationship between standards and use standards to achieve required part quality;</li> <li>5. Identify the basic principles of the different NDT techniques;</li> <li>6. Understand the probability of occurrence of the different defect types for a selection of materials and AM techniques;</li> <li>7. Assess the potential of each technique for practical applications;</li> <li>8. Identify appropriate ND techniques for AM parts,</li> <li>9. Select the appropriate NDT techniques for analysing the quality of MAM parts;</li> <li>10. Understand and interpret ND examinations;</li> <li>11. Define the materials mechanical properties;</li> <li>12. Outline the most common destructive tests;</li> <li>13. Select the appropriate standard for each DT</li> <li>14. Determine the metals mechanical properties regarding each destructive test results;</li> <li>15. Select the appropriate destructive test to evaluate the MAM part properties;</li> <li>16. Interpret the test results and take decisions.</li> </ol>									
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• General introduction to part quality</li> <li>• Measurement of MA parts quality</li> <li>• Factors affecting the Quality of MA manufactured parts</li> <li>• Importance of Quality Management, Standards, Quality Control and Measurement Sciences in Additive Manufacturing</li> <li>• General Introduction to ND techniques.</li> <li>• Typical defects of MA manufactured parts.</li> <li>• Characteristics and application range of the different ND techniques.</li> <li>• Construction codes and standards</li> </ul>									

<sup>20</sup> generic content, skills and relevance to the industry sector

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	<ul style="list-style-type: none"> <li>• Mechanical properties of metals</li> <li>• Different destructive testing methods (e.g. Compression test and tensile test)</li> <li>• Mechanical testing standards</li> <li>• Mechanical characterization of MA manufactured parts</li> </ul>
<b>Indicative reading</b>	<p>Essential reading:</p> <ol style="list-style-type: none"> <li>1. Chee Kai Chua, Chee How Wong and Wai Yee Yeong ; "Standards, Quality Control, and Measurement Sciences in 3D Printing and Additive Manufacturing" 2017, Academic Pres</li> <li>2. R Halmshaw, "Introduction to the Non-Destructive Testing of Welded Joints, 2nd Edition ,1997, Woodhead Publishing.</li> <li>3. Howard Kuhn, Howard Kuhn, Dana Medlin - ASM Handbook_ Volume 8_ Mechanical Testing and Evaluation, 2000, ASM International</li> </ol> <p>Additional reading:</p> <p>W.E. Gardner; "Improving the Effectiveness and Reliability of Non-Destructive Testing" ;1992, Pergamon Press.</p>

<b>Module title:</b> Economics of Additive Manufacturing		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>	No		<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> enter here			
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>	No		<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here			
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>21</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type</b> Compulsory / Elective	<b>Pre-requisite modules</b>	<b>Site (s) of delivery</b>	<b>Assessment summary</b>		
Type <sup>22</sup>				Weighting <sup>23</sup> %	Minimum Mark <sup>24</sup>	
Metal Additive Manufacturing	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	Ex	100%	40%
<b>Full details of assessment</b>	Written exam or individual assignment (with problem-based learning)					
<b>Learning Method(s) and Delivery Mode(s)</b>	Course notes. Problem-based learning.					
<b>Student Workload (Hours)</b>	Contact Time Total	26	Hours	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>		
	Independent Learning Time	74				

<sup>21</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>22</sup> Assessment Methods: 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

<sup>23</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>24</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

	<b>Total Notional Learning Hours</b>	<b>100 Hours</b>
<b>Rationale/Aim</b> <sup>25</sup>	The aim of this module is to give an introduction to some of the key general management, personal management, costing and supply chain.	
<b>Module Intended Learning Outcomes</b>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Define the objectives, principles, terminology and systems of management accounting, including costing</li> <li>2. Relate supply chain strategies to their effects on the performance of a manufacturing organisation</li> <li>3. Calculate the cost of a product made by AM, including labour costs, overhead costs, and consumable costs. Compare this with the cost of traditional manufacturing and determine the return on investment.</li> <li>4. Defend different management styles, team roles, different cultures, and how the management of human diversity can impact organisational performance</li> <li>5. Discriminate the relationship between the structure, aspects, and tools applicable in project management activities.</li> </ol>	
<b>Syllabus/Indicative content</b>	Management Accounting Principles and Systems; Personal style and team contribution, interpersonal dynamics, leadership, human and cultural diversity Cost modelling Elements of supply chain management Elements of project management	
<b>Indicative reading</b>	Essential reading: <ul style="list-style-type: none"> <li>- Peter Atrill and Eddie McLaney Accounting and Finance for Non-Specialists (5th Edition, 2006) FT Prentice Hall ISBN 0 273 70244 0</li> <li>- Belbin, R.M., [1981], Management Teams: why they succeed or fail, Heinemann Professional Publishing</li> <li>- Baumers, 2016, The cost of additive manufacturing: machine productivity, economies of scale and technology-push Technological Forecasting &amp; Social Change</li> <li>- Martina, 2016, WAAM vs machining from solid - A cost comparison</li> </ul> <p>Additional reading:  <a href="#">enter here</a></p>	

<sup>25</sup> generic content, skills and relevance to the industry sector

The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Module title:</b> Net-shape manufacturing		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>		<b>No</b>		<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> MSc – Metal Additive Manufacturing		
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>		<b>No</b>		<b>Details of Institution(s) and Award(s) this contributes to:</b> University of Birmingham, Cranfield University		
<b>Module used by:</b> <b>List All Courses (Module owner 1<sup>st</sup>)<sup>26</sup></b>  <i>Indicate if Course is AP by inserting AP against the course title<sup>AP</sup></i>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type Compulsory / Elective</b>	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
				<b>Type<sup>27</sup></b>	<b>Weighting<sup>28</sup> %</b>	<b>Minimum Mark<sup>29</sup></b>
Metal Additive Manufacture	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	ICW  EX	50%  50%	40%  40%
<b>Full details of assessment</b>	Individual summative assignment; 6000 words maximum.  1. An individual case study on the development of the manufacturing route for a complex-shaped component. 2. Decide and justify which manufacturing technique and component is to be discussed. 3. Determine and critically evaluate the development of this manufacturing route for the specific component chosen.  Individual exam; 2 hours long 1. A range of short answer questions 2. A choice of essay questions (answer 2 from 4)					

<sup>26</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>27</sup> Assessment Methods: 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

<sup>28</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>29</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Learning Method(s) and Delivery Mode(s)</b>	Lectures that include example problems. Delivery mode class-based (without VLE support).									
<b>Student Workload (Hours)</b>	<table border="1"> <tr> <td>Contact Time Total</td> <td>30 Hours</td> </tr> <tr> <td>Of which Practical Work = (Lab/Field/Visits)</td> <td>0 Hours</td> </tr> <tr> <td>Independent Learning Time</td> <td>70 Hours</td> </tr> <tr> <td><b>Total Notional Learning Hours</b></td> <td><b>100 Hours</b></td> </tr> </table>	Contact Time Total	30 Hours	Of which Practical Work = (Lab/Field/Visits)	0 Hours	Independent Learning Time	70 Hours	<b>Total Notional Learning Hours</b>	<b>100 Hours</b>	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
Contact Time Total	30 Hours									
Of which Practical Work = (Lab/Field/Visits)	0 Hours									
Independent Learning Time	70 Hours									
<b>Total Notional Learning Hours</b>	<b>100 Hours</b>									
<b>Rationale/Aim</b> <sup>30</sup>	This module will introduce the state-of-art of various net-shape manufacturing techniques: including various powder processing techniques; selective laser melting, electron beam melting, hot isostatic pressing, as well as casting and forming. The mechanisms of individual techniques will be explored to include the benefits, challenges, limitations and suitability of each process. Practical examples will be used throughout.									
<b>Module Intended Learning Outcomes</b>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Discuss the applicability of net-shape manufacturing processes: SLM, EBM, hot Isostatic pressing, casting, forming, powder processing as a complement or substitute of AM.</li> <li>2. Identify the benefits, challenges and limitations associated with the use of net-shape manufacturing techniques.</li> <li>3. Select a suitable net-shape manufacturing process for fabricating shapes and structures.</li> <li>4. Define the process requirements and parameters, based on the characteristics of the net-shape manufacturing process.</li> <li>5. Describe the underlying materials science concepts for the different net-shape manufacturing methods</li> </ol>									
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• Powder Processing – SLM, EBM and HIP</li> <li>• Net-shape manufacturing</li> <li>• Materials science</li> </ul>									
<b>Indicative reading</b>	<p>Essential reading:</p> <ol style="list-style-type: none"> <li>1. Gibson, I, Rosen, D.W., Stucker, B., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2009</li> <li>2. Materials Processing Handbook, edited by J. R. Groza, J. F. Shackelford, E. J. Lavernia, M. T. Powers (Taylor &amp; Francis CRC Press, 2007).</li> </ol> <p>Additional reading:</p>									

<sup>30</sup> generic content, skills and relevance to the industry sector

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	<ul style="list-style-type: none"><li>• <i>Welding and Joining of Aerospace Materials</i>. MC Chaturvedi, Ed. Woodhead Publishing Ltd., Cambridge, United Kingdom, 2012.</li><li>• S. Kalpakjian and Steven Schmid, <i>Manufacturing Engineering and Technology</i>, 6th edition. California: Addison Wesley Longman, Inc., 1997.</li></ul>
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<b>Module title:</b> Post-Processing		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>	No	<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> Metal Additive Manufacturing - MSc				
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>	No	<b>Details of Institution(s) and Award(s) this contributes to:</b> University of Birmingham, Cranfield University				
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>31</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type</b> Compulsory / Elective	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
				<b>Type</b> <sup>32</sup>	<b>Weighting</b> <sup>33</sup> %	<b>Minimum Mark</b> <sup>34</sup>
Metal Additive Manufacture	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	ICW  Group Presentation and report	50%  50%	40%  40%
<b>Full details of assessment</b>	<p>Individual summative assignment;</p> <p>1. A range of short and medium answer questions asking the students to describe various post-processing techniques, explain which technique would be most suitable for various given applications and describe the materials science principles behind why a technique is effective.</p> <p>Group presentation and report (maximum 4 in a group, maximum 3000 words)</p> <p>1. Each group will be given a specific AM process and application. The group will investigate and discuss possible post-processing techniques, the underlying materials science between the possible techniques and conclude which technique would be most suitable and why</p>					

<sup>31</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>32</sup> Assessment Methods: 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

<sup>33</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>34</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

<b>Learning Method(s) and Delivery Mode(s)</b>	Lectures that include example problems, a class based tutorial exercise and an industrial visit (depending on availability). Delivery mode class-based (without VLE support).	
<b>Student Workload (Hours)</b>	Contact Time Total      26 Hours Of which Practical      8 Hours Work = (Lab/Field/Visits) Independent Learning    74 Hours Time	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
<b>Rationale/Aim</b> <sup>35</sup>	This module will enable students to understand, describe and evaluate the different post processing techniques currently used on AM parts and allow them to select the most appropriate one for a specific AM process and application. It will explore the underlying material science concepts for these processes.	
<b>Module Intended Learning Outcomes</b>	On successful completion of this module a student should be able to: <ol style="list-style-type: none"> <li>1. Describe the different post processing techniques used on AM parts, to include those required for removal of support structures, improvement of surface characteristics and structural integrity.</li> <li>2. Explain the benefits and limitations of each post processing technique with respect to each AM process.</li> <li>3. Identify the most suitable post processing technique for a specific AM process and application.</li> <li>4. Describe the underlying materials science concepts for the different post-processing methods.</li> <li>5. Explain the benefits of in-process cold work on the properties and microstructure of parts.</li> </ol>	
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• Post-processing techniques.</li> <li>• Shot-peening, heat treatments, HIPping</li> <li>• Materials science</li> </ul>	
<b>Indicative reading</b>	Essential reading:  Additional reading: <span style="background-color: #cccccc; padding: 2px;">enter here</span>	

<sup>35</sup> generic content, skills and relevance to the industry sector

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<b>Module title:</b> Additive Manufacturing System Design		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10		
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>	Yes	<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> REMS				
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>	No	<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here				
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>36</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>	<b>Please give details below on a course by course basis</b>					
	<b>Module Type</b> Compulsory / Elective	<b>Pre-requisite modules</b>	<b>Site (s) of delivery</b>	<b>Assessment summary</b>		
				Type <sup>37</sup>	Weighting <sup>38</sup> %	Minimum Mark <sup>39</sup>
Metal Additive Manufacture	Compulsory (for MSc and PgDip)  Elective (for PgCert)	N/A	Cranfield	ICW	100%	40%
<b>Full details of assessment</b>	Individual summative assignment; 6000 words maximum. <ol style="list-style-type: none"> <li>1. Perform and write up experiments for producing a wall of given dimensions.</li> <li>2. Design of robot system and manipulators, jigs and methods of fixturing, and a method for loading and unloading the parts. Distortion of the parts will need to be addressed.</li> <li>3. Determine whether sensors are needed, and if so, what sensors should be used?</li> <li>4. Design of the shift system and labour force required.</li> </ol>					

<sup>36</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>37</sup> Assessment Methods: AO- Attendance only; ICW – Individual Coursework; GCW – Group Coursework; IPRES – Individual Presentation; GPRES – Group Presentation; IPRACT – 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

<sup>38</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>39</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

	<ol style="list-style-type: none"> <li>5. Estimate the cost per part, making reasonable assumptions of capital costs, labour costs, overhead costs, and consumable costs.</li> <li>6. Develop a factory layout that incorporates the material cutting operations, the robot cell and the finishing operations for the part.</li> <li>7. Develop a Project Plan for installation of the robotic system.</li> </ol>																		
<p><b>Learning Method(s) and Delivery Mode(s)</b></p>	<p>Lectures that include example problems, practical work including AM lab and metallographic analysis, an industrial visit (depending on availability). Delivery mode class-based (without VLE support).</p>																		
<p><b>Student Workload (Hours)</b></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">Contact Time Total</td> <td style="width: 20%; text-align: center;">23</td> <td rowspan="4" style="width: 20%; vertical-align: top;"><b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b></td> </tr> <tr> <td></td> <td style="text-align: center;">Hours</td> </tr> <tr> <td>Of which Practical Work = (Lab/Field/Visits)</td> <td style="text-align: center;">5 Hours</td> </tr> <tr> <td>Independent Learning Time</td> <td style="text-align: center;">77</td> </tr> <tr> <td></td> <td style="text-align: center;">Hours</td> <td></td> </tr> <tr> <td><b>Total Notional Learning Hours</b></td> <td style="text-align: center;"><b>100</b></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><b>Hours</b></td> <td></td> </tr> </table>	Contact Time Total	23	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>		Hours	Of which Practical Work = (Lab/Field/Visits)	5 Hours	Independent Learning Time	77		Hours		<b>Total Notional Learning Hours</b>	<b>100</b>			<b>Hours</b>	
Contact Time Total	23	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>																	
	Hours																		
Of which Practical Work = (Lab/Field/Visits)	5 Hours																		
Independent Learning Time	77																		
	Hours																		
<b>Total Notional Learning Hours</b>	<b>100</b>																		
	<b>Hours</b>																		
<p><b>Rationale/Aim</b> <sup>40</sup></p>	<p>This module will enable students to design their own additive manufacturing cell including manipulation equipment, and sensing. It also introduces the student to experimental design and how to develop suitable parameters for part production.</p>																		
<p><b>Module Intended Learning Outcomes</b></p>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Design a programme of experiments for producing a simple wall and demonstrate the effect of the main input parameters.</li> <li>2. Analyse data produced from these experiments so that the relationship between process inputs and outputs is understood.</li> <li>3. Design an AM cell for manufacturing a specific AM part that includes selection of a robot, and methods to manipulate the part, fixturing and sensing of the part, equipment for loading and unloading, labour requirements and an estimation of the time to manufacture.</li> <li>4. Calculate the cost of a typical robotic welding operation including labour costs, overhead costs, and consumable costs.</li> <li>5. Design a factory layout that incorporates all required operations (feedstock storage, machine preparation, material preparation, AM cell and the finishing operations for the part).</li> <li>6. Construct a project plan for the installation of the AM system.</li> <li>7. Propose methods for shielding of the part to prevent oxidation, and thermal management.</li> </ol>																		

<sup>40</sup> generic content, skills and relevance to the industry sector

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<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"><li>• Sensors for Additive manufacture.</li><li>• Manipulation</li><li>• Jigs and fixtures</li><li>• Robot cell design</li><li>• Project planning</li><li>• Factory layout</li><li>• Experimental design</li><li>• Part shielding</li><li>• Thermal management</li></ul>
<b>Indicative reading</b>	Essential reading:  Additional reading: <input type="text" value="enter here"/>

### 2.1.1 Optional modules

<b>Module title:</b> Product Development and Entrepreneurship		<b>Module SITS code:</b> enter here		<b>Credit rating:</b> 10			
<b>Is this module offered as part of an EngD or other Research Degree Programme(s)?</b>		<b>No</b>		<b>Title of EngD or other Research Degree Programme(s) to include Thematic Area:</b> enter here			
<b>Is the module offered as part of an award of another Higher Education provider (UK or International)?</b>		<b>No</b>		<b>Details of Institution(s) and Award(s) this contributes to:</b> enter here			
<b>Module used by:</b> List All Courses (Module owner 1 <sup>st</sup> ) <sup>41</sup>  <i>Indicate if Course is AP by inserting AP against the course title</i> <sup>AP</sup>		<b>Please give details below on a course by course basis</b>					
		<b>Module Type</b> Compulsory / Elective	<b>Pre-requisite modules</b>	<b>Site(s) of delivery</b>	<b>Assessment summary</b>		
					Type <sup>42</sup>	Weighting <sup>43</sup> %	Minimum Mark <sup>44</sup>
Metal Additive Manufacture		Compulsory (for MSc and PgDip)	N/A	Cranfield IST	GCW and GPRES	85% to 100%	50%
		Elective (for PgCert)			Prototype	0% to 15%	
<b>Full details of assessment</b>		<p>GCW – Group Coursework and GPRES – Group Presentation Design project and a prototype (optional).</p> <p>1. In the design project, inside a design team, the student must implement the methods learned in the course. The project will be about developing a product, suggested by the design team and approved by the faculty. The project will be divided in partial assignments during the semester.</p> <p>2. The design project will be discussed at the beginning of the module</p> <p>3 Each team will have 3 to 5 students.</p> <p>4. At the end of the module, each design team will make a 20 minutes' presentation of their product, followed by a 30 minutes' discussion.</p>					

<sup>41</sup> Enter course name in boxes below – e.g., the primary owner of the module 1st and subsequent courses thereafter.

<sup>AP</sup> AP Denotes courses provided by Cranfield University to the MoD as part of the Academic Provider contract

<sup>42</sup> Assessment Methods: 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

<sup>43</sup> For multi-part assessments the weighting here should be 100% and the type should be MULTI; details of how the weighting is broken down should be given in the 'Full details of assessment' box.

<sup>44</sup> (A mark of ≥50% is required to pass the assessment; where the stated minimum mark is 40%, a mark of 40-49% will be compensated by good performance in other modules providing that the overall average is ≥50%, a mark of <40% will require the assessment to be re-taken; where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken. The data contained in this document contains proprietary information and it may not be copied or communicated to a third party or used for any other purpose than that which it was supplied without the ADMIRE consortium's prior written consent.

	5.The students will be graded based on the design assignments, the design presentation and the optional prototype.	
<b>Learning Method(s) and Delivery Mode(s)</b>	Lectures, seminars, practical work (through a game). Delivery mode class-based	
<b>Student Workload (Hours)</b>	Contact Time Total            23 Hours Of which Practical Work    5 Hours = (Lab/Field/Visits) Independent Learning        77 Hours Time	<b>Of the notional work time indicate how many hours take place prior to module delivery: 8 hours</b>
	<b>Total Notional Learning Hours</b> 100 Hours	
<b>Rationale/Aim</b> <sup>45</sup>	This module will enable students to develop successful products (new or adapted) based on customer needs	
<b>Module Intended Learning Outcomes</b>	<p>On successful completion of this module a student should be able to:</p> <ol style="list-style-type: none"> <li>1. Identify customer needs and translate them into product specifications;</li> <li>2. Understand the product as a whole, from the first design sketches to the final production stages and commercialization;</li> <li>3. Design a product inside a team, innovating and creating based on market needs;</li> <li>4. Implement a structured methodology, reducing un-certainty, risk and time spent from idea to market launch;</li> <li>5. Make a development plan with milestones and re-source allocation for the different product development phases, establishing targets and partial objectives;</li> <li>6. Communicate with all the stakeholders, understanding clearly their role and the role of others.</li> </ol>	
<b>Syllabus/Indicative content</b>	<ul style="list-style-type: none"> <li>• Products and Services</li> <li>• Innovation and creativity in product development (PD)</li> <li>• Technology transfer and Intellectual Property</li> <li>• Product development process and organization.</li> <li>• Product planning</li> <li>• Customer needs.</li> <li>• Product specifications</li> <li>• Concept generation</li> <li>• Concept selection</li> <li>• Concept testing</li> <li>• Product architecture</li> <li>• Industrial design</li> <li>• Risk management</li> </ul>	

<sup>45</sup> generic content, skills and relevance to the industry sector

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	<ul style="list-style-type: none"><li>• Economic analysis and sources of financing</li><li>• Legal aspects associated with start-ups</li><li>• Prototyping.</li><li>• Design for Manufacturing and Assembly.</li><li>• Design for the Environment.</li><li>• Seminars.</li><li>• Design discussions.</li></ul>
<b>Indicative reading</b>	<p>Essential reading: Product Design &amp; Development K. T. Ulrich, S. D. Eppinger McGraw-Hill 2008, 5th Ed ISBN 9780071086950</p> <p>Additional reading: Effective Small Business Management N. Scarborough, T. Zimmer Prentice-Hall 2006 ISBN 0130212717</p>

## **Final European Metal AM MSc Curriculum**

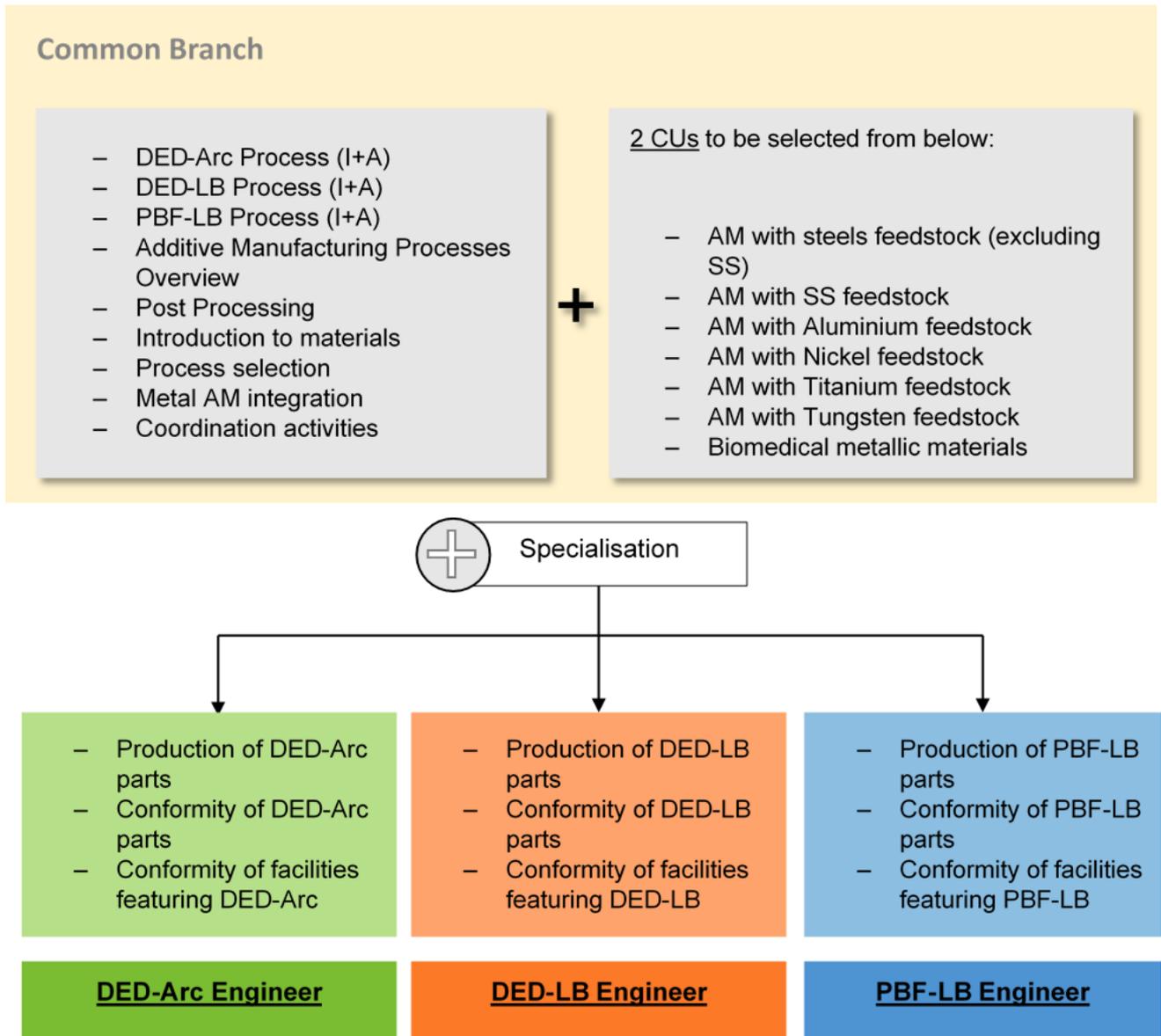
The final Curriculum was developed under a similar methodology as the initial curriculum. It is structured into small Competence Units (instead of modules) and was developed in accordance with European tools such as EQF, Learning Outcomes (LOs) approach and Job Functions and Job Activities structure for practical Competence Units.

The Curriculum addresses 4 different Professional Profiles (Metal AM Coordinator, Process Engineer PBF-LB, Process Engineer DED-Arc, Process Engineer DED-LB) as it facilitates the process of different Universities to award an harmonized similar Curriculum. It's structured as follows:

### **Metal AM Coordinator**

- DED-Arc Process (I+A)
- DED-LB Process (I+A)
- PBF-LB Process (I+A)
- Additive Manufacturing Processes Overview
- Post Processing
- Process selection
- Metal AM Integration
- Coordination activities

## ENGINEERS



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**Metal AM Coordinator**

COMPETENCE UNITS	E/I MAMC	
	Recommended Contact Hours*	Expected Workload**
CU 00: Additive manufacturing Process Overview	7	14
CU 01: DED-Arc Process	42	84
CU 08: DED-LB Process	35	70
CU 15: PBF-LB Process	35	70
CU 25: Post Processing	14	28
CU 34: Process Selection	28	56
CU 35: Metal AM Integration	21	42
CU 36: Coordination Activities	7	14
<b>TOTAL</b>	<b>189</b>	<b>378</b>

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**Metal AM DED-Arc Process Engineer**

COMPETENCE UNITS	E/IE DED-Arc	
	Recommended Contact Hours*	Expected Workload**
CU 00: Additive manufacturing Process Overview	7	14
CU 01: DED-Arc Process	42	84
CU 08: DED-LB Process	35	70
CU 15: PBF-LB Process	35	70
CU 25: Post Processing	14	28
CU 34: Process selection	28	56
CU 35: Metal AM integration	21	42
CU 36: Coordination activities	7	14
CU 37: Production of DED-Arc parts	28	56
CU 38: Conformity of DED-Arc parts	42	84
CU 39: Conformity of facilities featuring DED-Arc	7	28
<b>TOTAL</b>	<b>266</b>	<b>532</b>
<b>Optional CUs</b>		
CU 26: Introduction to materials	14	28
<b>TOTAL</b>	<b>280</b>	<b>560</b>
<b>Materials CUs***</b>		
CU 27: AM with steels feedstock (excluding Stainless Steel)	21	42
CU 28: AM with Stainless Steel feedstock	14	28
CU 29: AM with Aluminium feedstock	7	14
CU 30: AM with Nickel feedstock	7	14
CU 31: AM with Titanium feedstock	14	28
CU 32: AM with Tungsten feedstock	3,5	7
CU 33: Biomedical metallic materials	7	14

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**Metal AM DED-LB Process Engineer**

COMPETENCE UNITS	E/E DED-LB	
	Recommended Contact Hours*	Expected Workload**
CU 00: Additive manufacturing Process Overview	7	14
CU 01: DED-Arc Process	42	84
CU 08: DED-LB Process	35	70
CU 15: PBF-LB Process	35	70
CU 25: Post Processing	14	28
CU 34: Process selection	28	56
CU 35: Metal AM integration	21	42
CU 36: Coordination activities	7	14
CU 40: Production of DED-LB parts	21	42
CU 41: Conformity of DED-LB parts	35	70
CU 42: Conformity of facilities featuring DED-LB	14	28
<b>TOTAL</b>	<b>259</b>	<b>518</b>
<b>Optional CUs</b>		
CU 26: Introduction to materials	14	28
<b>TOTAL</b>	<b>273</b>	<b>546</b>
<b>Materials CUs***</b>		
CU 27: AM with steels feedstock (excluding Stainless Steel)	21	42
CU 28: AM with Stainless Steel feedstock	14	28
CU 29: AM with Aluminium feedstock	7	14
CU 30: AM with Nickel feedstock	7	14
CU 31: AM with Titanium feedstock	14	28
CU 32: AM with Tungsten feedstock	3,5	7
CU 33: Biomedical metallic materials	7	14

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**Metal AM PBF-LB Process Engineer**

COMPETENCE UNITS	E/IE PBF-LB	
	Recommended Contact Hours*	Expected Workload**
CU 00: Additive manufacturing Process Overview	7	14
CU 01: DED-Arc Process	42	84
CU 08: DED-LB Process	35	70
CU 15: PBF-LB Process	35	70
CU 25: Post Processing	14	28
CU 34: Process selection	28	56
CU 35: Metal AM integration	21	42
CU 36: Coordination activities	7	14
CU 43: Production of PBF-LB parts	21	42
CU 44: Conformity of PBF-LB parts	35	70
CU 45: Conformity of facilities featuring PBF-LB	14	28
<b>TOTAL</b>	<b>259</b>	<b>518</b>
<b>Optional CUs</b>		
CU 26: Introduction to materials	14	28
<b>TOTAL</b>	<b>273</b>	<b>546</b>
<b>Materials CUs***</b>		
CU 27: AM with steels feedstock (excluding Stainless Steel)	21	42
CU 28: AM with Stainless Steel feedstock	14	28
CU 29: AM with Aluminium feedstock	7	14
CU 30: AM with Nickel feedstock	7	14
CU 31: AM with Titanium feedstock	14	28
CU 32: AM with Tungsten feedstock	3,5	7
CU 33: Biomedical metallic materials	7	14

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## 2.2 Group Project

Group projects are consultancy-style projects sponsored by industry partners. They provide students with experience working on real problems for a real client, gaining essential technical and transferable skills, such as team working, managing resources and developing reporting and presentation skills.

The project applies technical knowledge acquired in the previous modules, and provides training in teamwork and the opportunity to develop non-technical aspects of the taught programme (project management, teamwork and independent research). In other words, the aim of the group project is to provide students with direct experience of applying knowledge to an industrially relevant problem that requires a team-based multidisciplinary solution.

Depending on the size and complexity of the group-project subject, group size can vary from four up to eight people. Every member is expected to make a full and fair contribution to the work. Objective measures of contribution include:

- Attendance at meetings
- Contribution to a designated role
- Minuted record of what each team member has done since the last team meeting, with evidence provided in support where possible, and signed off as a true record by each member
- Constructive contribution and positive interaction during meetings as witnessed by staff at meetings attended

Students will be offered a list of group projects to choose from; they will be asked to rank the projects they like the most, and whenever possible their first choice is allocated to them, considering the demand for the same project.

Often, group projects are based on real industrial needs or university-driven feasibility studies for innovative research ideas. Students will learn about a subject through the experience of solving an open-ended problem, which is the very definition of problem-based learning.

As a result of the external engagement with industrial stakeholders, Cranfield students have so far enjoyed a higher degree of success when it comes to securing their first employment, as testified by previous students routinely stating this.

As such, the group project experience is highly valued by both students and prospective employers.

It is clear that the modern engineer cannot be divorced from the commercial world. In order to provide practice in this matter, a poster presentation will be required from all students. This presentation provides the opportunity to develop presentation skills and effectively handle questions about complex issues in a professional manner. All groups submit a written report and deliver a presentation to the industry partners.

Part-time students can prepare a dissertation on an agreed topic in place of the group project.

### 2.2.1 Group project LOs

On successful completion of the group project, a student should be able to:

- Set objectives, plan and manage projects

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Subject/Deliverable: D3.1

- Evaluate a project brief set by a client
- Develop a set of project objectives appropriate to the client's brief
- Plan and execute a work programme with reference to key project management processes (e.g. time management; risk management; contingency planning; resource allocation)
- Select and justify a methodology appropriate to the task
- Collect & analyse data, review and critically analyse literature, generate conclusions
- Understand the differing roles within a team working environment
- Utilise individual skills and expertise to contribute to team output and collaborate effectively with others in a consultancy team context
- Chair and contribute to meetings
- Reporting, communications, reflective practice
- Communicate findings in a professional manner in written, oral and visual forms
- Reflect upon and evaluate personal and group performance in a team-based task

### 2.2.2 Self-reflection and peer review

Improvements in:

- Communication skills
- Time management
- Teamwork
- Formulation of a strategy/plan to develop/enhance particular skills
- Development of a reflective mode of learning

are assessed through a reporting on reflective self-assessment, and a mid-project peer-review assessment of self and group-project colleagues:

<b>Communicating effectively and presentation skills</b>					
<b>Definitions</b>					
Listens to others and effectively gets the message across to a wide variety of people and groups, using the most relevant means and style; presents information in visual form to enhance communication					
	<b>Negative indicators (0)</b>	<b>Level 1 Basic</b>	<b>Level 2 Self</b>	<b>Level 3 Others</b>	<b>Level 4 Leadership</b>
Written communication	Communicates written information in a way that can be misinterpreted.	Accurately communicates factual information in a written format.	Adapts written communication to suit the purposes of the recipient.	Presents written communication and chooses language that builds and develops positive relationships.	Uses written communication to positively influence the desired outcome and create enthusiasm.
Presentations (Oral)	Fails to use visual aids professionally, or distracts from spoken communication	Uses suitable visual aids with neutral impact on audience	Adapts visual aids to illustrate and clarify information in an organised and positive manner	Uses visual aids as an integral part of communication to create positive image of own (and others) work	Uses visual aids to maximum impact to create discussion and feedback.  Role model for others

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### **2.2.2.1 Self-Reflection Exercise**

- Each student to select the Team Work skill and two other skills to report on
- Reflect upon and select the level that best describes the competency for the skill at the beginning of the project
- Use a table to record the initial assessment
- The student should reflect and select the level they would like to achieve during the period of the Group Project, noting this down

### **2.2.2.2 Action Plan**

- Match competency assessment against the skills to identify where particular competencies can be developed
- Students are recommended to set SMART objectives:
  - Specific – define exactly what you are aiming for
  - Measurable – how are you going to measure success?
  - Achievable – yes, but make sure it is challenging
  - Relevant – is it relevant to project or your own personal development?
  - Time – set a review date and completion time

### **2.2.2.3 Reviewing Achievements**

- At the completion of a Group Project students reflect on their achievements noting down their new assessment of their competences
- Comparison of the achievements against the objectives set to assess the degree to which they have met them
- The process of reflection should be frequent and active; a reflection log can be a useful aid here
- Recognise that several objectives may have to be set before it can be judged that the competency level has been raised.

### **2.2.2.4 Report (part a)**

- Presentation of initial and final competencies
- Statement of the objectives set to raise competencies
- Provision of evidence to support how the objectives were implemented and whether they were successfully achieved in full or in part
- Description of what went well and what didn't during the project for the student personally and as part of a team
- What would the student do differently in future?

### **2.2.2.5 Peer Review**

Students will complete a Qualtrics survey midway through the project identifying:

- Strengths
  - Areas for improvement
  - Value as a team member
- Data from the survey will be collated by the admin team
- Identified staff will feed back a summary of the results to individual students

### **2.2.2.6 Report (part b)**

- Students are asked to report on their reflection of their results from the peer review
- Description of how they have sought to utilise their identified strengths
- Description of the strategies adopted to address the areas for improvement identified

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### 2.2.3 Marking Guidelines Self-Reflection Report

The aim of the reflective report is that the student demonstrates that they have developed and practiced skills of personal reflection on their way of working such that they have actively attempted to improve their competencies across a range of skills.

#### 2.2.3.1 Marking Criteria (6 key areas)

1. Has the student presented their initial competencies and reassessed these at the end of the project?
2. Has the student set out objectives to raise their skills for some or all of the competencies?
3. Has the student reflected upon whether the objectives have been met (degree to which they have been met, evidence presented to demonstrate the objective has been met, notification of any additional work required to meet the objective)?
4. Has the student reflected upon their own individual performance and as a team member?
5. Has the student reflected upon the project as a whole (what went well, what didn't, would you do differently)?
6. Has the student reflected upon their peer review results and described how they have used the results to enhance their role within the project?

#### 2.2.4 Group project assessment

Element of assessment	Contribution to overall mark	Proportion to contribution to overall mark
Final report	80%	64%
Exhibition Day presentation		16%
Individual contribution	20%	10%
Reflective review and peer review		10%

#### 2.2.5 Examples of recent group projects

Examples of recent group projects include:

- Wire + Arc Additive Manufacturing of a defence aluminium component
- Preliminary design of an offshore floating wind turbine
- Multi-disciplinary design of a high-speed marine vehicle with aerodynamic surfaces
- Design optimisation of the drive train for a vertical axis wind turbine

## 2.3 Individual Thesis

Students will be given a list of individual projects to choose from. They will be asked to rank the projects they like the most, and whenever possible their first choice is allocated to them, considering the demand for the same individual project.

Individual Thesis must be done in accordance with IAMQS quality assurance rules and procedure.

Individual thesis projects are based on real industrial needs or university-driven feasibility studies for innovative research ideas. Students will learn about a subject through the experience of solving an open-ended problem, which is the very definition of problem-based learning. As such, the individual project provides students with the opportunity to demonstrate their ability to carry out independent research, think and work in an original way, contribute to knowledge and overcome genuine problems related to real needs.

Students will make a formal presentation of their findings to a panel of academics and industry experts and submit a research thesis.

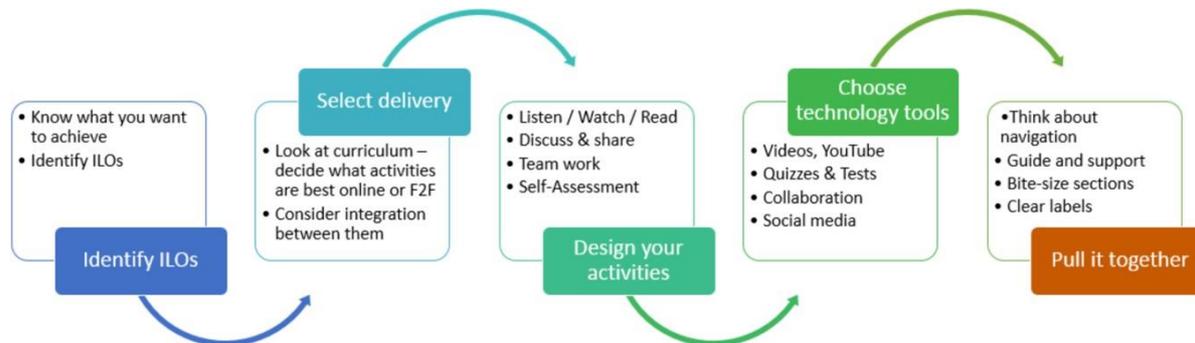
For part-time students it is common that their research thesis is undertaken in collaboration with their place of work and supported by academic supervision.

### 2.3.1 Examples of recent individual thesis projects

Recent individual research projects include:

- Development of Wire+Arc Additive Manufacturing techniques for large civil-engineering components
- Evaluation of effects of shielding gas characteristics on end-products made by Wire+Arc Additive Manufacturing
- Comparison of a panel method and Reynolds averaged Navier-Stokes (RANS) method to estimate the aerodynamic coefficients of a profile flying in ground effect
- The stress shielding effect of cracks in loaded components
- Review and modelling of heave and roll motion passive damping systems for offshore floating support structures for wind turbines.

### 3 Appendix – Blended learning



#### 3.1 Plan the course outcomes

First you need to:

- Start with the end in mind – design your intended learning outcomes (ILOs).
- What will your role be - this may change at times from "sage on the stage" to "guide on the side"

#### 3.2 Select mode of delivery

- Explore various blended learning models to select the one that works for you. Some of the most common models are: flipped, station rotation, lab rotation, flex, self-blend and enriched.
- Determine which materials should be delivered in the f2f component of your course and which items can be delivered online. Select items that are relevant to course objectives and student learning experiences
- What tools and resources are appropriate and available?
- Decide how will activities be sequenced and linked so that face-to-face and online components are integrated and the online does not just appear as an optional or unrelated add-on

#### 3.3 Design your activities

What types of activity / pedagogic approaches (online or face-to-face) are most appropriate to address the ILOs e.g. problem-based learning, discussion, practical work. Think about incorporating a variety of these types of activities

- Read - PDF/Word/Powerpoint/Slideshare
- Listen – Narration on PPT or MP3 files
- Watch – Videos, simulations, training material from Lynda.com
- Discuss and share – Discussion forums, wiki/blogs
- Test – Self assessment formative quizzes, submit assignments

Avoid delivering materials that will distract the student from the course objectives. Do not add irrelevant information to “fill-up” your pages.

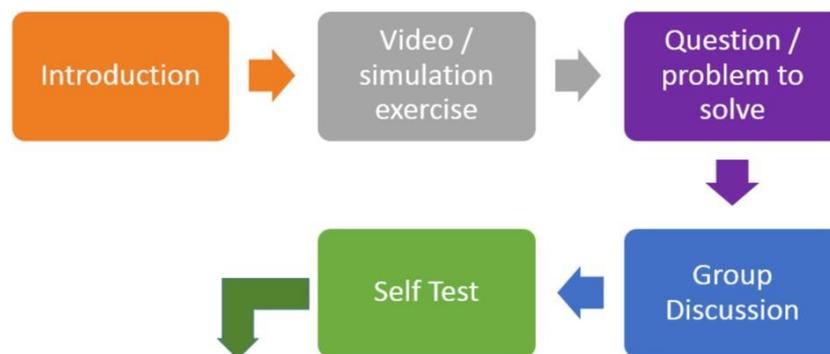
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### 3.4 Choose your technology

Decide on the appropriate platform for delivery (usually the VLE) and use appropriate tools to add interactivity and interest. Gather your material - scanning useful graphics, creating PDF/Word files, developing web pages or locating relevant web links to include, and recording

- Audio narration on your powerpoint slides - when presenting audio or video, include a brief description and information about the length. Keep the segments short, from 2-15 minutes, to help maximize listeners' absorption the information, avoiding information overload.
- iTunesU / YouTube / Vimeo
- Create your own videos/screen capture and stream from Ensemble. If you are adding videos or elearn material first create a script, then capture video material using various software such as ExplainEverything, Snagit, Camtasia, etc
- Images (remember to check copyright and IP)
- Quiz for formative assessment

### 3.5 Pull it together



Example of a blended learning activity

- Decide how will activities be sequenced and linked so that face-to-face and online components are integrated and the online does not just appear as an optional or unrelated add-on
- Provide a clear path through the material, and make sure guideposts are clear to the student.
- Organize the content in logical units, or modules, in which each module is organized around a major topic and contains relevant objectives, material, and associated activities. In the introduction to the module, include information about how long the student should expect to spend working on the module.
- Present content in bite-sized chunks.
- When presenting text, format the content by breaking it into short paragraphs and using headings, bullets, graphics and other formatting devices that make webpages easier to read and comprehend.
- Help your students digest the chunks of material by providing short recall quiz or collaborative discussion forum after each one.

Accommodate different types of learners. Make sure visual learners have graphics and text they can see to foster learning. Provide narration and text for verbal learners

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### 3.6 Delivering your module

Here is a framework for presenting and delivering a blended module. It provides practical guidance on the kinds of action required by the module leader during typical phases of blended module delivery.

<p>1) the timeframe for your module.</p>	<ul style="list-style-type: none"> <li>• What needs to happen and by when?</li> <li>• How will you present the online activity for your module to students?</li> <li>• How will they engage with the targeted learning over the duration of the module?</li> </ul>
<p>2) the balance of class-based and online activities.</p>	<ul style="list-style-type: none"> <li>• How will the online and face-to-face components be linked together?</li> <li>• What is expected of students and tutors in terms of their online activity and at what phases during the delivery of the module?</li> </ul>
<p>3) how students will be supported during the delivery of the module.</p>	<ul style="list-style-type: none"> <li>• What tools and resources will they require to complete the online activities and when should they be made available?</li> <li>• What are the key milestones in the module for feedback and assessment?</li> </ul>

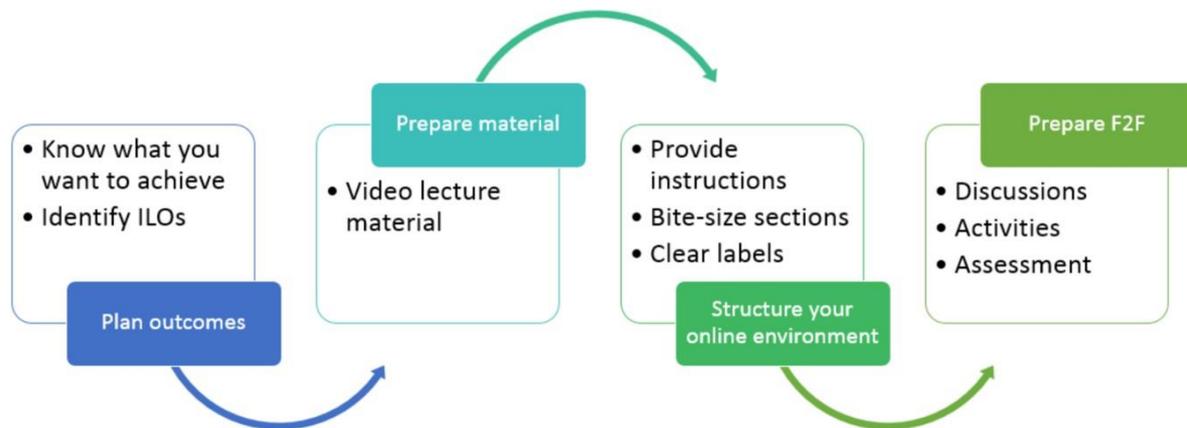
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## 4 Appendix – Flipped classroom

The flipped classroom is a pedagogical model in which the typical lecture and homework elements of a course are reversed. The value of a flipped class is in the repurposing of class time into a workshop where students can inquire about lecture content (which they have already seen online), test their skills in applying knowledge, and interact with one another in hands-on activities.

During f2f lecturers become coaches or advisors, encouraging students' individual inquiry and collaboration.

Note that the flipped classroom approach is not the same as Flipped learning - the Flipped Learning model deliberately shifts instruction to a learner-centered approach, where in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities.



First read about what the flipped classroom is and how it can be an effective approach to learning then follow the steps below...

### 4.1 Plan your course outcomes

You'll first need to:

- Start with the end in mind – design your intended learning outcomes (ILOs).
- What types of activity / pedagogic approaches (online or face-to-face) are most appropriate to address the ILOs e.g. problem-based learning, discussion, practical work.
- What tools and resources are appropriate and available?
- What will your role be - this may change at times from "sage on the stage" to "guide on the side"
- Determine which materials should be delivered in the f2f component of your course and which items can be delivered online. Select items that are relevant to course objectives and student learning experiences
- Accommodate different types of learners. Provide narration and text when videos are used for verbal learners

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## 4.2 Prepare your online material

The video lecture is often seen as the key ingredient in the flipped approach, either created by the lecturer and placed online or selected from an existing resource BUT remember with mobile technology the online component can be much more – vlogs, discussions, collaboration and reflection.

- Create your own videos/screen capture and stream from Ensemble. First create a script, then capture video material using various software such as ExplainEverything, Snagit, Camtasia, etc
- Use preparatory material – for example from iTunesU / YouTube / Lynda.com
- Keep videos short – no more than 5 minutes each!

## 4.3 Create your structure in your VLE

Decide how will activities be sequenced and linked, so that face-to-face and online components are integrated and the online part does not just appear as an optional or unrelated add-on

- When presenting audio or video, include a brief description and information about the length.
- Incorporate any activities required online such as discussions, self-assessment questions or reflective blogs Think about adding quizzes in between videos to test knowledge

## 4.4 Delivering your module

Remember - Although the idea is straightforward, an effective flip requires careful preparation. Recording lectures requires effort and time on the part of lecturers, and out-of- class and in-class elements must be carefully integrated for students to understand the model and be motivated to prepare for class. As a result, introducing a flip can mean additional work and may require new skills for the lecturer, although this learning curve could be mitigated by entering the model slowly.

The flipped model puts more of the responsibility for learning on the shoulders of students while giving them greater impetus to experiment.

## 5 Appendix – Online teaching

### 5.1 Be “Present” at the Course Site

Learners bring their own needs and experiences to a learning situation and are ready to act according to those needs. We must incorporate those needs and experiences into learning activities to help students take ownership and responsibility for their own learning.

Rich environments for active learning

- promote study and investigation within authentic contexts
- encourage the growth of student responsibility, initiative, decision making, and intentional learning
- cultivate collaboration among students and teachers;
- utilize dynamic, interdisciplinary, generative learning activities that promote higher-order thinking processes to help students develop rich and complex knowledge structures;
- and assess student progress using realistic tasks and performances
- provide learning activities that engage students in a continuous collaborative process of building and reshaping understanding as a natural consequence of their experiences and interactions within learning environments that authentically reflect the world around them.

The "best online" faculty – according to students – are faculty who show their presence multiple times a week, and at best daily. Setting clear expectations at the beginning of a course with course policies is very helpful, however and can reduce the need for daily presence if that is not your particular style. Setting regular times when you can meet in a virtual classroom, and thus be available – almost in real time similar to office hours, can be invaluable.

### 5.2 Create a supportive online course community

A good strategy for developing a supportive online course community is to design a course with a balanced set of dialogues. This means designing a course so that the three dialogues of faculty to student, student to student and student to resource are about equal.

Here are three strategies that can be used to encourage peer-to-peer, student-to-student engagement and thus the building of a course community,

- Launch the class with a personal introduction posting so that students can get to know one another and you get to know "where students' heads are." The types of info often shared by faculty and students include info on professional experiences, personal information such as family/friends/pets, and a photograph. Faculty also often include a note about their teaching philosophy and research projects
- Encourage use of a general open student forum for students to post and request help and assistance from each other through the various student-to-student tools, such as discussions, help areas, etc.
- Set up small groups where students can assume responsibility for supportive mentoring of fellow students and summarizing key points of a class assignment. The students might work in groups of 4-5. This strategy is similar to a study group. (This may be something you want to try with the data analysis assignments.) If you want to do this, ask Susan for help.) Set up problem-solving forums or discussions boards, and assign students or student teams to monitor and support or direct questions.

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Note: Learning within the setting of an online course community will work better for some students than for others. Some students may choose not to participate very actively at all (lurkers); other students find it is the best way for them to learn in an online setting. The point of this is that for those students who need it, it is essential part of how they learn. Vygotsky's theories remind us of how much we learn as social beings within a social context. The online community is part of what makes this happen for some students.

Share a set of very clear expectations for your students and for yourself as to

1. how you will communicate and
2. how much time students should be working on the course each week.

This best practice cannot be overemphasized. Include on your course site a set of expectations for how students communicate and dialogue online and how they communicate with you. For example, many faculty tell students that they can expect a response within 24 hours during the week.

Online learning is just as intensive as learning face-to-face, and time to do the work needs to be scheduled and planned for, just as if one were attending face-to-face classes. Being clear as to how much effort and time will be required on a weekly basis keeps surprises to a minimum.

Use a variety of large group, small group, and individual work experiences. A community works well when there are a variety of activities and experiences. Online courses can be more enjoyable and effective when students have the opportunity to brainstorm and work through concepts and assignments with either one or two or more fellow students. At the same time some students work and learn best on their own. So, building in options and opportunities for students to work together and individually is highly recommended.

Working in teams is particularly effective when working on complex case studies or scenarios for the first time.

Use both synchronous and asynchronous activities. When online courses were first introduced, they were almost totally asynchronous – an updated version of the distance learning courses by correspondence. Now we have course management systems and virtual live classrooms that make it possible to do almost everything we do in campus classrooms. Plus we can often engage learners in more collaborative and more reflective activities.

Sometimes there is nothing better than a real-time interactive brainstorming and sharing discussion; other times the requirement to think, plan, write and summarize is what makes learning most effective for an individual. The variety of activities that are now possible online makes it possible to create many types of effective learning environments.

For example, in many financial and statistical courses, real time problem-solving and question and answer review sessions can be very effective learning experiences. While working professionals often choose to complete advanced degrees online so that they can make use of the asynchronous, anytime, anywhere features of a program, these same learners enjoy getting together from anywhere at a specific time to interact in real time.

Early in the course – ask for informal feedback on "How is the course going?" and "Do you have any suggestions?"

Course evaluations have been called "post mortem" evaluations as they are done after the fact, and nothing can be changed to increase satisfaction or facilitate learning. Early feedback surveys or just informal discussions ask students to provide feedback on what is

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working well in a course and what might help them have a better course experience. This early feedback is done early in the course so corrections and modifications can be made. It is an easy opening for students who might have comments or suggestions or questions.

Prepare Discussion Posts that Invite Questions, Discussions, Reflections and Responses. Discussions in an online course are the equivalent of class discussions in a face-to-face class. A key difference, of course, is that these discussions are asynchronous, providing time for thought and reflection and requiring written /and or audio responses that become part of a course archive.

The communication tool that is the heart and soul of the online course community is the discussion board. Very simply, the discussion board is the primary place where faculty talk to students and students talk to other students.

This is the place where students and faculty get to know one another; this is the tool that helps a widely dispersed group of students and faculty become a learning community.

Discussions might be designed for one of the following purposes (Painter, et al., 2003; and Goodyear et al 2003, cited in Grogan, 2005):

- Provide an open question and answer forum
- Encourage critical or creative thinking
- Reinforcing domain or procedural processes
- Achieve social interaction and community building-- have the students get to know each other personally and intellectually
- Validating experiences
- Supporting students in their own reflections and inquiries

Focus on content resources and applications and links to current events and examples that are easily accessed from learner's computers. If content is not digital, it is as if it does not exist for students. This means that the content that students will more likely use is that content and applications that are available from their computers. Students want to be learning anywhere, anytime and often while they are doing other things, such as driving, exercising, etc. Carrying around large, heavy textbooks feels like an anachronism.

For many courses and disciplines, however, textbooks are not yet available in digital form, so this best practice applies mostly to supplementary resources and to library resources. A reference document with detailed instructions on accessing library resources is included in most courses. Additionally, a key member of the instructional team is the library reference person assigned to supporting online learners.

Students enjoy seeing how what they are learning links to current news events. Thus, building into a course discussions and links to current events is often motivating to learners.

So, this best practice includes the following: "Encourage students to help make the best use of the world of Internet resources." Here are some ideas.

Enlist student assistance in identifying high quality content that is available online.

- This can include tutorials, simulations and supplementary stat material online.
- Incorporate into assignments and discussions how the various statistical tools are used in professional situations and in decision-making. Include examples of when and why they helped and perhaps when they went awry.

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Combine core concept learning with customized and personalized learning. This best practice combines a number of basic learning principles, explained in length in other resources. Very briefly, it means that faculty identify the core concepts to be learned in a course -- the performance goals -- and then mentor learners through a set of increasingly complex and even customized projects applying these core concepts.

A popular new teaching and learning theory advocates making students' thinking visible. Making our thinking visible requires students to create, talk, write, explain, analyse, judge, report and inquire. These types of activities make it clear to students themselves, to the faculty, and to fellow learners what students know or don't know, what they are puzzled about and about what they might be curious. Such activities stimulate student's growth from concept awareness to concept acquisition.

Discussion forums, blogging, journals and small group work are all excellent strategies for engaging learners in clarifying and enlarging their mental models or concepts and building links and identifying relationships.

Plan a good closing and wrap activity for the course. As courses come to a close, it is easy to forget the value of a good closing experience. In the final weeks of a course, students are likely to be stressed and not take the time to do the lists and the planning that can help reduce stress and provide a calming atmosphere.

Here are a few hints for closing out a course experience with style and panache.

- take time to remind students of what's next and when assignments and readings are due. announcements of this type provide a "to do" list and schedule for the learners. By implication this list provides a helpful "to do" list and schedule for you! as always, it is good to post such reminders in two or more places on the course site, and make references to it when you are present.
- Plan the Ending of the Course Experience. A well-designed ending of a course provides opportunities for reflection and integration of useful knowledge. It is also a time to wrap up positive social and cognitive experiences.

End-of-course experiences often include student presentations, summaries and analyses and provide insights into just what useful knowledge students are taking away from a course.

## 6 Appendix – Assessment rules

### 6.1 Student responsibilities

The University expects the student, both at the point the student originally registers, and at the point at which the student commits to a particular module of study, to honour the commitment. When agreeing to a module or course, the student is accepting that he or she is able to meet the necessary commitments for:

- attending classes and other scheduled events;
- managing any private study commitments; and
- meeting the stated dates of assessment (either examination dates or deadlines for the submission of work for assessment),

as outlined in course documentation provided to the student through the course handbook, website or virtual learning environment.

The University encourages the students to take full responsibility for their learning: while it permits the students to take control of their studies and assessment in advance, it has strict rules relating to the consequences without prior approval, of:

- failure to attend formal examinations; or
- late submission of work for assessment; or
- failure to submit work for assessment.

#### 6.1.1 Participating in scheduled assessments – the concept of 'fit to sit'

In submitting work for assessment or attending an examination, the students are declaring themselves as 'fit to sit' (i.e. that they are capable and competent to undertake the assessment and therefore that they have determined that any relevant exceptional circumstances will not adversely impact on their ability to undertake the assessment).

If they do not feel able to attend an examination or complete an assessment for whatever reason, they must raise this in advance through the exceptional circumstances procedure.

Exceptionally, the University will consider requests after examination dates or submission dates, but will not do so once marks have been released for the assessment (even if the students subsequently are deemed to have performed badly). If a request is made following the examination or submission date, and the University does not accept that the circumstances could not have been managed proactively, this may have serious consequences for the ongoing studies.

#### 6.1.2 Managing the impact of personal circumstances on scheduled assessments

Where personal pressures result in the students concluding in advance that they cannot commit to the pattern of studies they have previously agreed to, they are expected to take responsibility for resolving these in good time. Some of the options available are outlined in detail in Section 6.10.4 (i.e. deferrals and extensions) but the students should also consider options detailed in the Student Handbook on Changes to Registration, including:

- suspension of studies;
- switching from full-time to part-time registration;
- switching to an alternative award (e.g. changing from an intention to receive an MSc to a Postgraduate Diploma or Certificate).

Such options should be discussed with the academic Lead but any changes to registration or requests for exceptional circumstances will not be considered until submitted in writing.

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Further advice on options can be discussed with independent staff as well, including:

- staff in Education Services (including the Assistant Registrars and staff in the Student Advice Centre);
- staff and students in the Cranfield Students' Association (CSA);
- staff across the University who have been appointed as Learning Support Officers and/or
- Dignity at Study Advisers.

### 6.1.3 Failure to attend or submit an assessment – risk of award failure

There are serious consequences if the students fail to complete scheduled assessments, and do not arrange in advance a modification to their pattern of studies and/or assessment.

Failure to attend an examination (without prior approval) will result in the students failing to be awarded the learning credits associated with the examination. Students will normally be permitted one further assessment opportunity, but their mark will be capped at 50%.

Failure to submit an assignment by the specified deadline (without prior approval) will result in the mark being capped at 50% if submitted within one week of the specified deadline. Thereafter the assessment will be formally recorded as the student failing to be awarded the learning credits associated with the assignment. The student will normally be permitted one further assessment opportunity, which must be submitted by the stated deadline provided by the course director, with the mark capped at 50%. Any late submission will result in an outright fail of the assessment - there is no one week grace period for resubmissions.

Subsequent failures to attend examinations or to submit assignments (without prior approval) will automatically result in the loss of learning credits, and accordingly will result in award failure.

Failure to submit a thesis by the specified deadline (without prior approval of an additional writing up period) will result in the work being capped at 50% if submitted within one week of the specified deadline, and thereafter the assessment being formally recorded as failing to be awarded the learning credits associated with the thesis, and accordingly will result in award failure. There is no one week grace period for the submission of Corrections or theses that have been referred for Revise and Represent outcome.

## 6.2 Definition of assessment types

“Assessment” is the generic term for all student work that contributes formally toward taught course awards. All assessments are categorised as:

- an examination is a time-limited, real-time assessment under controlled conditions which will assess the student's skills, understanding and/or knowledge. Examinations are usually undertaken as part of a cohort and under invigilation (either by appointed persons or through regulated IT systems) or in an isolated one-to-one formal environment (i.e. an oral examination); or
- an assignment is an assessment that does not take place in controlled conditions and takes place in either private study time or scheduled classes and is submitted by a specified deadline, this includes written pieces of work, tasks, essays, reports, drawings, pieces of computer code, prototype designs and posters; or
- a Group project is an assessment based, either in full or in part, on the group work of two or more students. This may include group presentations or group assignments

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and part group work/part individual assignment. Depending on the assessment used students may receive a group mark, an individual mark or a combination of both; or

- a thesis is an extended piece of written research, design, development or management studies, usually only applicable for a full Masters award. (This may also be referred to as project, portfolio or dissertation).

Assessments are designated as:

- Taught assessments – an examination or assignment (usually relating to assessments linked to 'taught modules') which the students are required to complete and attain the minimum mark. The pass mark for all assessments is  $\geq 50\%$ : additionally there is a minimum mark specified for each assessment (of either 40% or 50%), which is required in order to gain the associated learning credits. Where an assessment has a minimum mark of 40%, marks in the range of 40-49% will be automatically compensated by higher marks in other taught assessments. At the discretion of the Board of Examiners or by Board of Examiners Chair's action a student may be permitted to retake assessments between 40-49% with support of and rationale provided by the course director.
- Substantial pieces of assessment – A group project or other substantial piece of assessment corresponding to  $\geq 40$  credits and is not part of the taught assessment, which the students are required to pass ( $\geq 50\%$ ) in order to qualify for their intended award. A mark of  $< 50\%$  cannot be compensated by higher marks in other assessments.
- Thesis – usually related to an independent research project, and corresponding to  $\geq 65$  credits, which the students are required to pass ( $\geq 50\%$ ) in order to qualify for their intended award. A mark of  $< 50\%$  cannot be compensated by higher marks in other assessments.

### 6.3 Pass criteria for an overall award

In order to achieve their award, the students are required to achieve:

- An overall average mark of  $\geq 50\%$ ;
- An average mark of  $\geq 50\%$  across the taught assessment;
- All assessments need to be completed and the minimum mark attained: no more than one failure to complete an assessment will be permitted throughout the course of the studies;
- 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 the students fail to attain the minimum mark for up to 30 learning credits, they 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  $\geq 50\%$  across the taught assessments);
  - if, having failed to attain the minimum mark for 30 learning credits, the students fail to obtain the minimum mark for any additional learning credits over the course of their studies they will be disqualified from the right to re-take the assessments: this will normally result in intended award failure.
  - it is not permissible for the students to fail an elective module and then proceed to take a different elective module in its place.
- For Substantial pieces of assessment (corresponding to  $\geq 40$  credits, which are not part of the taught assessment average), the pass mark of  $\geq 50\%$  (where they exist);

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- For the thesis, a mark of  $\geq 50\%$  in order to receive a pass (where it exists). In all cases, the average mark is calculated by taking into account the relative weighting of the associated learning credits, and the proportionality of individual assessments within a module, as outlined in the course specification.

Where the students do not qualify for an award (taking into account the discretionary powers of the board of examiners), and the board of examiners decide to support a continuation of studies in order for the students to meet the required standards, exceptional permission may be granted by Senate's Education Committee (who may delegate cases to its individual members).

The required credits for the award will be outlined in the course handbook.

## 6.4 Pass criteria for individual assessments

The course handbook will detail the minimum marks for the assessments. The course may have modules which contain assessments with both 40% and 50% minimum marks for assessments. The pass mark for all pieces of assessment is 50%.

All pieces of assessed work are marked out of 100 (or are converted to marks out of 100 prior to being confirmed by the board of examiners). Marks are recorded either as integers or to one decimal place but modules will be rounded and recorded as integers on transcripts. The convention of rounding up the decimal place digit of  $\geq 5$  will apply. For example 57.3 will be rounded to 57, 57.7 will be rounded to 58 and 57.5 will be rounded up to 58.

The mark for any re-sit assessment will be capped at 50%, with no candidate able to attain a higher mark for that re-sit assessment. Re-sit marks of less than 50% will be recorded as final marks. For example, a re-sit mark of 70% would be capped at and recorded as 50%, a re-sit mark of 44% would be recorded as 44%.

### 6.4.1 Taught assessments (pieces of assessment corresponding to <40 credits)

- A mark of  $\geq 50\%$  is required to pass the assessment, however:
  - the stated minimum mark for each individual assessment must be attained (this is normally 40% but in some cases will be clearly stated as 50%);
  - where the stated minimum mark is 40%, a mark of 40-49% will be automatically compensated providing that overall the average mark (including the failed assessment(s)) is  $\geq 50\%$ : a mark of <40% will require the assessment to be re-taken;
  - where the stated minimum mark is 50%, a mark of <50% will require the assessment to be re-taken;
- The marks of a re-take (or re-submission) of an assessment will be capped at 50%. Providing the minimum mark is met, re-take marks within the range of 40-49% will be automatically compensated providing that overall the average mark (including the failed assessment(s)) is  $\geq 50\%$ ;
- Any re-take assessment will be of the same assessment type as the original failed assessment and be either:
  - a new (and different) examination; or
    - a new (and different) piece of submitted work;
    - a revision of the work submitted originally.
- A first instance of a failure to submit or attend an assessment would be permitted a further opportunity to submit or attend, but the marks obtained will be capped at 50%. Further instances of failure to attend or submit across the course would not entitle the

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students to any further assessment opportunities and would normally mean that the students would not gain the credits and therefore would fail the award.

- Failure to attain the minimum mark or failure to submit on the second attempt would normally mean that the students would fail the module and the intended award.

#### **6.4.2 Substantial pieces of assessment (pieces of assessment corresponding to $\geq 40$ credits)**

- A mark of  $\geq 50\%$  is required to pass the assessment. A mark of 40-49% cannot be compensated by performance in other modules.
- A mark of  $< 50\%$  will normally result in an opportunity to re-take the assessment or an opportunity to revise and represent the original work (this will be defined in the course handbook), in both cases with the re-take mark capped at 50%. The board of examiners reserve the right to fail a mark of  $< 40\%$  without a second assessment opportunity.
- A first instance of a failure to submit or attend an assessment would be permitted a further opportunity to submit or attend, but the marks obtained will be capped at 50%. Further instances of failure to attend or submit across the course would not entitle the students to any further assessment opportunities and would normally mean that the students would not gain the credits and therefore would fail the intended award.
- Failure or failure to submit on the second attempt would normally mean that the students would fail the intended award.

#### **6.4.3 Thesis (or other outcome from an individual research project)**

A mark of  $\geq 50\%$  is required to pass the assessment. The possible assessment outcomes for taught course theses are:

- An outright pass ( $\geq 50\%$ )
- A pass mark subject to corrections
- An opportunity to revise and represent the thesis
- An outright fail

##### **6.4.3.1 A pass mark subject to corrections**

The board of examiners may provide a pass mark subject to corrections of the thesis to be made by the student before that mark is confirmed. Any corrections will be provided in a written 'Statement of Corrections'. Corrections should be required in situations in which a thesis has met the required standard for a Masters degree except for unacceptable aspects of presentation which must be improved before a pass can be confirmed.

Corrections may be required to:

- amend tables, references, figures, graphs, usually to make things clearer or to correct an error or omission (e.g. units in a table or sourcing errors);
- reword sentences/paragraphs to make the meaning clear or to correct an erroneous or misleading statement;
- preserve anonymity of individuals and companies if inappropriately revealed.
- Corrections should not be used to improve the general quality of theses which have achieved a pass mark. The assignment of corrections would not be expected to be the norm. The required work will require little or no input from the student's thesis supervisor other than to confirm the corrections have been completed satisfactorily.

#### **6.4.3.2 An opportunity to revise and represent the thesis**

If not awarded a pass (either outright or subject to corrections) the students will normally be offered an opportunity to revise and represent their thesis, in line with a written 'Statement of Deficiencies' provided to them. The second opportunity will be assessed in line with this Statement and the final mark capped at 50%. The board of examiners reserves the right to fail a mark of <40% without a second assessment opportunity.

#### **6.4.3.3 An outright fail**

Failure to submit the thesis by the stated thesis-handing-in-date (or within a week, where the mark will be capped at 50%) will normally result in an award failure, with no opportunity for the thesis to be examined, unless an additional 'writing up period' or extension to registration has been requested in advance through the Course Director or academic lead.

Failure to submit corrections or revisions to the original thesis by the stated thesis-handing-in-date will also normally result in an intended award failure.

### **6.5 Re-take opportunities for assessments**

This section relates to circumstances where a second opportunity to take a taught assessment has been granted, and the specific rules that apply in those circumstances.

The course team will monitor progression throughout the course and as such the students may not be offered a re-take if it is clear that they will be unable to qualify for their intended award, whatever their performance in a re-take assessment might be. In such circumstances the academic lead or Course Director will outline where the students are failing to make academic progress, the likelihood of them failing the course and may advise what options are available to them to exit with a lower award. The academic lead or Course Director may recommend that the students withdraw from the course. Further information on withdrawal will be available in the Student Handbook on Changes to Registration.

#### **6.5.1 Re-take criteria**

Students will normally only be offered a re-take opportunity in the following circumstances:

##### **6.5.1.1 Taught Assessments (<40 credits):**

- Where the students fail to achieve the minimum mark at the first attempt, providing that the students have not failed to achieve the minimum mark for >30 credits across their course.
- At the discretion of the Board of Examiners or by Board of Examiners Chair's Action, where the minimum mark is 40%, and at a first attempt the students have a score of 40-49% which is not compensatable (if their overall taught mark is <50%).
- Where the students fail to submit or complete an assessment at the first attempt, providing this is the only occurrence of this during the course.
- In all cases, the students are only able to re-take a maximum of 30 credits across the taught element of their course.

##### **6.5.1.2 Substantial pieces of Assessment (≥40 credits):**

- Where the students fail to achieve the pass mark (50%) at the first attempt.
- Where the students fail to submit or complete an assessment at the first attempt, providing this is the only occurrence of this during their course.

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### 6.5.1.3 Thesis (≥65 credits):

- There is no formal re-take opportunity for theses. However examiners are able to ask that the students revise and represent their thesis if they feel it has the potential to meet the pass mark (50%).

### 6.5.2 Failure to complete an assessment on the first occasion

If the students fail to attend an examination or fail to submit an assignment without prior consent, this will be recorded as a 'failure to complete the assessment'.

'Failure to complete the assessment' means that the students will not receive the learning credits for that assessment/module. If the students fail to complete the assessment on one occasion, the students will normally have a further assessment opportunity classed as a second attempt and capped at 50%. If the students subsequently "fail to complete the assessment" on a second occasion, the students will not receive the learning credits and accordingly will not be eligible for their intended award.

This does not apply to the thesis: if the students fail to submit the thesis, the students will not be provided with a second attempt at the individual research project.

### 6.5.3 Number of attempts

For any one assessment, the students are permitted no more than two assessment opportunities (unless exceptional circumstances are agreed). The students may not automatically be given a second assessment opportunity if their performance in other modules means that they will be unable to complete their intended award. The re-take will normally be scheduled within the same academic year but may take place in the following academic year or later depending on the mode of study and course schedule.

If the students have passed a particular assessment, the students are not permitted to re-take it to improve their mark, unless the students have been required to do so following a formal appeal.

Where the students are permitted a re-sit due to exceptional circumstances, this will be classed as a further first attempt.

### 6.5.4 Nature of the second attempt

All second attempts at taught assessments (including those granted as a result of failure to complete the assessment on the first occasion) are automatically capped at 50% (i.e. in essence, the second attempt is restricted to a pass/fail outcome).

Boards of examiners reserve the right to award >50% for a re-taken assessment, but only if information not previously disclosed has been agreed.

Where the students have made more than one attempt at the same taught assessment, the final mark obtained will always be the higher of the two assessment opportunities (subject to any cap).

### 6.5.5 Modules with more than one taught assessment

Modules with more than one taught assessment may be categorised as either independent assessments or a single multi-part assessment. The following table outlines how either a failure to achieve the minimum mark or failure to complete the assessment is treated in these circumstances:

Independent assessments	Independent assessments
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e.g. three separate assessments, outlined in the module descriptor (10 credits) as: A assignment 25% B assignment 25% C assignment 50%	e.g. three assessments, but outlined in the module descriptor (10 credits) as: assignment 100%
<b>Example 1:</b> marks obtained 45% 20% 55% <b>outcome:</b> overall mark of 44%. minimum mark for overall assessment attained – but assessment B must be re-sat. The mark for assessment B will be capped at 50%.	<b>Example 1:</b> marks obtained 11/25 5/25 27/50 <b>outcome:</b> overall mark of 43%. minimum mark for assessment attained: assessment 2 does not need to be re-sat.
<b>Example 2:</b> marks obtained 45% 20% 42% <b>outcome:</b> overall mark of 37%. minimum mark for overall assessment not attained – but <b>only</b> assessment B must be re-sat. The mark for assessment B will be capped at 50%.	<b>Example 2:</b> marks obtained 11/25 5/25 21/50 <b>outcome:</b> overall mark of 37%. minimum mark for assessment not attained – and all assessments must be re-sat, with the re-sit mark capped at 50%
Failure to submit one or more of the three assignments would count as one instance of a failure to complete the assessment, and the one opportunity to be allowed to re-sit the assessment(s).	Failure to submit one or more of the three assignments would not require remedial action if the absence of the marks for that assignment still result in meeting the minimum mark for the assessment (whether 40 or 50% as appropriate).
The failure above (highlighted in red) corresponds to 2.5 learning credits (for the purposes of the stated 30 credit limit on re-take opportunities).	The failure in example 2 above (highlighted in red) corresponds to 10 learning credits (for the purposes of the stated 30 credit limit on re-take opportunities).

## 6.6 Assessment conventions and standards

### 6.6.1 Anonymity

Where practicable, the University implements mechanisms to allow for the anonymity of candidates during the marking process. This anonymity is not extended to consideration at boards of examiners (where exceptional circumstances recommendations may be considered) although there is the facility to do so.

Across the University, it is common for written examination scripts to be identified by the University's student number (rather than candidate name) in order to provide a reasonable barrier to unintended consideration of the candidate other than the quality of the completed assessment.

Mechanisms for anonymity of assignments vary in view of the need to balance the benefits of providing assurance of objective assessment against the effectiveness of providing formative feedback and support to students. In order to ensure that examiners are applying assessment criteria consistently, the University has a robust moderation process.

### 6.6.2 Moderation of marking

All elements of assessment are moderated; the University uses two forms of moderation:

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- Sampling moderation applies for most assessments (e.g. examination scripts and assignments). A sample of at least 10% of the total number of assessments for the piece of work or 5 pieces of work, whichever is the larger is moderated. In addition, normally all pieces of work receiving 52% or less by the first marker are moderated to ensure that there is full scrutiny of borderline assessments. The moderator will review the marks, range of marks and comments by the first marker to ensure that they reflect the outputs as measured against the model answer and/ or marking scheme.
- Double marking applies to all theses and normally for pieces of assessment >20 credits and/or alternative pieces of assessed work. Double marking means that at least two examiners or markers will independently review and mark the work.

### 6.6.3 External examiners

External examiners are appointed for all taught courses in order to provide confidence that the quality and standards of the degree are appropriate and consistent across the UK.

External examiners work alongside the other examiners to ensure fairness and conformity to the published assessment criteria. In the course of the assessment, students may be asked to meet the external examiners, to help them understand both the individual's performance and the provision as a whole. External examiners have the right to see all assessments and will be provided with a representative sample in the first instance to enable them to determine that internal marking and classifications are of an appropriate standard and are consistent.

As part of their duties, all external examiners produce an annual report for the University, outlining their views on the standards and quality of the course and its assessment. These reports are available on request to students from the Course Director or from Education Services. Please note that these reports are not written directly to benefit the students and that reports held will usually relate to previous years of the course, and not to the own year of provision.

### 6.6.4 Assessment feedback

The students should receive an appropriate level of general and/or individual feedback on all assessed work to promote learning and facilitate improvement.

For taught and substantial summative assessments, feedback is provided to the students within 20 working days of the submission date. However, where an extension to an assessment has been requested it is not always possible to provide feedback within the 20 working day period and therefore feedback will be provided no later than 40 working days after the agreed submission date.

The type of feedback the students will receive will depend on the type of assessment and will be defined by the course team. Feedback can include:

- Marks for the work provided in accordance with the qualitative descriptors detailed below
- Individual written feedback, outlining strengths and weaknesses of the assessed work; this may be provided on a feedback form, a written report, or via email
- Group written feedback, provided as reflective feedback on the assessed work
- Provision of exemplars, so that the students can reflect on how to improve their own work
- Individual oral feedback, particularly for small cohorts or individual presentations
- Group oral feedback, such as revision lectures or post-assessment workshops

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### 6.6.5 Errors in assessment

Where an assessment has failed to take place or has not taken place properly, and the University is liable for the errors, all affected candidates will be offered an additional assessment opportunity of the same type, as if the assessment with the error had not taken place (i.e. the erroneous assessment will not count as an assessment opportunity).

In very exceptional circumstances, the examiners may, in consultation with the Director of Education, agree instead to condone this piece of assessment. This means that the mark for this assessment will not be used to calculate the intended award but the credits will be awarded.

### 6.6.6 Alternative assessments

Assessments are generally prepared for cohorts of students. A re-take is normally prepared at the same time as the original assessment and reviewed by the external examiner; this helps ensure that, even where the re-take has to be delayed for some time, it should cover only those topics that were included at the time that the course was taken. Alternative assessments (e.g. coursework instead of an examination) can only be approved in exceptional circumstances, including (but not limited to):

- learning support reasons following the creation of a Learning Support Agreement with a Learning Support Officer
- disruption to group project assessments where alternative assessments are required for either individual candidates or a group of individual candidates to enable the assessment of a module to be completed.

### 6.6.7 Appeals against decisions of boards of examiners (academic appeals)

Academic appeals relate either to the decisions of the board of examiners about awards, or the decisions of markers about individual modules, and the processes by which they have come to those decisions. Appeals which are based on claims of inadequate or insufficient teaching or learning support will not be considered, and should be addressed through the student complaints procedure.

Failure to achieve the students' intended academic award does not grant the students an automatic appeal. Students must provide a written statement within 20 working days of the notification of the result, outlining the reasons the students believe the assessment process has not been appropriate, and clearly stating which grounds the appeal relates to. Details of the permissible grounds, the appeals process and contacts who can offer support and advice will be available from the Senate Handbook: Student Handbook Academic Appeals (Taught Courses).

## 6.7 Qualitative assessment criteria

Marks for all assessments are awarded in accordance with the qualitative assessment criteria:

Mark Range & Standard	Criteria / Descriptors (N.B. not all may apply for each piece of work or type of assessment)
80% - 100% Excellent	Demonstrating a comprehensive knowledge and understanding of the subject and subfields. All stated intended learning outcomes exceeded. High capacity for critical evaluation.

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	<p>Novel application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken extensive further reading.</li> <li>• Produced a well-structured piece of work.</li> <li>• Demonstrated excellent communication skills.</li> <li>• Exercised a high level of original thought.</li> </ul>
70% - 79% Very Good	<p>Demonstrating an extensive knowledge and understanding of the subject and subfields. All stated intended learning outcomes met, with many exceeded. Very good capacity for critical evaluation. Effective application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken substantial further reading.</li> <li>• Produced a well-structured piece of work.</li> <li>• Demonstrated very good communication skills.</li> <li>• Exercised a significant level of original thought.</li> </ul>
60% - 69% Good	<p>Demonstrating a good knowledge and understanding of the subject and subfields. All stated intended learning outcomes met, with some exceeded. Good capacity for critical evaluation. Competent application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken some further reading.</li> <li>• Produced a well-structured piece of work.</li> <li>• Demonstrated good communication skills.</li> </ul>
50% - 59% Satisfactory	<p>Demonstrating a satisfactory knowledge and understanding of the subject and subfields. All stated intended learning outcomes met. Standard critique of the subject matter. Adequate application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken adequate further reading.</li> <li>• Produced an adequately-structured piece of work.</li> <li>• Demonstrated basic but satisfactory communication skills.</li> </ul>
40% - 49% Poor	<p>Demonstrating an inadequate knowledge and understanding of the subject and subfields. Most stated intended learning outcomes met. Lacking critique of the subject matter. Limited application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken some relevant reading.</li> <li>• Produced a piece of work with a simple structure.</li> <li>• Demonstrated marginal communication skills.</li> </ul>
0% - 39% Very Poor	<p>Demonstrating a lack of knowledge and understanding of the subject and subfields. Many stated intended learning outcomes not met. Absence of critique of the subject matter. Lacking application of the subject matter to a specific context. Requiring a student to have:</p> <ul style="list-style-type: none"> <li>• Undertaken inadequate reading.</li> <li>• Produced a poorly-structured piece of work.</li> <li>• Demonstrated poor communication skills.</li> </ul>

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## 6.8 Examination procedures

Examination dates will be set in advance and published in the course handbook.

It is the students' responsibility to check the timetable and ensure that they are aware of the examination dates and locations.

### 6.8.1 Types of examination

- Closed Book Examinations: books or notes may not be taken into the examination.
- Open Book Examinations: any books may be taken into the examination, but no hand written notes or official handouts.
- Open Note Examinations: official hand-outs and personal notes taken during lectures into the examination may be taken, but no books.

Examinations can be both 'Open Note' and 'Open Book' and limitations may be placed on the number of books/notes per student as stipulated by the examiner in the examination instructions. The same categories can apply to both oral and written examinations.

### 6.8.2 Calculators in examinations

The use of programmable calculators in formal examinations is not permitted. The students are required to buy the University-recommended calculator, Casio FX 83 or Casio FX 85 range. These are the only models which will be permitted in the examination room. The students should have their calculator out on the examination desk for inspection. Calculators other than the prescribed model will be confiscated, and the students will have to sit the examination without the benefit of a calculator. The students should also note that they are responsible for the condition of their calculator and ensuring that the batteries are fully charged.

### 6.8.3 Use of dictionaries

The students are not permitted to take any kind of dictionary into the examination unless approved beforehand. The use of printed non-specialist English and/or foreign language dictionaries is permitted. Electronic dictionaries or a personal organiser containing such a dictionary will not be permitted.

Dictionaries, pencil cases and calculators will be subject to spot checks by the invigilator and/or the examination administrator. Unless otherwise advised, no personal electronic devices (including mobile phones and smart watches) will be allowed into the examination room.

### 6.8.4 Arrival at an examination

- The students must arrive at the examination room at least ten minutes before the scheduled start time of the examination.
- A seating plan will be displayed outside the examination room and the students should sit at the allocated desk.
- The students should display their photographic identification on the top left corner of their desk for checking by the invigilator.
- As all formal written examinations will be marked on an anonymous basis, the students should note their student number for use on their answer book.
- The students may only bring with them approved items necessary for the examination and previously agreed with the examiners. No mobile telephones or other personal electronic devices are permitted. All overcoats, briefcases and other bags must be left at the place set aside for that purpose.

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### **6.8.5 During an examination**

- Smoking is not allowed in the examination room. The students may bring a small tube or packet of sweets, and a small transparent bottle of water, but no other food or drink, into the examination room.
- The following will be supplied: question paper, answer book, graph paper and scrap paper (if required) and any additional materials agreed by the examiners beforehand.
- The students are responsible for checking that they have been issued with the correct examination paper.
- The students should write their student number on the cover of answer books and additional sheets. The students should also write their name on the right hand side of the exam booklet and fold and seal the edge as indicated. Correction fluid should not be used on the answer books.
- The students must obey the instructions set out on the cover of their answer books and any instructions given by the invigilators.
- The students should read through the question paper in its entirety once the examination has started and should raise any questions that arise from the question paper (by attracting the attention of the invigilator) during either the first 30 minutes of the examination or, where there is one, during the allocated reading time (where a period of reading time is allocated this is the only opportunity to ask questions).
- The students must not write on any paper other than that provided.
- If the students wish to attract the attention of the invigilator, they should raise their hand. In no circumstances should the students borrow anything from other candidates or leave their place without permission.
- The students must be silent except when asked to speak by the invigilator or by an examiner.
- The students can be admitted up to 30 minutes after the start of the examination, but if they are late they will not be allowed additional time and will be required to complete the examination at the same time as the other students. If the students arrive late, they should report to the invigilator.
- If the students arrive more than 30 minutes late, they will not normally be admitted to the examination room. The invigilator may in exceptional circumstances allow the students to be admitted to the examination; however, in such cases the relevant examination board will have to approve the inclusion of the marks from this examination in their academic record. If the students are late they will not be allowed additional time and will be required to complete the examination at the same time as the other students.
- The students will not be allowed to permanently leave the examination room until 30 minutes has elapsed from the start of the examination. They are not allowed to leave the examination room during the first 30 minutes or last 15 minutes of an examination, in view of the disturbance caused to other candidates. Where two or more examinations are taking place in one examination room, candidates may be advised that they cannot leave the examination room early in view of the disturbance caused to other candidates.
- If the students leave the examination room temporarily they must be accompanied by an invigilator or nominee. They will not be re-admitted unless throughout the period of the absence they have been under the supervision of a person appointed by the invigilators.

### 6.8.6 At the end of an examination

- At the end of the examination the students must stop writing immediately when instructed to do so by the invigilator.
- If an examination script is found to be missing, and it appears the fault lies with the University, the assessment may be condoned, at the discretion of the board of examiners. This means the students will be awarded no specific marks for the work, but the overall performance will not be affected by the missing material. The students retain the right, if they so choose, to re-take the examination as if for the first time at the next sitting of the examination.
- If an examination script is found to be missing, and it appears the fault lies with a student, the Chair of the Board of Examiners, in consultation with the Academic Registrar, will exercise his or her discretion in dealing with the issue. This discretion may include requiring the student to undertake a re-sit examination as for the first attempt.
- The students may not remove any papers, used or unused from the examination room, including the question paper (unless it has been marked to the contrary).
- The students must not remove any paper from an examination book.

### 6.8.7 Failure to follow assessment instructions

If the students fail to follow the instructions on an examination paper, the board of examiners may at its discretion award a mark of zero, discount one or more answers or apply any penalty outlined by the course team in advance in order for the examination to be considered valid.

In order to receive the credits for an assessment, the students will be required to demonstrate that they have made an attempt to follow the assessment instructions.

Failure to follow assessment instructions is not eligible grounds for an academic appeal.

### 6.8.8 Academic misconduct in examinations

- The students must not, directly or indirectly, give assistance to any other candidate, or permit any other candidate to copy or otherwise read their papers.
- The students must not, directly or indirectly, accept assistance from any other candidate or use any other candidate's papers.
- If the students are suspected of cheating, receiving assistance or assisting other candidates a note will be made of the circumstances by the invigilator and the matter will be reported to the Course Director and to the Chair of the board of examiners. The students will normally be allowed to continue with the examination, but the matter will be reported to the examiners and to the relevant Academic Conduct Officer. Disciplinary action may subsequently be taken in accordance with the Senate Handbook on Academic Misconduct.

### 6.8.9 Exceptional circumstances and alternative arrangements in examinations

- If the students are absent from an examination due to illness they must follow the exceptional circumstances procedure.
- The examiners have full discretion to modify the usual arrangements for examination and assessment to take account of a candidate's particular requirements (e.g. additional time for those with dyslexia, coloured examination papers, use of computers or a personal scribe (amanuensis) in examinations if necessary, etc.). Any candidate wishing to seek approval for such an arrangement should contact their Learning Support Officer in the first instance, normally at least two months in

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advance of the examination (unless exceptional medical circumstances prevent such prior notice) to ensure that sufficient time is available to make the appropriate modifications.

NOTE: It is University policy that students with dyslexia shall be given 25% additional time in formal examinations i.e. an extra 15 minutes per hour in addition to any other recommendations made by an appropriately qualified educational psychologist.

#### **6.8.10 Retention of examination scripts**

Examination scripts will be retained for at least the duration of the period of registration. Examination scripts will not be returned to the students but they can request access to the comments and marks of the examiners. Such comments will normally be communicated through the course team. Access to, or return of copies of, examination scripts to students is at the discretion of individual course teams, taking into account the potential formative learning opportunities this may provide.

### **6.9 Assignment procedures**

#### **6.9.1 Assignments specifications and deadlines**

The course team will provide the students with a coursework or assignment specification for each piece of assessed work which will outline the assignment question, deadline date and mark scheme and will also outline the method of submission and reassessment. Students are required to ensure that the assignment is submitted in accordance with the requirements of the assignment specification by the deadline date or to submit an exceptional circumstances request.

Assignment dates will normally be published in advance in the course handbooks.

#### **6.9.2 Turnitin and assignment submission**

Students are expected to submit written assessments through a non-originality detection system called Turnitin UK, except where expressly advised otherwise by staff. The extent to which Turnitin UK should be used will vary from course to course, and staff will confirm how many pieces of work prior to the thesis students are expected to submit to Turnitin UK.

Note: In exceptional cases, for example if public access to a thesis is restricted, an assessment may be exempt from submission to Turnitin UK. Staff will instead check for occurrences of academic misconduct manually.

Multiple submissions of assessments and theses can be made to Turnitin UK. On each occasion staff and students both have the opportunity to view a report that provides an Overall Similarity Index (OSI) and shows where similarities to other texts appear in the written work. Some staff may limit the number of submissions students can make per assessment.

Please note, Turnitin will only generate one an Overall Similarity Index report per 24 hours. Students are permitted to make as many submissions to Turnitin as they wish up to the submission deadline, however any submission received after the deadline will be considered the final, submitted assignment.

Some Schools require students to submit their work directly to Turnitin UK, whereas others will ask the students to submit via the VLE (Blackboard or Moodle). Details should be in the course handbook or will be available from the course team.

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### **6.9.3 Failure to follow assessment instructions**

If a student fails to follow the instructions for a piece of work submitted for assessment, the board of examiners may at its discretion award a mark of zero, or apply any penalty outlined by the course team in advance.

In order to receive the credits for an assessment, the students will be required to demonstrate that they have made an attempt to follow the assignment specification. The board of examiners may at its discretion award a mark of zero or apply any penalty outlined by the course team in advance. The examiners will use their academic judgment to determine whether the students have made sufficient attempt to be awarded the credit in order for their marks to be compensated by marks in other modules. Failure to follow assessment instructions is not eligible grounds for an academic appeal.

### **6.9.4 Exceptional circumstances and alternative arrangements for assignments**

If the students are unable to submit an assessment they must follow the exceptional circumstances procedure.

The examiners have full discretion to modify the usual arrangements for assessment to take account of a candidate's particular requirements (e.g. additional time, requiring a personal scribe (amanuensis) etc.). Any candidate wishing to seek approval for such an arrangement should contact their Learning Support Officer in the first instance in advance of the assessment to ensure that sufficient time is available to make the appropriate modifications.

### **6.9.5 Retention of assignments**

Assignments will be returned to students with feedback either through the VLE or in hard copy. Copies of assignments submitted electronically will be retained indefinitely.

## **6.10 Thesis procedures**

### **6.10.1 Prescribed form for the presentation of taught theses**

Details of the "Prescribed Form for the Presentation of Taught Theses" will be available on the intranet and provides guidance on the submission and presentation of taught thesis.

Supervisors may advise on the quality of early drafts but may not assist to the extent that the work becomes at least in part, that of the supervisor. The supervisor is not in a position to give a definitive judgment on the overall acceptability of a thesis, as the thesis will be subject to the University's double marking procedures and the final mark will be agreed by the examiners.

### **6.10.2 Thesis submission**

- Students should submit their thesis as directed by their Course Director.
- Final submission of the thesis must include a thesis cover sheet which is generated through a task on the EVE portal.
- When the students have passed their MSc a final clean version of their thesis must be submitted electronically to the Course Director and/or academic lead who will arrange for it to be submitted electronically to the Library.
- If the thesis requires restricted access, the students should also complete the template form for restriction of public access to thesis available on the intranet.

As with assignments, the students will be given a deadline for submission of the thesis and they should request a 'writing up period' through forms available on the Education Services intranet should they require an extension.

### 6.10.3 Retention of theses

Most theses will be stored and published in one of the University's libraries and made available to others through the inter-library loan service. Exceptions to this are where a restriction has been placed for commercial or security reasons, where the thesis has not achieved the pass mark (50%), or at the discretion of the board of examiners, for theses achieving <60%.

### 6.10.4 Exceptional circumstances

The University encourages the students to take full responsibility for their learning and permits them to take control of their studies and assessment in advance. This outlines the processes and procedures the students need to follow to:

- a. request a 'deferral' of an assessment (i.e. to sit an examination or to request the completion of a different assignment at the next available opportunity);
- b. request a short extension to the submission deadline of a current assignment, in advance of the scheduled date;
- c. present 'exceptional circumstances' to explain failure to attend an examination;
- d. present 'exceptional circumstances' to explain failure to submit an assignment on the scheduled deadline (including either a late submission or a failure to submit).

The University permits the students to self-declare 'exceptional circumstances' where they proactively request a deferral to a new and different assessment in the future (case (a) above): please note this is not necessarily an automatic right. Evidence to support personal circumstances will not normally be requested in this case.

Otherwise, the situations outlined in (b) to (d) above require the students to provide evidence of 'exceptional circumstances' to explain the inability to complete the assessment(s) at the scheduled time: failure to provide acceptable exceptional circumstances and/or supporting evidence will result in academic penalties being applied.

In all cases, the students should complete either a deferral form (relating to (a) above) or an exceptional circumstances form (relating to (b)-(d) above) available on the VLE and intranet.

### 6.10.5 Definition of exceptional circumstances

Exceptional circumstances are defined as those which are:

- **Relevant:** the circumstances directly affect the learning and or preparation for the assessment (i.e. occur within the timeframe of the assessment); and
- **Unexpected:** the circumstances were unforeseen prior to the request (i.e. the circumstances should be submitted as soon as they are known); and
- **External:** the circumstances were outside of the students' control and that they could not have reasonably been expected to take action to mitigate the impact of the circumstances.

Exceptional circumstances cannot be used to replace or invalidate academic performance. Acceptance of exceptional circumstances may result in an extension or the students being able to re-take the form of assessment again as a first attempt but will not result in individual marks being raised.

Third party corroborative evidence should be provided to support extension requests but may not be required for deferrals. Acceptable exceptional circumstances include (but are not necessarily limited to):

- serious unexpected illness or injury (usually a short-term condition or accident);
- death or serious illness of a close relative or significant other person;

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- long-term illness or health condition worsening;
- significant and unexpected adverse personal or family circumstances, including (but not limited to) being a victim of crime, or having to travel away from the University;
- unexpected travel disruption (e.g. road traffic/rail accident);
- for part-time students, significant and unexpected pressure from their employer;
- for examinations, religious commitments or observances.

Examples of circumstances which would not be considered exceptional include (but are not limited to):

- Aspects of the learning environment which the students have reasonable control over (e.g. availability of learning resources, deadline conflicts, misreading or misunderstanding assessment requirements/dates; personal computer/printer problems including loss of computer data, submitting the wrong work (or version of the work));
- Aspects of personal life which are not short-term or unexpected (e.g. change of address or employment, personal holidays or travel plans, self-inflicted illnesses (e.g. from substance abuse or sleep deprivation), weddings or similar family events);
- Financial issues;
- Poor time management;
- Foreseeable travel disruption (e.g. short train delays, travel strikes, road-works etc.);
- Routine full- or part-time employment activities;
- Personal conditions that were not disclosed in time for special examination arrangements to be made, but could have been;
- Circumstances where it is more appropriate to consider a suspension from studies (e.g. long-term illness, maternity/ paternity leave, major changes in personal or financial circumstances).

Claims may not be accepted if:

- The circumstances described are not deemed exceptional as outlined above
- The evidence does not cover the relevant period
- The evidence is not supplied by an independent third party
- The evidence does not support the suggested impact of the circumstances
- The evidence does not support the claim.

#### **6.10.6 Requests for adjustments to assessment scheduling due to personal circumstances**

Requests should be made in advance of the assessment date and the students may request:

- a. a deferral of an examination or an assignment (i.e. sit an examination or complete a different assignment at the next available opportunity);
- b. exceptional circumstances to be taken into account, to modify the completion of an existing assessment (including pre-submission requests for short extensions, and post-assessment presentation of circumstances which prevented the students from completing an assessment on time).

Requests relating to the submission of the thesis should be managed through consideration of an extension to registration and/or an application for a writing up period: these are requested instead through the academic lead.

### **6.10.6.1 Deferral requests**

If the students have not attended the module, they may request that they defer attendance and assessment until the next opportunity. If the students have attended the module, they may request that the related assessment is deferred until the next opportunity (which may be in the following academic year).

For each individual piece of assessment the students are only permitted one deferral opportunity. If a deferral is permitted, the students will normally be expected to take that piece of assessment at the next available opportunity.

In both cases, a deferral results in the re-scheduled assessment being considered as the students' first attempt (unless they are already taking the assessment as a second attempt).

Requests for deferrals do not normally require the provision of evidence to support the circumstances behind the request – but must be made prior to the examination date or assignment submission date. They should not assume at the point of the request that a deferral can be permitted, as there may be circumstances where the University cannot practically accommodate the request. Deferred assessments will be marked using the marking criteria in place when the module was originally attended.

Deferral requests should clearly state:

- whether the module or the assessment or both are being deferred
- which assessments the request relates to
- confirmation of the dates for deferral and confirmation of understanding of the impact on registration period

Deferral requests are considered against the following criteria:

- Impact on the students' ability to complete the award including, but not restricted to, consideration of:
  - whether the module will continue in its current format;
  - whether the deferral dates will impact on other taught modules;
  - whether the deferral dates will impact on the thesis;
  - whether the deferral dates will impact on the registration period;
  - whether a suspension is more appropriate, given personal circumstances;
  - whether the module is a pre-requisite;
  - whether there have been any previous deferrals.

The students should note that if the next opportunity is outside of their registration period, this may incur an additional tuition fee (extension fee) or have implications for their visa.

### **6.10.6.2 Exceptional circumstances requests: criteria, evidence and eligibility**

Requests to have exceptional circumstances taken into consideration should clearly state:

- which assessments the request relates to. It is expected that exceptional circumstances will be short-term and as such the requests will only apply to specified assessments. If future assessments are affected, a new request should be submitted.
- a description of the circumstances and (ideally) which category it fits into (see table below).
- evidence to support the circumstances the students are describing (see table below). In all cases, evidence from a third party should normally be provided to support the

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exceptional circumstances described, taking into account where necessary the ability of the culture, systems and infrastructure in other countries to provide such evidence. Requests will only be accepted if all three of the criteria for exceptional circumstances are met.

The students may not submit exceptional circumstances on the grounds of poor performance. In attending an examination or submitting work the students are declaring themselves fit to sit.

Some examples of exceptional circumstances, and the evidence required are:

<b>Exceptional circumstance</b>	<b>Example of Evidence</b>
Serious unexpected illness or injury (usually a short-term condition or accident)	Doctor or hospital note Police incident record University or company health and safety incident form
Death or serious illness of a close relative or significant other person	Death certificate Doctor or hospital note
Long-term illness or health condition worsening	Doctor or hospital note
Significant and unexpected adverse personal or family circumstances, including (but not limited to) being a victim of crime, or having to travel away from the University	Police incident record Letter of support from third party
Unexpected travel disruption (e.g. road traffic/ rail accident)	News report Police incident record
For part-time students, significant and unexpected pressure from their employer	Letter of support from current employer (where this cannot be provided, the contact details of the employer should be provided to enable the University to establish contact)
Religious commitments or observances	Letter of support from religious leader

There are circumstances, however, where the University will take action to accommodate examination incidents and irregularities without the students' intervention, including:

- Examination incident – e.g. the students are taken ill during an examination (this will be reported through the Invigilator report or Examinations Team);
- Shortcomings in provision and/or assessment – e.g. sub-standard teaching and/or support for an assessment for the whole cohort (this is raised through the Director of Education)
- Serious long-term medical incapacity – e.g. the students have a long-term absence from the University but have not pre-arranged the implications for their assessment (this will be raised through the School Assistant Registrar).

Otherwise, all exceptional circumstances requests should be submitted by the students. The students should not wait to gather evidence in order to submit a request. The University will consider requests, and make decisions, subject to the evidence being provided at a later date. All evidence, including subsequently requested evidence, should be provided as soon as possible, and by no later than 20 working days after the submission of the exceptional circumstances request.

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It is the students' responsibility to ensure that the evidence is provided as soon as possible: the University will not normally obtain evidence on the students' behalf.

Evidence must be original. Electronic evidence will be accepted but the original must be available on request. Evidence must be in English. Where evidence is not in English it must be accompanied by a translation certified by a Public Notary, accredited translator (member of the Association of Translation Companies) or a member of Cranfield University Staff (as approved by a Compliance Officer or Registry Manager).

The students may make exceptional circumstances requests after the deadline date but should be aware that the barrier for accepting circumstances after the assessment date is higher and the students will be required to provide a full explanation as to why the circumstances were not raised before. Cases relating to poor time management will not be accepted. The students are therefore encouraged to ensure that exceptional circumstances requests are made before the assessment date.

### **6.10.6.3 Deferral and exceptional circumstances requests: procedures**

All requests should be submitted by the students on the appropriate form, as provided by the academic lead or available on the VLE and intranet.

#### **Requests made prior to examination date or assignment submission deadline**

All requests prior to the assessment date must be submitted through the academic lead. The academic lead will coordinate the consideration of requests with the Course Director. Once a decision has been made, the academic lead will liaise with Registry to ensure that the request and outcome are recorded. Failure to make requests through the academic lead may result in the assessment record being incorrect.

The academic lead in agreement with the Course Director will review the form and will:

#### **Deferrals**

- approve a module deferral; or
- approve an assessment deferral; or
- return the form where the impact of deferral would not enable the students to successfully complete their award and provide advice on options available.

#### **Exceptional Circumstances (short extension request)**

- approve an extension of normally 10 working days up to a maximum of 15 working days, depending on the schedule for the return of marked work; or
- return the form where the grounds for exceptional circumstances have not been met.

Exceptionally, where employers will not provide evidence in writing, Education Services will contact the employer to obtain verbal confirmation of the circumstances described.

Submitting a false claim or fraudulent evidence is a serious matter and will be dealt with under the procedures in the Senate Handbook on Disciplinary Procedures.

The appropriate staff in Education Services will be advised of the outcome, to ensure the students' record is kept up to date. Academic leads, in agreement with Course Directors, can at their discretion approve extension requests pending receipt of evidence and in all cases, the academic leads will check that evidence has been received and that it confirms the

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impact and timeliness of the circumstances on the studies. Decisions can be reversed if evidence is insufficient.

Until such evidence is received, marks will reflect the fact that exceptional circumstances have not yet been approved. This evidence should be provided as soon as possible, and by no later than 20 working days after the submission of the exceptional circumstances request. If evidence has not been received at this point or is insufficient then the mark penalties shall stand and the exceptional circumstances will be rejected.

**Requests made after the examination date or assignment submission deadline**

All requests should be submitted by the students to their academic lead and include in the subject heading: ExCircs and the student's name. The academic lead will liaise with the students and their Course Director in order for all documentation to be completed and submitted to the Compliance team.

The Course Director will be asked to provide a statement (to support the request or otherwise). This will be provided to the students.

Cases must be submitted with:

- third party corroborative evidence, provided by the students;
- a clear and appropriate reason why the exceptional circumstances were not submitted prior to the assessment date, provided by the students.

Requests must be made prior to the release of marks for that assessment, and within 20 working days of the assessment date: later requests will not be considered, except in the case of serious long-term medical incapacity reported through the School Assistant Registrar. The decision to reject late requests should be considered the final decision of the University. The students are therefore strongly advised to submit the request as soon as possible after the assessment deadline to strengthen the case for consideration.

**6.10.7 Possible outcomes of exceptional circumstances requests**

**6.10.7.1 Initial consideration of the request**

Students should not assume that exceptional circumstances requests will be accepted. Non-submission or non-attendance is at their own risk.

Formal notification of the acceptance or rejection of requests will come from staff in Education Services, and may include recommendations in response to the decision.

The impact of the acceptance or non-acceptance of requests for deferrals or exceptional circumstances is outlined in the table below:

<b>Exceptional circumstance request</b>	<b>Result of acceptance of request</b>	<b>Result of non-acceptance of request</b>
Deferral of examination  Retrospectively- authorised absence from examination	Students would attend the next scheduled sitting of the examination.  Students rescheduled examination would be treated as a first attempt unless the examination in question was already deemed a second attempt.	A failure to complete the assessment would be recorded.  A re-take capped at 50% would only be permitted for the first instance of failure to complete the assessment. Subsequent instances would result in the credits

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		not being awarded and award failure.
<p>Deferral of an assignment</p> <p>Retrospectively- authorised failure to submit the assignment</p>	<p>Students would take a new and different assessment at the next available occasion as their first attempt, unless the assignment in question was already deemed as a second attempt.</p>	<p>A failure to complete the assessment would be recorded.</p> <p>A re-take capped at 50% would only be permitted for the first instance of failure to complete the assessment. Subsequent instances would result in the credits not being awarded and award failure.</p>
<p>Extension of assignment submission deadline</p> <p>Retrospectively- authorised late submission of assignment</p>	<p>For requests prior to the submission date, students would be allowed to submit the assessment up to 15 working days later (the revised deadline will be communicated to the students).</p> <p>For requests after the submission date, the late submission penalty would be removed. This would only apply if the work had been submitted (albeit late).</p>	<p>If the work was submitted within a week of the deadline, the mark would be capped at 50%.</p> <p>If the work was submitted after the one-week grace period, a mark of zero would be recorded.</p> <p>If the work was not submitted, a failure to complete the assessment and mark of zero would be recorded.</p> <p>A re-take capped at 50% would only be permitted for the first instance of failure to complete the assessment. Subsequent instances would result in the credits not being awarded and award failure.</p>

Where it is agreed that students can take the assessment at the next available occasion, this could be at the next scheduled re-take opportunity or the following academic year. Students would be expected to meet the costs of returning to the University to attend the assessment if required and to commit to the re-assessment date. The Course Director may also be required to request an extension to registration which may result in an additional tuition fee.

**6.10.7.2 Appeal against the initial decision**

Where requests are not agreed to, students will be provided with the reasons for the decision. Students have the right to appeal to Senate's Education Committee against the initial decision but only under specific circumstances. These are limited to:

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- a. that the evidence students provided was incomplete or inaccurate, to the extent where it is reasonable to conclude that the outcome may have been substantially different;
- b. that the person making the initial decision had summarily dismissed significant pieces of evidence in coming to his or her or their decision;
- c. that the criteria relating to the decision were not applied correctly by the person making the decision.

Students may not appeal because they do not like the outcome, or because they disagree with the reasons they were given.

Appeals must be made within 20 working days of the date of the original decision, and should be sent in writing to [appeals@cranfield.ac.uk](mailto:appeals@cranfield.ac.uk), clearly marked in the subject header as "Exceptional circumstances appeal". Students should include (or attach):

- the original decision with the appeal email;
- a statement, including clearly under which reason students are appealing (a, b or c); and
- evidence to support the statement.

Failure to provide all three items above may result in the appeal being rejected by the Secretary to Senate's Education Committee on its behalf.

The decision of Education Committee will be the final decision of the University: there is no further right of appeal (although students retain the right to complain to an external body).

**TITLE:** Guideline of the AM MSc's Purposes and Strategies Alignment

**Subject/Deliverable:** D3.1



### 3 Appendix – Final European Metal AM MSc Curriculum



ADMIRE\_Final MSc  
Curriculum\_Guideline

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