PROGRAMME SPECIFICATION

Awarding body/institution	Glyndŵr University
Teaching institution	Glyndŵr University
Details of accreditation by a professional, statutory or regulatory body	CEng accreditation of the MSc programme only will be submitted to Engineering Council (EAB) following one cohort having completed the programme
Final award/s available	MSc MRes PG Diploma PG Certificate
Award title	MSc Composites MRes Composites PG Diploma in Composites PG Certificate in Composites
UCAS code	NA
Relevant QAA subject benchmark statement/s	There are no relevant QAA subject benchmark statements for MSc or MRes (level 7).
Other external and internal reference points used to inform the programme outcomes	Academic Head of Department of Engineering and Applied Physics (internal)
Mode/s of study	Full time and part time
Language of study	English
Date at which the programme specification was written or revised	August 2011 Updated March 2014

Aims of the programme

Programme's broad purpose

The programme is based on a future perceived national need for good quality postgraduates for the near-future needs of the UK's Aeronautical, Mechanical and Manufacturing industries. The programme will produce a core of leading highly qualified engineers capable of integrating and solving problems over a range of engineering areas that generates wealth from knowledge rather than manufacture. The availability of a healthy flow of trained postgraduates is very likely to facilitate the creation of local spin–offs. Many of the existing metallic- based suppliers do not have the knowledge to adapt to manufacture of composites and most observers think it is probable that a new raft of companies with the knowledge and expertise will supply composite structures. The course will also lead to the development of aeronautical, mechanical engineering and manufacturing education which is a major contributor to the overall UK GDP.

The introduction of the MSc in Composites and MRes in Composites fits the needs that are consistent with the increasing emphasis on research and research-based projects. The initiative of developing the proposed MSc and MRes schemes is to further enhance Engineering's education provision for the region of North Wales. These programmes have been specifically requested by Airbus and Welsh Government with the latter providing funding to cover the development of the syllabus and to partially support delivery of the MSc. for the next seven years. In this way, the proposed programmes are contributing to University strategic needs and priorities. This proposal also underpins the mission and strategic plan of Glyndŵr University, in particular in that it will contribute to the portfolio of Higher Education courses being offered along the A55 knowledge corridor. The establishment and development of a composites centre is a component of the current university strategic plan.

Programme's aims and academic objectives

The aims of the proposed MSc programme are to provide the students with programmes of the necessary advanced, technical, professional and specialised study skills within the field of Composites Engineering. The aim of the MRes programme is to develop a critical awareness of the advanced techniques and technological advances available to conduct state of the art research in the area of Composites and to provide a programme of the necessary advanced, technical, professional and specialised study skills to do this. The programme is targeted towards those who wish to progress to a doctoral level of study in order to pursue subsequently an academic or industrial career. Candidates undertaking the MSc & MRes programmes will acquire the required skills in preparation for:

- 1. A career at an advanced level which involves academic research, including study at Doctoral level;
- 2. An active contribution to the development of new ideas and techniques in Composite Materials commercially-based engineering, particularly in the Aerospace industry;
- 3. Personal accountability in a supervisory capacity in the management of projects;
- 4. Life-long learning and an appreciation of the value of education in continuing professional development, thus to provide the depth of knowledge, skills and attitudes to meet the rapidly changing needs of a high technology industrial environment.

Intended learning outcomes of the programme

The programmes provide opportunities for students to achieve the following outcomes. By the end of the programmes the students will have developed critical and evaluative perspectives of composites engineering, together with analytical and creative problem solving abilities. The following specific intended outcomes are contextualised to be "within selected field of composites engineering and specialist areas of study".

On completion of the MSc in Composites programme, students will have achieved the following outcomes:

Intended Learning	gOutcomes						
	Students will be able to demonstrate knowledge and understanding of:						
	A1. theoretical principles and application techniques;						
	A2. current problems, being treated in a critical and evaluative manner;						
	A3. mathematical principles relevant to advanced concepts of composite designs;						
Knowledge & Understanding	A4. the range of methodologies and computer tools available for analysis and design of composites;						
subject skills)	A5. the role of the engineer as a manager of himself/herself and of others;						
	A6. current research and recent developments in composite science and technology, and the context within which aeronautical, mechanical and manufacturing engineering is applied.						
	The PG Certificate will particularly focus on learning outcomes A1, A2 and A3; the PG Diploma will have an additional focus on learning outcome A4, while the MSc will ensure that students achieve all six learning outcomes.						
	Students will:						
Intellectual Skills	B1. apply advanced engineering principles to the solution of design and operation problems and the investigation of new and emerging technologies in composite engineering;						
	B2. plan, conduct and report on an original programme of work (course work/ dissertation);						
	B3. analyse complex engineering issues in both a systematic and a creative way;						

	B4. evaluate data sources and make sound judgements in the absence of complete data;
	B5. make sound decisions in complex and unpredictable situations, both familiar and unfamiliar.
	B6. apply planning and management techniques, with an evaluation of commercial financial implications, in the conduct and management of an engineering project;
	The PG Certificate will particularly focus on learning outcomes B1, B3 and B4; the PG Diploma will have an additional focus on learning outcome B5, while the MSc will ensure that students achieve all six learning outcomes.
	Students will:
	C1. demonstrate self-direction and originality in tackling and solving composite engineering and design problems;
Practical, professional and employability	C2. develop group working skills and prepare in-depth reports at a professional level (course work/ dissertation);
	C3. act autonomously in planning and implementing experiment design and evaluative testing;
56115	C4. specify and use laboratory and workshop equipment competently and safely.
	The PG Certificate will particularly focus on learning outcomes C1 and C2; the PG Diploma will provide a moderate focus on learning outcome C3, while the MSc will ensure that students achieve all four learning outcomes.
	Students will:
	D1. exercise initiative and personal responsibility;
	D2. communicate clearly to specialist and non-specialist audiences;
Transferable/ Key Skills	D3. select and apply mathematical methodologies in the interpretation of problems and evaluation of solutions;
	D4. exercise judgement in the use of information technology - to source information and to model performance using specialised software packages, with awareness of the limitations computer models used in composite design applications;
	D5. apply the independent learning ability required for

continuing professional development;
D6. exercise autonomy and self direction regarding own performance and self management.
The PG Certificate will particularly focus on learning outcomes D1 to D4; the PG Diploma will have an additional focus on learning outcome D5, while the MSc will ensure that students achieve all six learning outcomes.

On completion of the MRes in Composites programme, students will have achieved the following learning outcomes:

Intended Learning	g Outcomes						
	Students will be able to demonstrate knowledge and understanding of: A1. theoretical principles and application techniques;						
	A2. current problems, being treated in a critical and evaluative manner;						
Knowledge & Understanding	A3. mathematical principles relevant to advanced concepts of composite designs;						
(including subject skills)	A4. the range of methodologies and computer tools available for analysis and design of composite systems;						
	45. the role of the engineer as a manager of himself/herself and of others;						
	A6. current research and recent developments in composite science and technology, and the context within which aeronautical, mechanical and manufacturing engineering is applied.						
	Students will:						
	B1. apply advanced engineering principles to the solution of design and operation problems and the investigation of new and emerging technologies in composite engineering;						
Intellectual Skills	B2. plan, conduct and report on an original programme of work (course work/ dissertation);						
	B3. analyse complex engineering issues in both a systematic and a creative way;						
	B4. evaluate data sources and make sound judgements in the absence of complete data;						

	B5. make sound decisions in complex and unpredictable situations, both familiar and unfamiliar.
	B6. apply planning and management techniques, with an evaluation of commercial financial implications, in the conduct and management of an engineering project;
	Students will:
	C1. demonstrate self-direction and originality in tackling and solving composite engineering and design problems;
	C2. develop group working skills and prepare in-depth reports at a professional level (course work/ dissertation);
Practical, professional and	C3. act autonomously in planning and implementing experiment design and evaluative testing;
employability skills	C4. specify and use laboratory and workshop equipment competently and safely.
	C5. use scientific literature effectively and work towards producing novel and original research findings.
	Students will:
	D1. exercise initiative and personal responsibility;
	D2. communicate clearly to specialist and non-specialist audiences;
Transferable/	D3. select and apply mathematical methodologies in the interpretation of problems and evaluation of solutions;
Key Skills	D4. exercise judgement in the use of information technology - to source information and to model performance using specialised software packages, with awareness of the limitations computer models;
	D5. apply the independent learning ability required for continuing professional development;
	D6. exercise autonomy and self direction regarding own performance and self management.

The Aims and outcomes were derived as a result of consultation within the programme team and having reference to the Credit and Qualifications Framework for Wales (CQFW, 2004), the framework for higher education qualifications (QAA, 2010) and the Engineering Council UK-SPEC (2004, 2010). The programme learning outcomes differentiated by award (i.e. PG Cert, PG Dip, MSc and MRes) are summarised as listed in the following curriculum matrix.

CURRICULUM MATRIX

MSc in Composites

		Knowled	Knowledge and understanding, intellectual skills, subject skills, and practical, professional and employability skills																					
	Module Title	Core Option	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B 6	C1	C2	С3	C4	D1	D2	D3	D4	D5	D6
	Introduction to the Use, Manufacture and Properties of Composites	Core	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Assembly, joining and repair of composites	Core	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*
	Design with Composites-theory	Core	*	*	*	*	*	*	*	*	*	*	*		*	*	*		*	*	*	*	*	*
MSc	Design with Composites- practice	Core	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Analysis, testing and QA of composites	Opt	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Environmental aspects of Composites	Opt	*	*			*	*	*	*	*	*	*	*	*	*			*	*			*	*
	Research Design and Methods	Opt				*		*				*												
	Structures and Numerical Analysis	Opt	*		*	*															*	*		
	Dissertation (MSc)	Core	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*

Refer to appendix B for detailed modules specifications.

MRes in Composites

		Knowled	Knowledge and understanding, intellectual skills, subject skills, and practical, professional and employability skills																						
	Module Title	Core Option	A1	A2	A3	A4	A5	A6	B1	B2	B 3	B4	B5	B 6	C1	C2	СЗ	C4	C5	D1	D2	D3	D4	D5	D6
	Introduction to the Use, Manufacture and Properties of Composites	Core	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Assembly, joining and repair of composites	Option	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*
	Design with Composites-theory	Option	*	*	*	*	*	*	*	*	*	*	*		*	*	*		*	*	*	*	*	*	*
MRes	Design with Composites- practice	Option	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*
	Analysis, testing and QA of composites	Option	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Environmental aspects of Composites	Option	*	*			*	*	*	*	*	*	*	*	*	*			*	*	*			*	*
	Research Design and Methods	Opt				*		*				*										*	*		
	Structures and Numerical Analysis	Opt	*		*	*																			
	Dissertation (MRes)	Core	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*

Refer to appendix B for detailed modules specifications.

Distinctive features of the programme

Curriculum design

The initiative of developing the proposed MSc and MRes curriculum is to further enhance Engineering's education provision for the region of North Wales. These programmes have been specifically requested by Airbus and Welsh Government with the latter providing funding to cover the development of the syllabus and to partially support delivery of the M.Sc. for the next seven years. Curriculum design consultation with Airbus, which will be one of the largest regional manufacturers of composite designs, confirms the need for the modules selected within this programme.

The proposed programme has been designed to accommodate both our full and part time students. The students will study advanced modules that will extend their depth of study in the field of composites. The programmes respond to the needs of major industry (i.e. aerospace, automotive etc.) within the region.

The proposed curriculum is in line with the University Institute for Arts, Science and Technology and Glyndŵr University strategic plan of providing taught Masters programmes within Engineering. The current research expertise within Engineering has been further developed to create, and underpin the post-graduate ethos and framework. Specific staff members have been recruited to lead and develop this area which is seen by both Glyndŵr University and Welsh Government as strategically important. Experience gained through staff having taught on and developed modules for Masters courses at Glyndŵr and other Institutions (University of Manchester, Queen Mary, University of London, University of Birmingham etc), having reviewed MSc submissions for accreditation for Professional bodies (Loughborough, Cranfield, Manchester) and through the team members acting as external examiner for the Masters programmes at several institutions and also on accreditation visit to numerous universities, has contributed to the pool of expertise that has created the programmes. The programme development has also involved consultation with a member of the Further Learning Committee and the Academic Assessment Committee of the IoM3 under the aegis of the Engineering Council.

The provisions of the Masters programmes are also consistent with the stated requirements of the Engineering Council, in the UKspec (Standard for Professional Engineering Competence), originally published in 2004 and now updated in 2010. This now requires a Chartered Engineer to be qualified to Masters level or its equivalent to meet the adademic requirements for chartered status. It is anticipated that the MSc Composites programme will be submitted for CEng accreditation within two years of validation.

The introduction of the MRes in composites fits the needs that are consistent with the increasing emphasis on research and research-based projects.

Curriculum development

In developing the composite masters programmes as outlined above the potential market has been explored and this has clearly confirmed that there will be an industry demand. To supply this demand the market for students identified four major areas:-

- 1. Progression for existing BEng students. The admissions tutors in the subject area of Engineering have for several years been commenting on the demand from Glyndŵr engineering graduates for the opportunity to progress onto Master studies in Engineering and in some cases further to doctorate studies. It is estimated that between six and ten existing full time students per year will, by virtue of meeting entry requirements and demonstrating commitment to Postgraduate Study, progress onto the Masters programmes. This would be in addition to potential part time students that have also been identified from previous and future graduates. Airbus at Broughton, who state that Aero/Mechanical Engineering at Glyndŵr is its preferred Higher Education provider, is supportive of this development as contributing to their workforce planning and enabling a complete route for progression of its Engineers from Foundation to Higher degree status. They have agreed that some of their staff will go on this course including two students who have progressed from craft apprentice to graduates through Glyndŵr University courses. Airbus has also agreed to provide internal and external publicity including celebration of the award of the degree to former apprentices at an appropriate point.
- 2. National marketing to attract further students, with relevant Bachelor degrees. Regionally the other universities are Bangor and Aberystwyth. Neither has any taught courses in Advanced Composites at undergraduate or post-graduate level, hence there is no other provision in this subject in the North and Mid Wales region at this, or even degree level.
- 3. International marketing, through the effort of International Office at Glyndŵr, is being steadily increased to attract more or more students. Recent marketing in India and China has identified a ready and growth market for Aeronautical, Mechanical and Manufacturing subjects. This has involved detailed discussions with a number of HE Institutes in the sub continent which Senior Colleagues within Glyndŵr have been actively managing and maintaining significant high value relationships. Discussions are taking place in Malaysia and Russia about the use of modules and even the entire M.Sc. by students from these countries. Initial discussions have taken place regarding a 1+1 scheme with a Russian university where the Glyndŵr M.Sc. is offered as the first year and the second year is undertaken in Moscow. This would lead to the award of both a Glyndŵr University and a Russian M.Sc. However, this is still very much at the discussion stage, and the programme team will ensure that as the scheme develops, appropriate approval procedures will be followed.
- 4. The modular nature of the schemes means that individual modules may be selected and marketed to meet specific continuing education requirements in industry on a CPD basis. This will be especially relevant to applicants applying for chartered status via the further learning route of the IoM3. In fact the Institution of Mechanical Engineers has compiled a data base of institutions that offer modules at Masters level to be used for the above purpose. This will also be a useful marketing tool for the Glyndŵr programmes.

Considering all the above mentioned factors, the programme team believes that the following set-up of the modules in these programmes reflects the needs and also the features of the disciplines. They will be complementary to the existing MSc programmes in the Academic Subject of Aero/Mechanical Engineering.

Programme's benefits for the students

Some of the key benefits of studying the programme for potential students are:

- 1. The students will benefit from a board of composite specialists that has been recently recruited specifically for the delivery of this programme.
- 2. The newly established centre, Advanced Composite Training and Development Centre (ACTDC), provides exceptional space for workshop training of students as well as research and teaching with a purpose built lecture theatre and conference area.
- 3. The University is located in a geographical area with a large industrial base. The nearby Wrexham and Deeside industrial estates are two of the largest in Europe with a significant number of manufacturing companies, including major users of composite materials. There is considerable scope to undertake research and development in composites in partnership with such companies.
- Specifically speaking, ACTDC is situated very close to Airbus' new A350 composite wing production and assembly facility. The students will benefit from the long-term training collaboration between Airbus and Glyndŵr University.
- 5. Broadly speaking, composite science and technology fall under the umbrella of materials science and engineering. Glyndŵr University has already demonstrated its excellence in research by achieving a component of 4* rating ("world leading") in its submission to RAE-2008 for the Metallurgy and Materials Science unit of assessment. In this way, students will benefit from a nationally recognised research-focussed group.
- 6. The University is a member of the North West Composites Centre (NWCC), a consortium of universities collaborating in research and training initiatives for industry. NWCC consists of the following universities: Manchester, Liverpool, Lancaster, Bolton and Glyndŵr. The students will have access and they will benefit from state of the art composite manufacturing and characterisation tools.
- 7. This proposal will broaden current provisions in Aero/Mechanical Engineering at Glyndŵr, by providing opportunities for students to progress through the academic requirements for Chartered Engineer status in variety of areas.

Learning and teaching strategy used to enable outcomes to be achieved and demonstrated

The Graduate School has a Learning, Teaching and Assessment implementation plan as part of University re-structuring and developments. This seeks to assist the student to become an independent learner. The curriculum is designed to encourage an appreciation for learning. Learning is enriched by appropriate underpinning current research, industrial applications and the development of transferable skills

The broad aim of the Composite Engineering in its postgraduate teaching is to focus on depth of study, and critical awareness and evaluation, in selected areas of current research and advanced scholarship within the academic disciplines of Engineering Science; while at the same time ensuring a more general all round ability. In addressing this aim, the proposed MSc Composites programme and MRes in Composites include material on the theory, design, implementation and testing of composite systems while at the same time focusing on particular specialist areas of research within the academic disciplines of Aeronautical, Mechanical and Manufacturing Engineering.

The nature of the programmes including common and specialist elements necessitates the use of a wide range of teaching techniques. Lectures are used as the main delivery mechanism, typically supplemented by case study and practical lab classes, and group discussion. Some modules include group and small-scale project work, with student-led seminars and presentations. The programme will not be delivered online. However, online tools (i.e. Moodle etc.) will be used to support teaching. The Subject also operates a number of computer labs, with teaching and industrial application based software.

(i) Lecture

This is usually a formal discourse for the purposes of dissemination of information, the demonstration of techniques and the discussion of supporting ideas and consequences. The lecture is supported by a full range of equipment including Moodle, whiteboard, OHP, video and computer projection facilities where appropriate. Although this type of presentation is suitable for a one-sided discourse ample opportunity exists for questions, interaction and discussion.

(ii) Seminar and Tutorials

These activities encompass a wide range of activities, each suited to the particular module. On the one hand, some tutorials will consist of the staff supporting students engaged in problem solving. On the other hand a tutorial may involve group exercises where each group is encouraged to allocate responsibilities, allocate tasks, etc. Generally, this type of teaching is used to support the lecture, clarify the material and experiment with the techniques and skills required.

(iii) Laboratory

The nature of some designed modules (introduction to the use, manufacture and properties of composites, assembly ,joining and repair of composites, design with composites- practice, analysis, testing and QA of composites, environmental aspects of composites) of the programmes requires students to gain practical skills. This activity takes place in Engineering laboratories and recently established Advanced Composite Training and Development centre near the Airbus site in Broughton. The students would have access to the laboratories on site. They will also have access to the material laboratory (scanning electron microscope, Instron testing facility etc.) at the Plas Coch site. Student will be provided opportunities to access facilities in North-West Composite Centre, Manchester for their research and projects.

(iv) Group Work

On some modules, students are encouraged to work in groups to achieve set objectives. Assessment of these activities includes both group and individual elements. In this way, students learn to work as a team to achieve a common goal whilst at the same time individual contribution is recognised and evaluated. (vii) Dissertation

The dissertation serves the primary purpose of integrating technological and research strands, which are developed in the preceding PG Cert stage, and does so in the context of a substantial research or information systems development project.

The dissertation typically involves the development and evaluation of the solution to a problem, which occurs within a relatively unstructured domain. The problem is original to the student and its solution therefore requires the innovative application of knowledge and techniques either studied in the previous PG Cert stage or acquired through independent research of recent and relevant literature.

The dissertation provides a vehicle for integrating specialist knowledge with analytic, problem solving, managerial and communication skills. All of these are exercised and evidenced through the execution and outcomes of the dissertation, which include a dissertation proposal, a progress presentation and submission of dissertation.

Feedback is provided continuously to students through informal contact with subject lecturers and tutors. In accordance with University Guidance, feedback is provided on assessed practical work normally within three weeks of submission of the work.

The Welsh Language

The University will offer and establish the need for Welsh medium assessment as part of its registration processes. Where a qualified tutor is available, students will then be allocated to a tutor who is able to assess the work in Welsh. At present, the Department does not have bilingual tutors or full-time academic staff members who are able to assess through the medium of Welsh. Where a need for Welsh medium assessment has been identified and no appropriate Welsh speaking tutor/assessor is available, the written assessment will be translated into English. This translation will be conducted by University qualified translators.

Additionally the programme team would wish to develop the language skills of students taking this programme. The University already offers modules in Welsh as a second language at HE level to students studying degrees which involve working with the public e.g. social work, nursing, youth and community work. It is anticipated that the MSc students whose first language is not Welsh, or who wish to improve their Welsh skills (either an improver or a new learner) would be offered these sessions as an extra module outside the programmes. The University's investment in its Second Language Learning Centre ensures that this aspiration can be delivered from within existing arrangements.

Assessment strategy used to enable outcomes to be achieved and demonstrated

The Graduate School has an agreed Assessment Strategy for all engineering programmes which provides a framework for the assessment of students' competence, knowledge and understanding, and the grading of students for progression and the conferring of awards. It allows staff to give feedback to students

and to evaluate the effectiveness of their own teaching. This strategy will be closely adhered to in the delivery of the programme and is guided by QAA Code of Practice-Section 6: Assessment of Students, National Qualifications Framework, and Glyndŵr University Assessment Guidelines.

Assessment Strategy

Students will receive formative assessment, particularly during the practical and selfstudy elements of the programmes to ensure they can keep track of their progress and development. This will also be a key factor in ensuring student engagement and retention on the programme of study. In the case of practical assessment, this may be a final summative assessment, so more frequent formative assessment provides academic rigour and increases student awareness and confidence in the subject.

There will be emphasis placed upon students to undertake independent study and research activities, in particular when conducting the project for the Dissertation of the programmes.

Assessment Methods

The assessment of students will be by means of in-course assignments, which generally have both a formative and a summative function and by examinations. The pattern proposed is the same as for the existing suite of masters programmes and gives a mixture of assessment methods which is appropriate at this level. This pattern is required in order to met the requirements of the professional body the Engineering Accreditation Board. The programme team are continually seeking, and experimenting with, further ways of assessing students, including non-formal time-constrained practical or written exercises. It is notable that in Annex A of the QAA Benchmarks for Engineering, twenty-one examples of assessment style are quoted and these are stated as 'not exhaustive'. The grading for assessment work will be awarded by the module tutor.

Internal Moderation

There is a standard procedure and documentation for internally moderating all assessed work, both before the assignment/exam is set and, by sampling, after the student work has been marked. In general, 'blind' double marking is not used except for the main dissertation.

The following tables show details of module weightings for examinations and assignments together with the recommended time schedules for both programmes.

	SCHEDULE OF ASS	ESSME	NTS – MSc Com	posites
	Module	Credit	%	Week No
ENGM01	Introduction to the Use, Manufacture and Properties of Composites	20	50% coursework 50% examination	
ENG709	Assembly, joining and repair of composites	20	100%	Each coursework
ENG710	Design with Composites- theory	20	50% examination 50% portfolio	will be submitted at the end of each delivery block.
ENG711	Design with Composites- practice	20	50% coursework 50% examination	All examinations will be taken at the
ENG712	Analysis, testing and QA of Composites	20	100%	examination period following the
ENG713	Environmental aspects of Composites	20	100%	delivery block – January, April or
ENGM67	Research Design and Methods	20	40% individual critique 20% presentation 40% research proposal	August
ENGM62	Structures and Numerical Analysis	20	40% report 60% design project]
EMGM66	Dissertation	60	100%	12 mths following start of programme

Refer to appendix B for detailed modules specifications.

SCHEDULE OF ASSESSMENTS – MRes Composites

	Module	Credit	In course %	Week No
ENGM01	Introduction to the Use, Manufacture and Properties of Composites	20	50% coursework 50% examination	Each coursework will be submitted at the end of each
ENG709	Assembly ,joining and repair of composites	20	100%	All examinations
ENG710	Design with Composites-theory	20	50% examination 50% portfolio	the next available examination period following the completion of
ENG711	Design with Composites- practice	20	50% coursework 50% examination	each delivery block – January, April or August

ENG712	Analysis, testing and QA of Composites	20	100%	
ENG713	Environmental aspects of Composites	20	100%	
ENGM67 (ENG737)	Research Design and Methods	20	40% individual critique 20% presentation 40% research proposal	
ENGM62 (ENG738)	Structures and Numerical Analysis	20	40% report 60% design project	
ENG714	Dissertation	100	120	12 mths following start of programme

Assessment regulations that apply to the programme

The University's academic regulations for Taught Masters will apply to the MSc Composites programme.

There are a number of derogations from regulations that apply to the MSc Composites programme:

Credits shall be awarded by an Assessment Board for those Level 7 modules in which an overall mark of at least 50% has been achieved with a minimum mark of 40% in each assessment element. Credit may be awarded by condonement as specified below.

The Assessment Board has the right to allow candidates who fail to obtain a pass mark in a module to be re-examined in that module on one subsequent occasion. The re-examination shall take place at the next available opportunity and within the registration period of the programme. The maximum mark for Candidates who are re-examined in a module shall be 50%.

At the completion of a Postgraduate Diploma or Part One of a Masters programme, failure may be condoned in a module, where:

- All elements of the assessment for the module have been attempted with a minimum mark of 40% in each assessment element;
- The student has achieved a mark of at least 40% for the module;
- 100 credits have been passed;
- The average mark of all modules is at least 50%.

The modular pass-mark for all Part Two modules shall be 50%.

The University's academic regulations for Master of Research will apply to the MRes Composites programme. The above derogations from regulations DO NOT apply to the MRes Composites programme.

Programme structures and requirements, levels, modules, credits and awards

For MSc programme, part 1 consists of six 20-credit taught modules and these must have been completed successfully before the student can be assessed in Part 2, the Dissertation. The student is not able to progress to Part 2 if he/she has completed Part 1 with compensation of one 20 credit module and is only eligible for the award of a Post Graduate Diploma. For MRes programme, Part 1 consists of three 20-credit taught modules and they are chosen by the students on the needs of the project and advice from the project supervisor. Part 2 of the programme is a 120-credit Dissertation project.

Post Graduate Certificate

A Post Graduate Certificate is awarded to a student who completes 60 credits of one of the programmes (i.e. three 20-credit modules) but is unable, or does not wish, to continue with the programme. In these two programmes this component can be a combination of the introductory module plus any two others.

Post Graduate Diploma

A Post Graduate Diploma is awarded to a student who has completed the 120 credits of part 1 of the programme (MSc Composites only) but does not complete part 2, the Dissertation.

Study Modes and indicative delivery schedules

Full-time Mode for MSc/ MRes

The taught element, part 1, of the MSc programme will be delivered in two 12-week trimesters and part 1 of the MRes in one 12-week semester. Each trimester has a loading of 60 credits. The taught modules will have lectures and tutorials/practical work on a weekly basis. The expected timetable will be 15 hours contact plus 7.5 hours of directed study per week. Part 2 (dissertation) will then take a further 15 weeks having a notional study time of 600 hours (MSc dissertation) or 1200 hours (MRes dissertation). During this time the student will be responsible for managing his/her time in consultation with an academic supervisor. In practice, the regulations allow the student further time to complete the dissertation provided that the entire study of one of the programmes is completed within two years.

Part-time Mode for MSc/ MRes

The taught element, part 1, of the MSc programme will be delivered in two academic teaching years. 60 credits or equivalent worth of modules will be delivered in the first year and 60 credits or equivalent in the second year, with lectures and tutorials/practical work taking place during one or two days on a weekly basis. The part time students would join the full time delivery, and would be given the option to study whichever module was most convenient to them. To allow this flexibility, students may opt to study three modules in one trimester and none in the other, or one module in one trimester and two in the other Similarly, the taught element of the MRes programme will be delivered over one or two academic teaching years, depending on the modules chosen by the students. The MSc dissertation, in year 3, will then take a further 30 weeks having a total notional study time of 600 hours. MRes students will commence the MRes dissertation, in year 2 and will take a further 50 weeks having a total notional study time of 1200 hours. During this time the student will be responsible for managing his/her time in consultation with an academic supervisor. In practice, the regulations allow the student further time to complete the dissertation provided that the entire programme is completed within five years.

Block-release Mode for MSc

The taught element, (120 credits, part 1), of the programme will be delivered in the summer period (12 weeks) of two years. 60 credits or equivalent worth of modules will be delivered in the first year and 60 credits or equivalent in the second year, with lectures and tutorials/practical work taking place during the working days of the week. The dissertation will be supervised during the 12 week block-release period of year 3. During this time the student will be responsible for managing his/her time in consultation with an academic supervisor. In practice, the regulations allow the student further time to complete the dissertation provided that the entire programme is completed within five years.

Block-release Mode for MRes

The taught element, (60 credits, part 1), of the programme will be delivered in the summer period (12 weeks) of the first year of delivery, with lectures and tutorials/practical work taking place during the working days of the week. The dissertation will be supervised during the 12 week block-release period during the second and third years of delivery. During this time the student will be responsible for managing his/her time in consultation with an academic supervisor. In practice, the regulations allow the student further time to complete the dissertation provided that the entire programme is completed within five years.

Indicative structure of the proposed programme with exit awards

MSc Composites

	Properties of Composites 20 credits Core	20 credits Core	20 credits Core
	ENG711 Design with Composites- practice 20 credits Core	Students to take two of the following options ENG712 Analysis, testing and QA of Composites 20 credits Option	ENG713 Environmental aspects of Composites 20 credits Option
		ENGM67 Research Design and Methods 20 credits Option	ENGM62 Structures and Numerical Analysis 20 credits Option
Part 2	ENGM66 Dissertation 60 Credits Core		

MSc Composites

180 credits, all at level 7:- 120 (taught) at Part 1, 60 at Part 2 (dissertation).

Post Graduate Diploma

120 credits (taught) at level 7, all taught modules.

Post Graduate Certificate

60 credits (taught) at level 7, a combination of the introductory module plus any two other modules.

Module leaders:

Prof. Richard Day Prof. Alison McMillan Dr Richard Grant Martyn Jones Rob Bolam Dr. Zoubir Zouaoui

MRes Composites

	ENGM01 Introduction to the Use, Manufacture and Properties of Composites 20 credits Core	ENG709 Assembly, joining and repair of composites 20 credits Option	ENG710 Design with Composites-theory 20 credits Option		
Part 1 (ENGM01 plus two optional modules)	ENG711 Design with Composites- practice 20 credits Option	ENG712 Analysis, testing and QA of Composites 20 credits Option	ENG713 Environmental aspects of Composites 20 credits Option		
	ENGM67 (ENG737) Research Design and Methods 20 credits option	ENGM62 (ENG738) Structures and Numerical Analysis 20 credits option			

Part 2 ENG714 Dissertation 120 Credits Core

Refer to appendix B for detailed modules specifications.

MRes Composites

180 credits, all at level 7:- 60 (taught) at Part 1, 120 at Part 2 (dissertation).

Programme Delivery

The delivery modes are listed in the following diagrams.

Module leaders:

Prof. Richard Day Prof. Alison McMillan Dr Richard Grant Martyn Jones Rob Bolam Dr. Zoubir Zouaoui

MSc Composites

Programme delivery for full-time entry mode – one year – trimester one start

MSc	Trimester 1	Introduction to the Use, Manufacture and Properties of Composites	20	Core
		Assembly, joining and repair of composites	20	Core
		Design with Composites- theory	20	Core
	Trimester 2	Design with Composites- practice	20	Core
		Analysis, testing and QA of Composites	20	Option
		Environmental aspects of Composites	20	Option
		Research Design and Methods	20	Option
		Structures and Numerical Analysis	20	Option
	Summer period	Dissertation (Intended submission date: 31 st August)	60	Core
PG Diploma				All taught modules to the value of 120 credit points
PG Certificate				A combination of the introductory module plus any two other modules

	Trimester	ENGM01	ENG709	ENG710			
	-	Introduction to the Use, Manufacture and Properties of Composites	Assembly, joining and repair of composites	Design with Composites- theory			
		20 credits Core	20 credits Core	20 credits Core			
		Above modules to be submitted to May assessment board					
Part 1	Trimester 3	ENG711 Design with Composites- practice 20 credits Core	Students to take two modules ENG712 Analysis, testing and QA of Composites 20 credits Option ENGM67 Research Design and Methods	of the following optional ENG713 Environmental aspects of Composites 20 credits Option ENGM62 Structures & Numerical Analysis 20 credits Option			
		Above modules to be subm	itted to September ass	essment board			
		ENGM66					
Dart	Trimostor	Dissertation					
2	1 1	60 Credits Core					
		Students to submit disserta following January assessm	tions by early December ent board	er. Results to go to			

Indicative programme delivery for part-time and block-release modes – three years

NO-		Introduction to the Use	00	0
MSC	Year 1 and 2	Manufacture and Properties of Composites	20	Core
Note: Part-time		Assembly, joining and repair of composites	20	Core
delivered over academic		Design with Composites-theory	20	Core
trimesters Block release delivered over 12 week blocks during the Summer period		Design with Composites- practice	20	Core
		Analysis, testing and QA of Composites	20	Option
		Environmental aspects of Composites	20	Option
		Research Design and Methods	20	Option
		Structures and Numerical Analysis	20	Option
	Year 3	Dissertation	60	Core
PG Diploma				All taught modules to the value of 120 credit points
PG Certificate				A combination of the introductory module plus any two other modules

MRes Composites

Programme delivery- full-time entry - one year

MRes	Trimester 1	Introduction to the Use, Manufacture and Properties of Composites	20	Core
		Assembly, joining and repair of composites	20	Option
		Design with Composites-theory	20	Option
T 6 tu b	Trimester 2	Design with Composites- practice	20	Option
	60 credits in total across both trimesters	Analysis, testing and QA of Composites	20	Option
		Environmental aspects of Composites	20	Option
		Research Design and Methods	20	Option
		Structures and Numerical Analysis	20	Option
	Trimester 1 + Trimester 2 + Summer period	Dissertation (Intended submission date: 31 st August)	120	Core

Indicative programme delivery for part-time and block-release modes – three years

MRes	Year 1 and Year 2 (60 credits in total across both years)	Introduction to the Use, Manufacture and Properties of Composites	20	Core
		Assembly, joining and repair of composites	20	Option
Note:		Design with Composites-theory	20	Option
Part-time delivered over academic trimesters Block release delivered over 12 week blocks during the Summer period		Design with Composites- practice	20	Option
		Analysis, testing and QA of Composites	20	Option
		Environmental aspects of Composites	20	Option
		Research Design and Methods	20	Option
		Structures and Numerical Analysis	20	Option
	Year 3	Dissertation	120	Core

There are no requirements for work placements or fieldwork in terms of length of time, award of credit and whether it is compulsory for achievement of the award.

Criteria for admission to the programme

Applicants will be required to attend for an interview. In case of the applicants being not able to attend the interview, e.g. overseas students, alternative ways to conduct an interview or to have personal contact will be implemented. This will be carried out via either the telephone or electronically beside the application forms, recommendations and references from their existing institutions. Places on the programmes will be offered on the basis of applicants' background qualifications and, where appropriate, experience. In all cases the programme team will have to be satisfied that the applicant demonstrates the qualities needed to successfully complete and pass the chosen programme.

Normal entry requirements for the MSc and MRes will be one of:

- (a) A Bachelor of Engineering Honours degree, or other Bachelors Honours degree, with at least a 2:2 classification in a relevant subject area;
- Academic qualifications at a lower level than honours degree but supported by a maturity of experience at a professional level in a relevant specialist area*;
- (c) Equivalent overseas qualifications deemed satisfactory by the programme team.

Some applicants, for example, those who have achieved an ordinary BEng degree

are compulsorily required to undertake a bridging programme that will ensure shortfalls in any academic subjects, prior to entry to the MSc and MRes can be addressed. The bridging unit include modules pertinent to the specific programme that the student would wish to undertake at level six. The total credit value would be 50 of which 40 would be the final year honours level project (level 6, ENG629). The remaining 10 credits would be the advanced materials modules (level 6, ENG677). The module aims to extend previous studies of materials and components and to extend them by considering the latest developments in materials used in machinery such as aircraft and to apply analysis methods to these, including computer-based analysis, and relating them to their applications. The applicants have to successfully complete the bridging unit prior to enrolling on the MSc or MRes programmes. Some overseas applicants, on advice and judgement of the admission tutor or programme team, may be required to undertake the bridging programme prior to formal enrolling on the MSc or MRes programmes. The bridging unit will be delivered in summer (trimester 3) prior to the start of the programme.

Additionally, international students whose first language is not English are required by Glyndŵr University regulations to hold the IELTS (International English Language Testing System) standard of 6.5, for post-graduate courses.

*According to Glyndŵr University Regulations for Modular Masters Degrees, a nongraduate can be admitted to candidature provided that he/she:

 has held, for a minimum of two years, a responsible position relevant to the scheme to be pursued.

For these two programmes, the programme team would expect a minimum of five years experience from a non-graduate applicant who wishes to join the programmes. A minimum of five years experience had been stated as there was evidence from the professional bodies to suggest that people working at technician level for more than five years were more likely to succeed in the further learning element of the requirement for Chartered Engineer status, i.e. Masters level award or modules, than those who had less than five years experience.

Programme Management

The programme team

The programme team will comprise the programme leader and the staff involved in lecturing and tutoring on the programme. The staff concerned will be allocated from the following list of subject tutors:

Prof. Richard Day (Programme Leader) Prof. Alison McMillan Dr Richard Grant Martyn Jones Rob Bolam Dr. Zoubir Zouaoui

Full details of an individual's post held, qualifications and experience are contained in appendix C 'Staff CVs' section. Subject responsibilities are shown in the Modules Directory.

The Masters staff team members are highly qualified and experienced at postgraduate and post-doctoral level and are research active. They have previous experience from teaching at other universities and are feeding this into Engineering's programmes, such as the proposed Masters programmes. They are contributing to the ever-developing research and scholarship ethos and culture surrounding Engineering at Glyndŵr. Longer-established members of the team have commensurate specialist qualifications and experience in a professional and consultancy field at a high level.

Programme management and quality assurance

The programmes will be managed under the auspices of the Department of Engineering and Applied Physics and the programmes will develop and operate within the terms of the overall management of curriculum within the Department. The designated programme leader for the proposed MSc/ MRes programmes will be responsible for the day-to-day running of the programme, including the following:

- The management and development of curriculum and the course portfolio,
- Student tracking and student records
- Collation of assessment data, presentation of data at assessment boards
- Management/co-ordination of overall assessment activities across the programmes
- Liaison with external bodies and agencies,
- Quality assurance and annual monitoring, including compilation of the Annual Monitoring Report
- Co-ordination of admissions activities and other recruitment activities, including relevant publicity activities

The module leader takes responsibility for the following:

- The maintenance and development of teaching and learning materials for all students enrolled on the module,
- The publishing and updating of module timetables,
- The setting, marking and collation of marks for all module assessments and examination papers, including resit assessments, and submission of student results to the Programme Leader
- Tutorial support for students taking the module which they are responsible
- Quality monitoring, including processing of annual student feedback questionnaires and, where appropriate, student feedback for individual modules

The programme team meetings

The Programme team meeting is held regularly, consisting of the staff from the teaching team, the programme leader, student representatives, invited representatives of other departments (such as Information and Student Services) and the Academic Head of Department. By this means, matters requiring the considered attention by other committees or departments, including the university management, can be identified and taken actions. The meetings will take place at least three times per year and will respond to the on-going needs of the programmes as they arise, reporting directly to the Department, School and University management when appropriate. The programme team will also be meeting with the composite industry specialists and the outcomes of those meetings will be discussed during the programme team meetings. The meetings will also be overseeing quality matters and

subject strategy.

Programme monitoring and review

Programme monitoring and review is taken very seriously. It is an on-going process which involves everyone concerned with the programme as well as others within the Department, Academic Registry, members of Quality Strategy Committee (SQC) and student feedback (e.g. SEMs, SSCCs). In practice, the Programme Leader and teaching team will monitor the day-to-day operation with input as necessary from student representatives

In line with Glyndŵr's QA systems and procedures an Annual Monitoring Report (AMR) will be prepared by the Programme Leader in November of each academic year and formally discussed and presented to the Subject Team at a special review meeting which takes place during November/December before it is considered by the Subject board in Nov/Dec as part of the annual monitoring and review processes (AMR), which is also attended by QSC representatives. The AMR will include performance of modules as well as overall programme performance using indicators such as mean, standard deviation, retention data and feedback from students and staff.

There is also staff monitoring and review which is external to the programme which is based on the principles of peer observation and this is fed into the ISDR process to support individual staff development plans.

Research and Scholarship underpinning the curriculum

The last few years have seen a continuous growth in research activity within the Engineering subject area leading to a large increase in research volume and high quality of research outputs. The teaching in Engineering has benefited from the establishment of the Engineering Research Centre (ERC). The ERC is a multidisciplinary centre that undertakes research selectively at national and international levels of excellence within interrelated areas of staff expertise. The Centre is engaged in research collaboration with a number of international (China, France and Denmark) and UK (Birmingham, Manchester, Loughborough) universities with the view to publish jointly and submit joint grant proposals. The Engineering Research Centre has been building targeted resources gradually and is in a position now to provide a good supportive environment for its members and associated postgraduate students for conducting quality research of international significance. The staff members in the ERC have been intensively involved in teaching, curriculum leadership activities and other scholarly activities, leading to their research expertise underpinning the curriculum development.

The composites research area is one which is strategic for Glyndŵr University. In January 2010 an appointment was made to a chair in Composites Engineering, Prof Richard Day who had worked at University of Manchester and was then director of the Northwest Composites Centre. More recently Prof Day has been appointed University of Wales Professor of Composites Engineering. A further two appointments will be made in a week that will strengthen the team. Together with Airbus and Welsh Government, Glyndŵr University have helped to establish the Advanced Composites Training and Development Centre in Broughton. Within the Glyndŵr University area of this facility is a purpose built research laboratory for composites and a lecture theatre for forty students equipped with state of the art facilities including an interactive white board. The rest of the facility is used for training Airbus employees in composites and is run according to the requirements

and behaviours of lean engineering in exactly the same way as a modern aircraft factory is. Hence not only will the students be taught in first class facilities and have easy access to research facilities but they will be embedded in a lean manufacturing aircraft factory environment. Research in this area encompasses out of autoclave manufacture of components using microwave and radio frequency heating, assembly (including bonded assembly), bonding, formulation of resins for out of autoclave cure, aging and impact in composite materials.

The majority research projects in the ERC are conducted by the proposing programme team members. Within the composites activity the focus is on rapid manufacturing, assembly and characterisation of multi-functional composites and development of smart nanocomposites for aerospace applications. The scholarship underpinning the curriculum is also evident by the programme team members involving various scholarly activities. The programme team have acted as referees for more than 20 different peer-reviewed international academic journals. Prof Day has been a member of the technical committees for a number of international conferences, is a referee for more than 10 journals and has published widely. All programme team members have collaborative researches either nationally or internationally and they have regularly attended various international conferences relating to mechanical and manufacturing engineering.

The proposed programme team members also undertake consultancy work for industry. In addition a number of KTP's projects have been and are being held. More KTPs are being negotiated. Engineering has secured a SRIF (Research Infrastructure) funding which has helped to underpin the research capital infrastructure within the Subject and improve the research capability within the school.

It is evident that the proposed programmes have been designed around the academic strengths within Engineering, harnessing the expertise of individuals and allowing their relevant research and consultancy to contribute to and inform the programme content. The programme team is clear that the contribution of research to these programmes is paramount. In the introduction to the rationale we referred to a statement from a DTI document stating that research in an Institution reflects in the quality of the teaching on the programmes. This is especially important to these new programmes where all the modules are specialist areas of the staff lecturing on them. The modules that have been developed enable the specialist research of the staff to drive and underpin the Masters curriculums. In addition consultancy work undertaken by staff for industry will form specialist case studies and worked examples that will be presented to students as part of the programme. Also, the present suite of MSc programmes in Engineering has been accredited through the major professional bodies, Institution of Mechanical Engineers and the Royal Aeronautical Society as meeting the academic requirements to satisfy the CEng.

Further underpinning of the Masters programmes within Mechanical and Aero Engineering will be the specialist seminars that the research staff and students present throughout the year as part of their research work. In addition specialist guest lectures will be organised and invited and Industry has agreed to participate by contributing specialist lectures from practising professional colleagues to the programme.

Particular support for learning

Learning support mechanisms

Student Support

Students on the programmes will receive the following forms of student support and guidance:

- 1. Admissions. All students on the programmes will have the opportunity to discuss their application with staff, and receive appropriate advice and guidance prior to admission. This will include review of expectations of the programme and clarification of workload and requirements.
- 2. Induction. New students on the programmes will undergo an induction programme which will provide them with a full introduction to the programme, and will include elements of work on study skills and professional development.
- 3. Student Handbook. All students on the programmes will receive a Student Handbook which will contain details and guidance on all aspects of the programme and forms of student support and guidance.
- 4. Progress Review and Attendance Monitoring. Student attendance will be subject to regular monitoring through registers, and this will be a means of addressing issues of student support. There will also be regular reviews for each student with personal tutors.

Every student is allocated a personal tutor when he/she has registered for one of the programmes. The personal tutor is someone students can contact to discuss any problems of a non-academic nature. These may relate to special needs or personal problems that may affect the student's academic performance.

Academic problems should first be addressed to the module leader concerned. If the problem is not resolved or it does not relate to a specific module, then the Programme Leader should be contacted.

Staff Student Consultative Committee (SSCC): Student representatives, who are elected by the students, meet lecturing staff on the programme once a trimester to exchange ideas about the programme. This allows students to communicate their shared concerns in an informal manner, and for the staff to react and respond speedily to address their concerns.

Other support for students include the opportunity to access study skills, mathematics workshops, research seminars and English language training.

University provision and accommodation

There is a commitment at University level to support all aspects of resource provision necessary in the development and implementation of first degrees, post-graduate degrees and research. This has been established over the period of time for which degree programmes have been operating at Glyndŵr. Thus the intention of providing adequate resources for these programmes is clear. The resource framework includes

provision across the University and specifically includes the facilities listed below:

Marketing and Student Recruitment (MSR). A department dealing with all aspects of marketing development of University business, this includes specialists in European Union initiatives for both staff and students.

International Office. A facility devoted to developing world-wide links and programme promotion, especially outside the EU. It co-ordinates language provision for all overseas students and provides other support required by overseas students.

Edward Llwyd Centre. This building provides:

- 1. A good stock of academic reference and lending books,
- 2. A range of support materials: audio-tapes, videos, microfiche and CD-ROM, on-line resources, academic journals,
- 3. A study area,
- 4. Open-access language facilities,
- 5. A large open-access computer with a comprehensive range of software and self-learning packages based on a college-wide network,
- 6. Photo-copying and printing facilities report editing and binding,
- 7. An audio-visual aids department (to service all sections of the University),
- 8. Support for student self-study and short courses on relevant 'transferable' skills,
- 9. I.T. support.

In addition Student Services provides:

- Student counsellors
- Careers counselling and full careers service including placements and an employment agency
- Advice and issue of grants and student loans

Student Village. Situated within the campus boundary and comprising 215 selfcatering flat lets. The expansion to approximately 750 units has been completed.

Teaching Accommodation. There is now a range of different sized classrooms (for 15 up to 50 students) and lecture theatres (for 80 up to 150 students) equipped with modern multimedia facilities.

Engineering subject support and staffing

All sections of the University undergo an on-going review of the course portfolio. Within Aero/Mechanical Engineering this takes the form of a rationalisation which optimises staff contact time. The aim is to combine modules where possible and thus to release staff to undertake student support, research, course development work, and to further develop the laboratory provision.

There are 10 tutoring staff available within Engineering or post-graduate students supporting the delivery of programmes. This whole set of developments combines to provide a suitable grounding for the support of post-graduate programmes. The laboratory areas within Engineering are maintained and operated by three demonstrators and five technicians.

Staff development such as scholarly activities is encouraged in the Subject and is made within the staffing budget to cover staff development relevant to these

programmes.

Programme-specific learning resources

The programme will be delivered through existing infrastructure developed specifically for this purpose at the Advanced Composites Training and Development Centre, in Hawarden, a partnership between Airbus, Glyndŵr University and Welsh Government. Students and staff members will have access to:

Composite materials and storage facility

- Carbon fibre pre-pregs
- Liquid resins (mainly epoxy)
- Nano-additives and reinforcements
- Dedicated chemical storage facility
- Dedicated liquid nitrogen storage facility
- Dedicated gas storage facility (outside research laboratory)

Composites Characterisation

- Dynamic Mechanical Analyser
- Differential Scanning Calorimetry
- Thermal Mechanical Analyser
- Microwave Reaction System
- Microwave Curing System for vacuum bagging
- Freezers for pre-preg storage
- A range of temperature measurement instruments (flouroptics etc.) for measuring and controlling temperature during processing of resins and composites.
- Optical and scanning electron microscopy facilities will be available in C08, Engineering materials laboratory in Plas Coch and these facilities will be duplicated at ACTDC.
- Balances and density measuring kit

Composite Processing

- Microwave processing facilities (RF, power generators, signal analysers etc.)
- Dedicated lay-up room
- Dedicated fume-hoods for volatile chemicals
- Vacuum bagging facilities
- Vacuum oven facilities for curing polymers and composites (order in progress)
- High-shear mixing apparatus

Composite Workshop facility (currently used for training Airbus apprentices)

- Industrial/ Airbus standard workshop
- 15 work-stations
- Drilling
- Shimmng
- Fasterning
- Composite repairing
- Dust-extraction facility on each work station
- Non-Destructive Testing (NDT)

Mechanical and Impact Testing

 Instron testing machine (to be ordered for ACTDC). Currently the facility is in the working condition at the main campus in Wrexham (i.e. lab C08).

- Hardness testing facility (in Wrexham, lab C08).
- Charpy and Izod impact testing facility (in Wrexham, lab C08).

IT Facilities

 17 work-stations connected to Glyndwr University Intranet containing specialist research resources like ANSYS, AUTOCAD, ABAQUS, subscription to Web of Knowledge and e-journals.

The programme team has recently been awarded £75,000 from the Higher Education Funding Council for Wales (HEFCW) for developing the composites laboratory. Glyndŵr University is part of Northwest Composites Centre (NWCC), Manchester, which allows its students to access state-of-the art composite manufacturing and characterisation facilities. NWCCS is a regional centre of expertise supporting, evaluating and introducing innovation in composite manufacture, design and testing. NWCC was established by the Universities of Bolton, Lancaster, Liverpool, Glyndwr and Manchester to create a centre of international scientific reputation to the benefit of industry.

Equality and Diversity

The programme design is relying on the students' involvement. The programme team believes that high learning outcomes can only be achieved through recognising the value of every individual. The proposed programmes aim to create an environment that respects the diversity of staff and students and enables them to achieve their full potential, to contribute fully, and to derive maximum benefit and enjoyment from their involvement in the life of the University experience.

To this end, the University acknowledges the following basic rights for all members and prospective members of its community:

- to be treated with respect and dignity
- to be treated fairly with regard to all procedures, assessments and choices
- to receive encouragement to reach their full potential

These rights carry with them responsibilities and the University requires all members of the community to recognise these rights and to act in accordance with them in all dealings with fellow members of the University. In this way, the programme complies with all relevant legislation and good practice laws stated in the University's equality schemes and equality legislation.