

PROGRAMME SPECIFICATION

Bachelor of Science with Honours (SW) in Applied Mathematics with Engineering

Awarding institution	Liverpool John Moores University
Teaching institution	LJMU
UCAS Code	GG16
JACS Code	G100
Programme Duration	Full-Time: 3 Years, Sandwich Thick: 4 Years
Language of Programme	All LJMU programmes are delivered and assessed in English
Subject benchmark statement	Mathematics, Statistics & Operational Research (MSOR) 2015
Programme accredited by	Institute of Mathematics & its Applications
Description of accreditation	This programme will meet the educational requirements of the Chartered Mathematician designation, awarded by the Institute of Mathematics and its Applications, when it is followed by subsequent training and experience in employment to obtain equivalent competences to those specified by the Quality Assurance Agency (QAA) for taught masters degrees.
Validated target and alternative exit awards	<p>Bachelor of Science with Honours in Applied Mathematics with Engineering</p> <p>Bachelor of Science with Honours (SW) in Applied Mathematics with Engineering</p> <p>Diploma of Higher Education in Applied Mathematics with Engineering</p> <p>Diploma in Higher Education (SW) in Applied Mathematics with Engineering</p> <p>Certificate of Higher Education in Applied Mathematics with Engineering</p>
Programme Leader	Ian Malabar

Educational aims of the programme

This programme focuses on the application of mathematics in an engineering context, and employment therein. It is designed to develop a high level of technical expertise in both mathematics and engineering disciplines. Hence it may be characterised as 'practice-based' (as referred to in the MSOR benchmark statement).

Its main aims are:

- to provide students with an opportunity to enhance their mathematical education by studying broad, yet integrated subjects which have application in engineering.
- to produce graduates with the mathematical knowledge to model, solve and analyse problems using the increasingly sophisticated quantitative techniques adopted by major commercial institutions.
- the development in students of skills which can be utilised in unfamiliar situations, e.g. the ability to conjecture, justify and evaluate.
- to enhance students' key and transferable skills such as communication, applications of IT, working with others, improving their own learning, etc.
- to develop in students an awareness of knowledge and skills necessary for a career as a mathematician or engineer.

- to produce graduates capable of progression to postgraduate areas of study in mathematical and engineering disciplines.
- to deliver the educational experience in which students can develop their knowledge of engineering science and core engineering principles.
- to develop students confidence to analyse challenging technical problems and to further develop their core engineering knowledge and skills through the investigation and development of credible and robust solutions.
- to encourage students to engage with the development of employability skills by completing a self-awareness statement.
- for students undertaking a placement year the aim is to provide students with an extended period of work experience at an approved partner that will complement their programme of study at LJMU. This will give the students the opportunity to develop professional skills relevant to their programme of study, as well as attitude and behaviours necessary for employment in a diverse and changing environment.

Alternative Exit/ Interim Award Learning Outcomes - Certificate of Higher Education

A student who is eligible for this award will be able to:

- Develop a thorough grounding in the basic mathematical concepts and methods needed to solve a range of problems with scientific, business and engineering applications.
- Appropriately use mathematical and other software to support conceptual understanding and problem solving.
- Apply the theoretical techniques of linear algebra in a practical context.
- Formulate and solve a variety of real-world modelling problems.
- Apply the basic principles of applied mechanics and thermodynamics and fluid mechanics to simplified engineering problems.
- Demonstrate key skills appropriate to the professional engineer.

Alternative Exit/ Interim Award Learning Outcomes - Diploma of Higher Education

A student who is eligible for this award will be able to:

- Develop a thorough grounding in Mathematical methods in the areas of multidimensional calculus such as partial differentiation and applications, together with elements of discrete mathematics such as graph theory, linear programming, etc.
- Appreciate the importance of career management in terms of both personal and professional development.
- Understand computing in an increasingly sophisticated technological world.
- Develop mathematical skills in an independent manner.
- Demonstrate the application of basic principles of applied mechanics and thermodynamics and fluid mechanics to the solution of standard engineering problems
- Demonstrate the intermediate engineering skills that will be required for completion of engineering modules at Level 6.

A student who successfully completes a placement year will be eligible for the Sandwich award and will, in addition to the above, be able to demonstrate the professional and personal skills necessary for effective employment within a professional environment.

Target award Learning Outcomes - Bachelor of Science with Honours (SW)

A student successfully completing the programme of study will have acquired the following subject knowledge and understanding as well as skills and other attributes.

A student who is eligible for this award will be able to:

1. Demonstrate their knowledge and understanding of a range of fundamental areas of mathematics applied to engineering.
2. Apply analytical techniques and algorithms to solve quantitative problems relating to engineering.
3. Use and apply a range of software to solve mathematical and engineering problems.
4. Identify the role of computers and I.T. in mathematics and engineering.
5. Understand engineering principles and the ability to apply them to analyse key engineering processes.
6. Represent and explore relationships between algebraic, numerical and graphical forms of representation.

7. Model systems in an engineering context: conjecture, hypothesis, analysis, inference, conclusion, interpretation, evaluation.
8. Apply appropriate problem-solving strategies and select appropriate tools.
9. Synthesise a balanced viewpoint from a variety of (potentially contradictory) evidence and perspectives.
10. Demonstrate the skills necessary to plan, undertake and report on a project of original research.
11. Apply appropriate quantitative science and engineering tools to the analysis of problems.
12. Model real world situations.
13. Use a wide range of appropriate software packages for the analysis/synthesis of information.
14. Communicate technical issues in non-technical language.
15. Plan and manage course/project work.
16. Present their work in a professional manner using appropriate I.T. and graphical software.
17. Understand contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc.).
18. Use information technology, e.g. Internet, for effective information retrieval.
19. Apply problem solving skills.
20. Communicate effectively by written or verbal means.
21. Plan and manage learning and development.

Alternative target awards

A student who is eligible for the following awards will be able to:

Bachelor of Science with Honours in Applied Mathematics with Engineering -

A student successfully completing this award will have acquired the subject knowledge and understanding as well as skills and other attributes as detailed above but will not have successfully completed a placement year.

Teaching, Learning and Assessment

The methods used to enable outcomes to be achieved and demonstrated are as follows:

Core knowledge and understanding is acquired via lectures, tutorials, practical computing sessions, team working and guided independent study. Independent study is used where appropriate resource material is available and increases as the programme progresses.

Assessment methods are specified in each module specification. All learning outcomes in a module are assessed and the type of assessment specified for each outcome. Each module is assessed by examination and/or course work (individual or group). The nature of the course work varies for each module.

Intellectual skills are developed and applied through class discussion, individual and group practical work, tutorials and course work assignments.

Intellectual skills are assessed via formal examinations and through course work assessment.

The final year project, involving a major report and oral presentation, allows a student to demonstrate his/her cognitive skills.

Practical skills are developed throughout the programme, and are reinforced in practical sessions at each level. The basic skills are provided at the lower levels. These are supplemented at higher levels by more advanced tools and techniques. Some of these skills are practised in the placement year.

Specialist software is available in School labs or from specified PCs in the libraries.

Assessment is normally by course work and formal, written, timed examination.

The placement year is assessed, by portfolio, on a pass / fail basis.

Key skills are developed throughout the programme in a variety of forms, specifically through a combination of research related coursework, guided independent study and projects, examinations, group work and presentations. Skill 1 is developed through a combination of research-related coursework, guided independent study, and projects. Skill 2 is developed through study of technical methods, modelling exercises, examinations, coursework, and projects. Skill 3 is developed through report writing for coursework and projects, written examinations, teamwork, presentations, and group discussion. Skill 4 is developed via the management of learning tasks and deadlines for coursework and projects.

Key skills are assessed as part of coursework (1-4), projects (1-4), written examinations (2, 3) and presentations (3).

Programme structure - programme rules and modules

Students must select two option modules at Level 6. The choice of option modules could cause an imbalance in terms of credits across the year. The maximum imbalance would be 70:50. A balanced structure is clearly possible. Students can choose to have an imbalance of credits but they will be counselled carefully regarding the consequences in terms of the management of their work.

The placement year, module 5101APMATH, will follow Level 5 and students will be enrolled on a 480 credit honours sandwich programme. The Level 5 mean for the final award mark will be calculated based upon the 240 credits at Level 5. Students successfully completing the assessment of the placement year are eligible for a Sandwich award.

Students not undertaking a placement year are registered on the non-sandwich version of the programme and will have the opportunity of an additional study year abroad following Level 5. Students will be enrolled on a 480 credit honours with study abroad programme. Of those 480 credits, 120 will be taken via a Level 5 study abroad module 5105APMATH. The modules to be studied in the host institution must be agreed in advance. The Level 5 mean for the final award mark will be calculated based upon the 240 credits at Level 5.

Level 6	Potential Awards on completion	Bachelor of Science with Honours (SW)
Core	Option	Award Requirements
6100MATHS PROJECT (40 credits) 6101MATHS OPERATIONAL RESEARCH (20 credits) 6102MECH Engineering Analysis (20 credits) 6109MATHS ADVANCED CALCULUS (20 credits)	6108MECH Fluid Dynamics and Heat Transfer (10 credits) 6109MECH Thermodynamics (10 credits) 6111MECH Structural Integrity (10 credits) 6113MECH Dynamics and Control (10 credits)	100 core credits at level 6 20 option credits at level 6

Level 5	Potential Awards on completion	
Core	Option	Award Requirements
5100MATHS FURTHER MATHEMATICAL METHODS (20 credits) 5103MATHS NUMERICAL METHODS (20 credits) 5104MATHS PERSONAL AND PROFESSIONAL DEVELOPMENT (20 credits) 5104MECH Applied Mechanics 2 (20 credits) 5105MATHS Differential Equations (20 credits) 5105MECH Thermodynamics and Fluid Mechanics 2 (20 credits)		120 core credits at level 5 0 option credits at level 5

Level 4	Potential Awards on completion	
Core	Option	Award Requirements
4101MATHS MATHEMATICAL METHODS (20 credits) 4103MECH Applied Mechanics 1 (20 credits) 4104MECH Thermodynamics and Fluid Mechanics 1 (20 credits) 4110MATHS LINEAR ALGEBRA (20 credits) 4111MATHS MODELLING 1 (20 credits) 4113MATHS MODELLING 2 (20 credits)		120 core credits at level 4 0 option credits at level 4

Information about assessment regulations

All programmes leading to LJMU awards operate within the University's Academic Framework.
<https://www.ljmu.ac.uk/about-us/public-information/academic-quality-and-regulations/academic-framework>

Opportunities for work-related learning (location and nature of activities)

5104MATHS Personal and Professional Development - This module provides students with an opportunity to consider their future role as an applied mathematician and develop a plan to enable them to progress in their chosen career.

5105MECH Thermodynamics and Fluid Dynamics 2 – This module provides an insight into thermal plant cycles and the physical behaviour of fluid flow and heat transfer by application of the theory to practical engineering examples. The students will be exposed to real engineering calculation and the performance analysis of thermal plant.

5101APMATH Sandwich Year Applied Mathematics with Engineering - The aim is to provide students with an extended period of work experience at an approved partner that will complement their programme of study at LJMU. This will give students the opportunity to develop professional skills relevant to their programme of study as well as the attitude and behaviours necessary for employment in a diverse and changing environment.

Criteria for admission

A/AS Level

112 UCAS points to include 2 A-levels or Double Award (to include A2 Maths grade C or above)

BTEC National Diploma

BTEC Extended Diploma

To the value of 112 UCAS points

BTEC Diploma / 90 Credit Diploma / Subsidiary Diploma /Certificate

To the value of 112 UCAS points when combined with other qualifications. Must include appropriate Mathematical content.

Irish Leaving Certificate

Applicants should have or expect to obtain a total of 112 UCAS points overall, including appropriate Mathematical content.

Scottish Higher

Applicants should have or expect to obtain a total of 112 UCAS points overall, including appropriate Mathematical content.

International Baccalaureate

Applicants should have or expect to obtain a total of 112 UCAS points overall, including Higher Level Maths at grade 5.

Higher national diploma

Pass with Maths at Level 3

Other

In addition to 112 UCAS points applicants should have five GCSEs at grade C or above including GCSE Mathematics grade C and English Language grade C or equivalent.

Mature entry

Without the necessary qualifications but relevant experience are encouraged to apply and may be requested to attend an interview and aptitude test.

Overseas qualifications

Offers will be based on individual qualifications and experience. All applicants should have achieved IELTS 6.0

External Quality Benchmarks

All programmes leading to LJMU awards have been designed and approved in accordance with the UK Quality Code for Higher Education, including the Framework for Higher Education Qualifications in the UK (FHEQ) and subject benchmark statements where applicable.

The University is subject to periodic review of its quality and standards by the Quality Assurance Agency (QAA) Published review reports are available on the QAA website at www.qaa.ac.uk

Programmes which are professionally accredited are reviewed by professional, statutory and regulatory bodies (PSRBs) and such programmes must meet the competencies/standards of those PSRBs.

Support for students and their learning

The University aims to provide students with access to appropriate and timely information, support and guidance to ensure that they are able to benefit fully from their time at LJMU. All students are assigned a Personal Tutor to provide academic support and when necessary signpost students to the appropriate University support services.

Students are able to access a range of professional services including:

- Advice on practical aspects of study and how to use these opportunities to support and enhance their personal and academic development. This includes support for placements and careers guidance.
- Student Advice and Wellbeing Services provide students with advice, support and information, particularly in the areas of: student funding and financial matters, disability, advice and support to international students, study support, accommodation, health, wellbeing and counselling.
- Students studying for an LJMU award at a partner organisation will have access to local support services

Methods for evaluating and improving the quality and standards of teaching and learning

Student Feedback and Evaluation

The University uses the results of student feedback from internal and external student surveys (such as module evaluations, the NSS and PTES), module evaluation questionnaires and meetings with student representatives to improve the quality of programmes.

Staff development

The quality of teaching is assured through staff review and staff development in learning, teaching and assessment.

Internal Review

All programmes are reviewed annually and periodically, informed by a range of data and feedback, to ensure quality and standards of programmes and to make improvements to programmes.

External Examining

External examiners are appointed to programmes to assess whether:

- the University is maintaining the threshold academic standards set for awards in accordance with the FHEQ and applicable subject benchmark statements
- the assessment process measures student achievement rigorously and fairly against the intended outcomes of the programme(s) and is conducted in line with University policies and regulations
- the academic standards are comparable with those in other UK higher education institutions of which external examiners have experience
- the achievement of students are comparable with those in other UK higher education institutions of which the external examiners have experience

and to provide informative comment and recommendations on:

- good practice and innovation relating to learning, teaching and assessment observed by external examiners
- opportunities to enhance the quality of the learning opportunities provided to students

Please note:

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content, teaching, learning and assessment methods of each module can be found in module and programme guides.