PROGRAMME SPECIFICATION (Taught Postgraduate)	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	Postgraduate Certificate
4	**Programme Title**	Power Electronics for Sustainable Electric Propulsion
5	**Programme Code**	3179F
6	**Programme Accreditation**	
7	**QAA Subject Benchmark(s)**	Engineering
8	**FHEQ Level**	7
9	**Last updated**	May 2023

10 Programme Aims

The programme aims are:

1. To educate engineers to understand electrical propulsion engineering as an ordered academic discipline at the post-graduate level by providing them with extensive experience of recent industrial applications and the relevant theoretical background.
2. To provide students with a flexible learning environment which will increase access for employees and prepare them for lifelong learning.
3. To increase the students' skills of analysis, synthesis and evaluation in order to solve problems in the field of power electronics engineering.
4. To develop the students' transferable skills (communications, planning, time management, report writing etc.).
5. To increase the pool of qualified engineers in power electronics for sustainable power propulsion in the UK as required by the UK power industry.
6. To provide a well-balanced understanding of the essential disciplines of power electronics engineering including the design and implementation for power electronics, advanced AC drives, data management and exploratory data analysis and mechatronic design to name a few.
7. To develop the multidisciplinary and group working collaboration skills of communication, group work, analysis, synthesis, evaluation and review and to develop the students' on-line competencies.
8. To further research within power electronics via students undertaking a substantial research project leading to a subsequent related PhD in Power Electronics for Sustainable Electric Propulsion.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Power Engineering. Learning outcomes will be dependent on optional modules chosen. Please refer to appendix 1 for table.

Knowledge and Understanding Science & Maths

On completing the programme students should:

A1. Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies.
A2. Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems.
A3. Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline.
A4. Awareness of developing technologies related to own specialisation.
A5. A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.
A6. Understanding of concepts from a range of areas including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects.

Teaching and Learning Methods

Fundamental and specialist knowledge and understanding (A1-A6) is delivered through lectures, seminars and activity based training. During the teaching for each module and the corresponding distributed learning material that includes many worked examples, exercises and design projects to enable students to check their learning and extend their knowledge. Student understanding and learning is enhanced by within module problem solving, group work and assessed projects. Independent learning is encouraged via reading lists, within module formative material reviews, seminars, and 'homework' problems; with online resources available in relation to these. Significant time in each module is available for private study to further encourage independent learning.

Assessment Strategy

Summative assessments are used to assess knowledge and understanding, and to evaluate student problem solving, practical skills and group work. Formative assessment is included to provide student feedback throughout the course, without contributing to module marks. Formal feedback is provided for each piece of assessed coursework in the form of an individual proforma and a review session in subsequent lectures (A1-A6).

Intellectual Skills Eng. Analysis

On completing the programme students should be able to:

B1 Understanding of engineering principles and the ability to apply them to analyse key engineering processes.
B2 Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques.
B3 Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action.
B4 Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems.

Teaching and Learning Methods

Intellectual skills developed through a combination of lectures, practicals and case studies. Both teaching methods include subsequent directed self-learning either via additional online content, or via including laboratory practicals or problem-based learning or a combination of all. Practical sessions and problem-solving exercises are used to develop skills and bridge the knowledge between the theoretical design and the practical implementation of electric power and control. Small group work and tutorials are used to develop knowledge and understanding on specific key topics and develop critical analysis, analytical methods and to develop an understanding of subject-specific research literature (B1-4).

Students are also encouraged to learn by doing, i.e. by performing calculations, using appropriate software packages, undertaking design projects and presenting their own analysis.

Assessment Strategy

Intellectual skills are assessed by written examinations and continuously-assessed material that includes written reports, practical write-ups, literature reviews, group projects and oral presentations. The assessment methods aim to evaluate the students' understanding and ability to apply the manufacturing processes and electromechanical interaction into specific requirements.

These skills are assessed by unseen written examination in-module assessment and project work (B1-4).

Practical Skills Eng. practice

On completing the programme students should be able to:

C1 Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc.)
C2 Knowledge of characteristics of particular materials, equipment, processes, or products
C3 Ability to apply relevant practical and laboratory skills
C4 Understanding of the use of technical literature and other information sources
C5 Understanding of appropriate codes of practice and industry standards
C6 Understanding of, and the ability to work in, different roles within an engineering team.
C7 Awareness of quality issues and their application to continuous improvement
C8 Ability to work with technical uncertainty
C9 A thorough understanding of current practice and its limitations, and some appreciation of likely new developments
C10 Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints
C11 Advanced level knowledge and understanding of a wide range of engineering materials and components

Teaching and Learning Methods

Lectures, seminars and computer-based practicals will be employed to provide students with the key software and practical skills required for power electronics research. Critical evaluation of current research will be developed through literature searching and coursework exercises. The dedicated modules on Electrical Power and Control and Power Electronics Design solutions and Project Development will put theoretical learning into practice. Students will work on the hardware from the beginning of their CDT experience. Students will work in teams to design, build and test an electric drive train and power converter with the intend to integrate the hardware into small scale models of the car and helicopter (C1-11).

Assessment Strategy

Practical skills are assessed in the form of individual reports from practical classes, literature reviews, seminar contribution, tutorial exercises and the group project reports (C1-11).

Transferable/Key Skills economic, legal, social and env.

On completing the programme students should be able to:

D1 Understand how to verbally communicate effectively
D2 Understand how to effectively communicate via written work
D3 Work effectively within a group based environment.
D4 Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct.

D5 Knowledge and understanding of the commercial, economic and social context of engineering processes,
D6 Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives.
D7 Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate.
D8 Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues.
D9 Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques.

Teaching and Learning Methods

Verbal presentation skills are developed by group discussions in tutorial sessions, by communication during group exercises, and by the preparation of oral presentations on specific research topics and for seminar exercises. Written communication skills are developed during independent study, the preparation of coursework, and through the completion of the group project. Lectures and practicals cover the use of online resources and research techniques. Module practicals and practical exercises develop generic transferable computing skills (D1-9).

Assessment Strategy

Written communication skills are assessed by report preparation. Oral communication skills are assessed in oral presentations and seminar discussion contributions. Computer-based literacy is assessed through the preparation of literature reviews and through peer-and self-assessment. Group work is formally evaluated using group-based problem solving, particularly in the practicals. Independent work is assessed in literature reviews (D1-9).

12 Programme Curriculum, Structure and Features

Basic structure of the programme

This one-year programme forms the training component for the 4-year EPSRC Centre for Doctoral Training in Power Electronics for Sustainable Electric Propulsion. Students will be recruited from the engineering and sciences area to spend one semester in Newcastle and the second semester in Nottingham. The taught component will provide training on the key concepts and application of power electronics management, analysis, simulation and visualisation, along with key engineering skills that is transforming the applied use of sustainable electric propulsion.

Four modules will cover the fundamentals of power electronics and electric propulsion and will provide the essentials that are required to commence a career as a power electronics engineer. Power Electronics - Design and Implementation; Electrical Machines; Power Systems for Aerospace, Marine, and Automotive Applications, and Advanced AC Drives.

The following bespoke modules will be created to allow students to focus on the design and integration aspects of the programme. Data Management and Exploratory Data Analysis, Mechatronic Design, Introduction to Transport Materials, and Aerospace Manufacturing.

Two laboratory modules will be offered, one at Newcastle University and the other at University of Nottingham to allow students to bridge their knowledge between theoretical design and practical implementation.

Key features of the programme (including what makes the programme distinctive)

This programme forms the initial training component of the four year PhD in the EPSRC CDT in Power Electronics for Sustainable Electric Propulsion. The training is distinctive in that it combines the core knowledge, understanding and skill required in electric propulsion and will provide the necessary foundations for multi-facet challenges in electric propulsion and power electronics.

The programme provides students with detailed practical skills in the application of the approaches covered in the taught modules. Activities in the laboratories allow students to bring this learning together in an integrated group activity and will be the first stepping stone to focus on the research area relating to their PhD research starting in year 2. The programme is distinctive in that it will be accessible to engineers and scientists; providing training to an interdisciplinary cohort. The programme is predominately by key academic staff both at Newcastle University and The University of Nottingham.

Programme regulations (link to on-line version)

-R3179F.pdf (ncl.ac.uk)

13 Support for Student Learning

Generic information regarding University provision is available at the following link.
Generic Information

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

Generic information regarding University provision is available at the following link.
Generic Information

Accreditation reports

Additional mechanisms

15 Regulation of assessment

Generic information regarding University provision is available at the following link.
Generic Information

In addition, information relating to the programme is provided in:

The University Prospectus: https://www.ncl.ac.uk/postgraduate/

Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided.