1 Awarding Institution	Newcastle University
2 Teaching Institution	Newcastle University
3 Final Award	MSc
4 Programme Title	Advanced Sensor Technology
5 Programme Code	5157F
6 Programme Accreditation	The Institution of Engineering and Technology (IET)
7 QAA Subject Benchmark(s)	Engineering
8 FHEQ Level	Masters
9 Date written/revised	August 2007

10 Programme Aims

1. To provide an opportunity for students from a wide backgrounds, such as electrical and electronic engineering, mechanical engineering, computer sciences, physics and materials science, to study sensor technology at an advanced level.
2. To provide graduates with the skills and knowledge to be competitive in their chosen field of employment, which could include the manufacturing, aerospace, homeland security, automotive, communication and energy sectors. The programme will bridge skill gaps identified by businesses in these sectors.
3. To promote sensor technology research and give students the necessary background to move on to further research.
4. The programme aims to meet the descriptors, for a qualification at Masters (M) level, published by the Framework for Higher Education Qualifications in England, Wales and Northern Ireland.

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the above areas. The programme outcomes have references to the benchmark statements for Advanced Sensor Technology.

Knowledge and Understanding

On completing the programme students should:

A1 Have detailed knowledge and understanding of facts, concepts, principles and theories relevant to Advanced Sensor Technology.
A2 Have gained mathematics and physics appropriate to Advanced Sensor Technology. and related fields.
A3 Have detailed knowledge of IT applications to the field of Advanced Sensor Technology.
A4 Understand the role of Advanced Sensor Technology in society and the constraints within which their engineering judgement will be exercised.
A5 Have gained appropriate management principles and business practices, including professional and ethical responsibilities.
A6 Understand production practice, including codes of practice and regulatory framework.
A7 Be familiar with assessment of safety risks, and the legislative framework for safety.

Teaching and Learning Methods

Acquisition of A1 and A2 is through a combination of lectures, tutorials, example classes, laboratory activities and coursework. Outcome A3 is achieved by lectures, tutorials and, where appropriate, hands-on computer exercises. Acquisition of A4 is through lectures, tutorials, case studies, laboratory experiments and student investigations and presentations. Outcome A5 depends primarily on lectures and tutorials. The broader professional outcomes in A6 are taught by lectures and coursework studies. Outcome A7 is formally taught in lectures and developed in tutorials.

Assessment Strategy

Formative assessment occurs through tutorial examples and coursework. The primary means of assessing factual knowledge is the closed book examination. This is supported by assessed coursework involving both written and oral presentations. In depth individual learning frequently forms part of the project, which is assessed by dissertation, and for selected students, viva voce examination.

Intellectual Skills

On completing the programme students should be able to:

B1 Plan, conduct and report a programme of investigative work;
B2 Analyse electronic systems;
B3 Be creative in the solution of problems and in the development of designs;
B4 Evaluate designs and systems and consider improvements;
B5 Evaluate and integrate information and data from a variety of sources;
B6 Determine the appropriate mathematical tools for the solution of problems;
B7 Determine the correct model to use in the analysis of electronic systems;
B8 Analyse experimental or computational results and determine their strength and validity.

Teaching and Learning Methods

Where appropriate, B1 is reinforced in lectures, but learning is principally in tutorials and assignments. The abilities characterised by B2 are initially encountered in lectures, practical classes and case studies but are developed principally during the research project. Acquisition of B3 occurs through lectures and design coursework and may form a major part of the project. B4 and B5 are developed through coursework activities, research and design projects. B6, B7 and B8 are developed through lectures of theoretical analysis, using modelling and simulation and design software, theoretical and experimental studies. In all modules, practicals and coursework and reports are used to develop these skills (B1-B8).

Assessment Strategy

Formal examinations are used to assess intellectual abilities. Assessed coursework provides further opportunities to demonstrate intellect and ability. The project, which is assessed by dissertation and, for selected students, viva voce examination, provides final evidence of the levels attained.

Practical Skills

On completing the programme students should be able to:

C1 Use appropriate mathematical methods for modelling and analysing problems in Advanced Sensor Technology
C2 Carry out experimental laboratory work in a professional manner
C3 Use commercial computer packages for appropriate tasks
C4 Design a system.
C5 Test design ideas with technical analysis and to evaluate the results critically.
C6 Search for information for the further development of ideas.
C7 Apply engineering techniques taking account of industrial and commercial constraints

Teaching and Learning Methods

The skills associated with C1 –C2 are acquired principally through experience gained in coursework and the project. Skills associated with C3 are developed initially through lectures and hands-on design coursework. Further individual learning may also form a significant part of the project. The skills associated with C4 are acquired through lectures and developed through design coursework and/or the project. Design coursework provides initial opportunities for developing the skills associated with C5 and C6, but the project forms the principal vehicle for their acquisition. The skills required for C7 are acquired initially through lectures and developed by design coursework, and some projects may require further individual learning in this area. Effective project management is learnt through coursework and the project.

Assessment Strategy

Practical skills are assessed through a design report, coursework reports, project reports and presentations.

Transferable/Key Skills

On completing the programme students should be able to:

D1 Manipulate and present data in a variety of ways
D2 Use scientific evidence based methods in the solution of problems
D3 Demonstrate good capability in IT skills
D4 Be creative and innovative in problem solving
D5 Work with limited or contradictory information
D6 Communicate effectively orally and in written material
D7 Confidently approach engineering problems
D8 Manage time and resources

Teaching and Learning Methods

Transferable skills associated with D5, D6 and D8 are developed in project-based coursework. All the other transferable skills are covered in a dedicated module on research skills.

Assessment Strategy

Key (transferable) skills are assessed by both written and oral presentations (D1-D8). The skills associated with D1 and D2 are assessed through formal examination. Those with D5, D6 and D8 are assessed through coursework. Information retrieval and oral presentation test the skills of D3, D4 and D7.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

This is a one year programme leading to a Masters degree. The programme has 180 credits and all modules are compulsory. The taught part of the programme takes place from September to June with 55 credits in semester 1 and 45 credits in semester 2. There are five taught credit modules in semester one with 55 total credits and four taught modules in semester two with 45 total credits. Students spend some time during these semesters on the 80-credit individual project but most of the work on this module (60 credits) starts in June with the final submission at the end of August.

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

Sensor technology is an emerging, inter-disciplinary field, driving the interfacing of the physical and digital worlds. The ability to sense the behaviour of a remote system offers a whole new range of technological opportunities, from the ability to monitor pollution to the control of manufacturing processes and hence substantially benefit our science based economy. A review of the literature shows that ‘the advent of wireless sensor network technology can also be viewed as the next major qualitative change that will have a dramatic effect within Information and Communication Technology (ICT) and the other industries it enables’ [DTI Global Watch Mission – Wireless Sensor Networks]. The expected application

areas for this technology includes Environmental monitoring, Automotive, Health and Industrial monitoring, as well as non destructive testing, crime prevention, anti terrorism, ageing and healthcare.

The proposed programme is designed to support an emerging technical need, combining both the application led interests of industry, with the theoretical background required to challenge conventional thinking. World class research within the school informs teaching on the programme. The programme also benefits from close links the school has with industry in this field.

Programme regulations

The regulations for this programme can be found at:
http://www.ncl.ac.uk/regulations/programme/

13 Criteria for admission

A good honours degree (2ii or equivalent) in an electrical or electronic engineering or computing related subject. Graduates from other disciplines who have extensive work experience in engineering, technical and computing related fields may also be considered on an individual basis.

Admissions policy/selection tools
All candidates will be considered individually. Engineering requires a wide range of attributes and abilities so selection is not solely based on academic grades but selectors seek evidence of motivation and commitment from the personal statement and reference on application forms.

Non-standard Entry Requirements
Potential students with qualifications other than those specifically listed above will be considered on an individual basis by the selector and, if appropriate, will be made an offer.

Level of English Language capability
Entry into the degree programme requires an English language competence of IELTS 6.0 or equivalent. Students whose English language ability does not meet this level may be recommended to attend pre-sessional English courses or to register on the INTO Newcastle University programme.

14 Support for Student Learning

Induction
During the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and their programme, as described in the Degree Programme Handbook. The International Office offers an additional induction programme for overseas students.

Study skills support
Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the Programme Specification. Some of this material is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both group and individual projects.

Numeracy support is available through Maths Aid.

Help with academic writing is available from the Writing Development Centre.

Academic support
The initial point of contact for a student is with a lecturer or module leader, or their tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Staff-Student Committee, and/or at the Board of Studies.

Pastoral support

All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. In addition the University offers a range of support services, including one-to-one counselling and guidance or group sessions/workshops on a range of topics, such as emotional issues eg. stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues etc.

Support for students with disabilities
The University's Disability Support Service provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies.

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-sessional language training can be provided. The INTO Newcastle University Centre houses a range of resources which may be particularly appropriate for those interested in an Erasmus exchange.

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

Module reviews
All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the School Teaching and Learning Committee and at the Board of Studies. Student opinion is sought at the Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Teaching and Learning Committee.

Programme reviews
The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Teaching and Learning Committee.

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Teaching and Learning Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

Student evaluations
All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Staff-Student Committee, and the Board of Studies.

Mechanisms for gaining student feedback
Feedback is channelled via the Staff-Student Committee and the Board of Studies.

Faculty and University Review Mechanisms
The programme is subject to the University's Internal Subject Review process. Every five years degree programmes in each subject area are subjected to review. This involves both the detailed consideration of a range of documentation, and a two-day review visit by a review team which includes an external subject specialist in addition to University and Faculty

representatives. Following the review a report is produced, which forms the basis for a decision by University Teaching and Learning Committee on whether the programmes reviewed should be re-approved for a further five year period.

Accreditation reports
It is intended that this programme will be accredited by the IET.

16 Regulation of assessment

Pass mark
The pass mark is 50

Course requirements
Progression is subject to the University's Masters Degree Progress Regulations, Taught and Research and Examination Conventions for Taught Masters Degrees. Limited compensation up to 40 credits of the taught element and down to a mark of 40 is possible and there are reassessment opportunities, with certain restrictions.

Common Marking Scheme
The University employs a common marking scheme, which is specified in the Taught Postgraduate Examination Conventions, namely:

Summary description applicable to postgraduate Masters programmes		**Summary description applicable to postgraduate Certificate and Diploma programmes**	
<50	Fail	<50	Fail
50-59	Pass	50 or above	Pass
60-69	Pass with Merit		
70 or above	Pass with Distinction		

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, after recommendation from the Board of Studies. The External Examiner is expected to:

- See and approve examination papers
- Moderate examination and coursework marking
- Attend the Board of Examiners
- Report to the University on the standards of the programme

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

The University Prospectus (see http://www.ncl.ac.uk/postgraduate/)

The School Brochure (contact enquiries@ncl.ac.uk)

The University Regulations (see http://www.ncl.ac.uk/regulations/docs/)

The Degree Programme Handbook

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. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes (ILOs) onto Curriculum/Modules

ILO	Module codes (Compulsory in Bold)
A1.	**EEE8066, EEE8065, EEE8067, EEE8069, EEE8070**
A2	**EEE8066, EEE8065, EEE8067**
A3	**EEE8066, EEE8040, EEE8068, EEE8070**
A4	**EEE8066, EEE8069**
A5	**EEE8069**
A6	**EEE8069**
A7	**EEE8069**
B1	**EEE8094**
B2.	**EEE8070, EEE8094, EEE8068**
B3	**EEE8070, EEE8094**
B4	**EEE8070, EEE8094, EEE8068**
B5	**EEE8069, EEE8070, EEE8094**
B6	**EEE8070, EEE8094**
B7	**EEE8070, EEE8094**
B8	**EEE8070, EEE8094, EEE8068**
C1	**EEE8070, EEE8094, EEE8068, EEE8069**
C2	**EEE8070, EEE8094**
C3	**EEE8070, EEE8094, EEE8068**
C4	**EEE8070, EEE8094, EEE8068**
C5	**EEE8070, EEE8094**
C6	**EEE8094**
C7	**EEE8070, EEE8094, EEE8069**
D1	**EEE8070, EEE8094**
D2	**EEE8070, EEE8094**
D3	**EEE8070, EEE8094, EEE8068**
D4	**EEE8070, EEE8094**
D5	**EEE8070, EEE8094**
D6	**EEE8070, EEE8094**
D7	**EEE8070, EEE8094**
D8	**EEE8070, EEE8094**