Programme Specification (Postgraduate)

Date amended: 13/9/15

1. Programme Title(s):
MSc / PG Certificate in Reliable Embedded Systems

2. Awarding body or institution:

University of Leicester

3. a) Mode of study

Part-time (Blended learning)

b) Type of study

Distance learning (Blended learning)

4. Registration periods:

The normal period of registration is: 2 years and 3 months (MSC), 2 years (PG Cert)
The maximum period of registration is: 4 years (MSc), 3 years (PG Cert)

5. Typical entry requirements:

Normally a candidate will be expected to hold an undergraduate degree (e.g. BSc, BEng) in an appropriate related discipline from a UK University, or recognised international equivalent, at the level of second class honours (2:2) or equivalent.

In exceptional cases where a candidate's degree is not in a related discipline, or a candidate does not meet the degree requirements, significant directly relevant industrial experience may be taken into consideration as a compensating strength.

All teaching will be in English. Evidence of proficiency in English may be required where appropriate.

6. Accreditation of Prior Learning:

Candidates may take EG7510 as a stand-alone CPD activity. If they register as a CPD delegate, they may engage with the advance study component of the module, and the block teaching week. They will not engage with the final (assessed) case study. They will be given feedback – but not formal marks – for laboratory work during the course of the week.

Candidates will have a 12 month period (equating to two entry points to the programme) to register for the MSc or postgraduate certificate. They will have the option to APL the credits for this module by completing the assessed case study (in the timetable/calendar slot matching new students, with the equivalent support) and obtaining a full marks profile for the module. A fees consideration may be applied in this case.

They may also elect not to APL the credits for EG7510, and to register for the complete programme. No time restrictions apply in this case, and no previous results are transferable. No fees considerations will apply in this case.

The same APL applies to the Postgraduate Certificate.

7. Programme aims:

The programme aims to provide the knowledge and skills required of a professional engineer to design reliable embedded systems, in a format and at a level that reflects state-of-the-art industrial practice. The course includes modules on programming, software architecture, field-programmable gate arrays, real-time operating systems and multi-core / multi-processor systems. Students should be able to:

- Demonstrate specific knowledge and understanding of advanced topics in reliable and real-time embedded systems and to be able to apply this knowledge in the design and implementation of real-world systems;
- Continue to develop their professional engineering education through CPD programmes of related areas;
- Work effectively as part of both multi- and single-disciplinary teams;
- Demonstrate clear communication skills and be competent users of IT communication techniques (e.g. oral presentation and report writing);
- Pursue research (MSc graduates only);
- Undertake the normal roles of Chartered Engineers in industry (MSc graduates only).

8. Reference points used to inform the programme specification:

- QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland
- QAA Master's Degree Characteristics
- QAA Benchmarking Statement Engineering (2015)
- PDR report (May 2008)
- University Learning Strategy
- University Employability Strategy
- Graduate Survey (2014)
- First Destination Survey
- External Examiner's Reports

9. Programme Outcomes:

MSc in Reliable Embedded Systems

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
(a) Subject and Professional skills		
Knowledge		
Core knowledge of state-of-the-art architectures and techniques for reliable and real-time embedded systems.	Lecturer-driven seminar classes for each module, laboratory exercises and design classes, problem solving classes, background reading and directed independent reading of current research, on-line tutorial support.	Submission of design solutions and laboratory exercises, literature review reports, oral presentations, execution of large case study relevant to each module.
Concepts		
Design of modern embedded systems contrast the relative merits of different designs (time triggered and event driven) with regards to reliability, and apply the range of techniques that may be used to achieve reliability.	Lecturer-driven seminar classes for each module, laboratory exercises and design classes, problem solving classes, background reading and directed independent reading of current research, on-line tutorial support.	Evaluation of design solutions and laboratory exercises, supported by oral presentations, execution of large case study relevant to each module.

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
Techniques		
Practical demonstration of experimental methods and measurement techniques including collection of results. Competence use of a variety of current industrial design tools for CPU and FPGA platforms.	Practical demonstrations and execution of laboratory exercises and applications in problem solving classes.	Demonstration of design solutions and laboratory exercises, supported by oral presentation, execution of large case study relevant to each module.
Critical analysis		
Appraisal of different techniques used to design, analyse, and measure results of contrasting designs and techniques.	Laboratory practical classes and laboratory exercises, follow-up seminar classes and on-line teaching support.	Submission of design solutions evaluation and laboratory exercise evaluation, oral presentations, project progress and project report.
Presentation		
Ability to debate with supporting scientific and engineering evidence the relative merits of software, hardware, and design techniques in the context of large engineering projects.	Supported laboratory exercises, group exercises and seminar discussions, project supervision.	Oral presentations and seminar discussion performance, final project report.
Appraisal of evidence		
Constructive evaluation, analysis, and review of relative safety and merits of end product embedded systems.	Seminar discussions, experimental evaluation of laboratory exercises, directed private study and research, project supervision and evaluation.	Submission of laboratory reports, project proposal and final project report.
(b) Transferable skills		
Research skills		
Study skills, information management including searching research archives, project planning and management including literature review, experimental design and data analysis. Comprehension of hardware/software descriptions and data sheets.	Student led seminar and laboratory classes, on-line directed study support, project supervision meetings.	Submission of course work and case studies for each module, project proposal and final project report.
Communication skills		
Report writing, scientific communication and presentation of results appropriate to a wider engineering context such as a systems engineering one.	Project supervision meetings, lecturer-driven seminar classes	Submission of course work and case studies for each module, project proposal and final project report.
Data presentation		
Analytical methods for evaluating performance and reliability of systems including identifying, categorizing and reviewing relevant results (such as execution times, usage, and adherence to industry standards).	Student led seminar and laboratory classes, on-line directed study support, project supervision meetings.	Submission of course work and case studies for each module, project proposal and final project report.

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
Problem solving		
Ability to define, catagorise, and investigate problems and challenges in construction of reliable embedded systems in relevant domains. Appreciation of evaluation of costs and implication of relative solutions in relation to wider engineering projects.	Project proposal supervision meetings. Project supervision meetings.	Project proposal and final project report.
Working relationships		
To be able to define and deliver the requirements, contributions, and limitations of a (reliable) embedded system in the wider context of a large engineering projects	Student led seminar and laboratory classes,project supervision meetings.	Assessment of group design exercises and related oral presentations, final project report.
Managing learning		
Research and select appropriate architectures, techniques, and approaches for a specific engineering problem and relate it to large engineering project. Relate new research advances to existing knowledge.	Student led seminar and laboratory classes,project supervision meetings.	Timely submission of coursework and case studies; successful completion of novel project work including identifying the role of the contribution in a wider context literature review.
Career management		
Define and extend the use and role of reliable embedded systems as appropriate to an industrial context and industrial projects.	Project supervision meetings.	Application of a variety of techniques in a novel project proposal and project.

Postgraduate Certificate in Reliable Embedded Systems

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
(a) Subject and Professional skills		
Knowledge		
Core knowledge of state-of-the-art architectures and techniques for reliable and real-time embedded systems.	Lecturer-driven seminar classes for each module, laboratory exercises and design classes, problem solving classes, background reading and directed independent reading of current research, on-line tutorial support.	Submission of design solutions and laboratory exercises, literature review reports, oral presentations, execution of large case study relevant to each module.
Concepts		
Design of modern embedded systems contrast the relative merits of different designs with regards to reliability, and apply a range of standard techniques.	Lecturer-driven seminar classes for each module, laboratory exercises and design classes, problem solving classes, background reading and directed independent reading of current research, on-line tutorial support.	Evaluation of design solutions and laboratory exercises, supported by oral presentations, execution of large case study relevant to each module.

Intended Learning Outcomes	Teaching and Learning Methods	How Demonstrated?
	Techniques	
Practical demonstration of experimental methods and measurement techniques including collection of results. Competence use of a variety of current industrial design tools for CPU and/or FPGA platforms.	Practical demonstrations and execution of laboratory exercises and applications in problem solving classes.	Demonstration of design solutions and laboratory exercises, supported by oral presentation, execution of large case study relevant to each module.
	Critical analysis	
Appraisal of different techniques used to design, analyse, and measure results of contrasting designs and techniques.	Laboratory practical classes and laboratory exercises, follow-up seminar classes and on-line teaching support.	Submission of design solutions evaluation and laboratory exercise evaluation, oral presentations.
	Presentation	
Ability to illustrate some relative merits of software, hardware, and design techniques.	Supported laboratory exercises, group exercises and seminar discussions, project proposal supervision.	Oral presentations and seminar discussion performance.
	Appraisal of evidence	
Constructive evaluation and analysis of relative safety and merits of end product embedded systems.	Seminar discussions, experimental evaluation of laboratory exercises, directed private study.	Submission of laboratory reports.
	(b) Transferable skills	
	Research skills	
Study skills, information management including searching research archives.	Student led seminar and laboratory classes, on-line directed study support.	Submission of course work and case studies for each module.
	Communication skills	
Scientific presentation of results appropriate to a wider engineering context such as a systems engineering one.	Lecturer-driven seminar classes	Submission of course work and case studies for each module.
	Data presentation	
Analytical methods for evaluating performance and reliability of systems including reviewing relevant results.	Student led seminar and laboratory classes, on-line directed study support.	Submission of course work and case studies for each module.
	Problem solving	
Ability to define and categorise, problems and challenges in construction of reliable embedded systems in a general context.	Laboratory practical classes.	Submission of coursework.
	Working relationships	
To be able to define and deliver the requirements, contributions, and limitations of a (reliable) embedded system in a wider context.	Student led seminar and laboratory classes.	Assessment of group design exercises and related oral presentations.
	Managing learning	
Research and select appropriate architectures, techniques, and approaches for laboratory exercises	Student led laboratory discussions.	Timely submission of coursework and case studies.
	Career management	
Define and extend the use and role of reliable embedded systems as appropriate to an industrial context and industrial projects.	Project supervision meetings.	Application of a variety of techniques in a novel project proposal and project.

10. Special features:

The programme is intended to support current industrial practitioners in a CPD context. As such, modules (specifically the tools, hardware and software platforms, and techniques covered) are intentionally state-of-the-art, with teaching being very practical and hands-on, rather than focusing on core and fundamental concepts. A consequence of this is that project work (in particular) normally focusses on a specific challenge or issue facing the student in the line of their employment.

11. Indications of programme quality:

The programme has been included in the Engineering Department IET Accreditation submission.

12. Scheme of Assessment

This programme follows the Senate Regulation 6 for Taught Postgraduate Programmes. See:
http://www2.le.ac.uk/offices/sas2/regulations/general-regulations-for-taught-programmes

Modules are assessed by coursework submission, with resit examinations where needed.

13. Progression points

A student is normally required to successfully complete modules EG7510, EG7520, and EG7530/EG7570 before taking modules EG7540, EG7550, and EG7560. A student will normally be expected to have reached this progression point within 12 months of commencing the course.

A student is normally required to successfully complete modules EG7510, EG7520, and EG7530/EG7570 before commencing the project proposal (EG7580). A student will normally be expected to have reached this progression point within 12 months of commencing the course.

A student is required to successfully complete the project proposal (EG7580) before commencing the project (EG7590). A student will normally be expected to have reached this progression point within 18 months of commencing the course.

A student is normally required to successfully complete modules EG7540, EG7550, and EG7560 within 24 months of commencing the course.

In cases where a student has failed to meet a requirement to progress he or she will be required to withdraw from the course and a recommendation will be made to the Board of Examiners for an intermediate award where appropriate.

14. Rules relating to re-sits or re-submissions:

As the taught modules are all assessed via laboratory exercises and case studies (with on-line support) re-submission is not permitted. Where necessary, the module can be re-assessed based on 100% examination.
This programme follows the Senate Regulation 6 for Taught Postgraduate Programmes. See:
http://www2.le.ac.uk/offices/sas2/regulations/general-regulations-for-taught-programmes

15. Additional information [e.g. timetable for admissions]

We propose that students may enter the programme at one of 2 points: September, or April. Their active date of registration will be from the date they take their first module.

16. External Examiners

The details of the External Examiner(s) for this programme and the most recent External Examiners' reports can be found here.

Appendix 1: Programme structure (programme regulations)

- EG7510 (15 credits, core) Programming Techniques For Reliable Embedded Systems
- EG7520 (15 credits, core) Design and Verification of High Integrity Embedded Systems
- EG7530 (15 credits, option #1) Software Engineering for Reliable Embedded Systems
- EG7540 (15 credits, core) Using FPGAs in Reliable Embedded Systems
- EG7550 (15 credits, core) Multi-processor and multi-core designs for Reliable Embedded Systems
- EG7560 (15 credits, core) Using an RTOS in Reliable Embedded Systems
- EG7570 (15 credits, option #1) Embedded automotive systems using ISO26262
- EG7580 (30 credits, core) Project planning and pilot study
- EG7590 (60 credits, core) Project execution and reporting

Appendix 2: Module Specifications

See module specification database http://www.le.ac.uk/sas/courses/documentation