Embedded Electronics Systems Design and Development Engineer Degree Apprenticeship (BEng (Hons) Electronic Engineering) – Top-up

Programme Specification

Primary Purpose:
Course management, monitoring and quality assurance.

Secondary Purpose:
Detailed information for students, staff and employers. Current students should refer to the related Course Handbook for further detail.

Disclaimer:
The University of Portsmouth has checked the information given in this Programme Specification. We will endeavour to deliver the course in keeping with this Programme Specification; however, changes may sometimes be required arising from annual monitoring, student feedback, review and update of units and courses. Where this activity leads to significant changes to units and courses, there will be prior consultation of students and others, wherever possible, and the University will take all reasonable steps to minimize disruption to students. It is also possible that the University may not be able to offer a unit or course for reasons outside of its control, for example; the absence of a member of staff or low student registration numbers. Where this is the case, the University will endeavour to inform applicants and students as soon as possible. Where appropriate, the University will facilitate the transfer of affected students to another suitable course.

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Programme Specification

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1. Named Awards

Embedded Electronics Systems Design and Development Engineer Degree Apprenticeship (BEng (Hons) Electronic Engineering) – Top-up

2. Course Code (and UCAS Code if applicable)

C2717P

3. Awarding Body

University of Portsmouth

4. Teaching Institution

University of Portsmouth

5. Accrediting Body

IET UK-SPEC (Partial CEng)

6. QAA Benchmark Groups

Engineering

7. Document Control Information

October 2016

8. Effective Session

2017-18

9. Author

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10. Faculty

Faculty of Technology

11. Department

School of Engineering

12. Educational Aims

Electronic engineering has been the key to past advances in technology – from computers, Blu-ray recorders and games consoles to engine management systems, smart phones, satellite navigation systems, tablets and TV – and will continue to be so in the future.

This top-up degree will enable candidates with HNDs and Foundation Degrees to enhance their qualifications, knowledge and skills to degree standard. Coupled with the work experience gained from their employments, candidates potentially will be in a great position to obtain their professional Engineering status (either full IEng or CEng).

Candidates on this top-up degree will only study level 6 units alongside the on-campus students.

The top-up year of this degree apprenticeship covers advanced electronic systems, real time embedded systems, digital signal processing and VHDL and FPGA systems. These engineering topics are taught in a practical and exciting way. The School's laboratories and computing suites and the new Future Technology Centre will support learning and provide access to industry-standard design tools.

In addition to the taught units, candidates will also have the opportunity to carry out an individual project on a specific in-depth task related to their employment which could be undertaken in their place of work.

Upon graduation as an electronic engineer, there are employment opportunities in areas as diverse as consumer and professional electronics, robotics, defence, broadcasting and telecommunications. The problem-solving and analytical abilities of electronic engineers also make them very attractive to financial and commercial organisations.

This course is mainly based on an IET accredited course and share all the level 6 units of the accredited programme. However, this course will apply for accreditation by the Institution of Engineering and Technology (IET), leading to partial Chartered Engineer status.

Reference Points
The major reference points were University of Portsmouth Curriculum Framework, the University policy on Key Skills, subject Benchmark Statements, Framework for Higher Education Qualifications (FHEQ), The QAA UK Quality Code for Higher Education and University of Portsmouth Policy on Placement Learning. In particular the programme has been designed with the QAA's Engineering benchmark and the Engineering Council's UK-SPEC in mind.

The core elements of the engineering benchmark, interpreted in the context of electronic engineering, are:

Underpinning Science and Mathematics (US): Knowledge and understanding of scientific principles and methodology appropriate to electronic design, to enable appreciation of its scientific and engineering context, and to support their understanding of historical, current, and future developments and technologies; with particular reference to principles governing: analogue circuits and systems; digital and microprocessor systems, including hardware description languages; control systems; telecommunication systems; software systems. Knowledge and understanding of mathematical principles and methods appropriate to electronic design, with particular reference to methods required in analogue electronics, control systems, telecommunications and signal processing. Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own discipline.

Engineering Analysis (E): Understanding of engineering principles and the ability to apply them to analyse key engineering processes; ability to identify, classify and describe the performance of systems and components through analytical methods and modelling techniques; ability to apply quantitative methods and computer software to electronic engineering problems; understanding of and ability to apply a systems approach to engineering problems in such areas as analogue circuits and systems; digital and microprocessor systems, including hardware description languages; control systems; telecommunication systems; software systems.

Design (D): Creation and development of an economically viable product or system to meet a defined need. Knowledge, understanding and skills to: identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues; understanding of customer and user needs; identify and manage cost drivers; use creativity and innovation; ensure fitness for purpose for all aspects of the problem and manage the design process.

Economic, Social and Environmental Context (S): Knowledge and understanding of commercial and economic context of engineering processes; knowledge of management techniques which may be used to achieve engineering objectives, sustainable development; awareness of the framework of relevant legal requirements including personnel, health, safety, and risk (including environmental risk) issues; understanding of the need for a high level of professional and ethical conduct in engineering.

Engineering Practice (P): Solution of engineering problems to meet specified technical requirements as well as time and resource constraints. Knowledge of characteristics of particular equipment, processes, or products; workshop and laboratory skills; engineering project management methods, including planning, monitoring, control and reporting; use of technical literature and other information sources; awareness of nature of intellectual property and contractual issues; understanding of appropriate codes of practice and industry standards; awareness of quality issues; ability to work with technical uncertainty. Electronic design practices, including: electronic components and data sheets; use of laboratory instruments and equipment; pcb design, fabrication, assembly and test; design and proving of analogue and digital circuits.

The abbreviations in parentheses are used for cross reference purposes in the learning outcomes.

13. Learning Outcomes

A. Knowledge and Understanding of:

1. Analogue and digital electronics, microprocessors, DSP, computer architecture and real-time embedded systems. (US, E, D, P).
2. Appropriate mathematical methods (US).
3. The role of computing and simulation in the solution of problems, including hardware description languages (D, P, E).
4. Practical design of electronic systems (D, P).
5. The business context of engineering: commercial, legal, contractual and statutory frameworks (S).
6. Professional and ethical responsibility (S).
7. Engineering practice and the roles of engineers in industry.

<u>Learning and Teaching Strategies and Methods</u>

Knowledge (1, 2 and 3) is acquired through lectures, design projects, experimental work and computer laboratory work. Directed reading, study guides, tutorial questions, worked examples and design problems support individual learning.
Practical design considerations (4) are learned through lectures, project work, practical exercises and simulations. The business, industrial, and professional contexts (5, 6) are mainly understood through lectures, engineering applications and the individual project. Students on this course are all in full-time employment and therefore (7) is learnt through experience and observation on the job and the individual project.

<u>Assessment</u>

Testing of core knowledge is through a mix of unseen examinations, assignment work and tests (some of which are computer based).
Project and laboratory work are assessed by observation, logbooks and submission of reports.

B. Cognitive (Intellectual or Thinking) Skills, able to:

1. Select and apply appropriate knowledge of electronic principles to model and analyse systems (US, E, P).
2. Select and apply appropriate mathematical methods to model and analyse electronic systems (E).
3. Select and apply computer-based design and simulation techniques (P, E).
4. Design, build and test systems and subsystems to meet specified requirements (D, P).
5. Assess electronic and computer systems from commercial and statutory viewpoints, including assessment of risks (S).
6. Solve problems in a systematic and manageable manner (P).

Learning and Teaching Strategies and Methods

Intellectual and analytical skills (1, 2) are developed through lectures, design and experimental work, case studies and worked examples. The ability to apply knowledge to achieve viable solutions (3, 4 and 6) is acquired through design projects and simulations. Assessment of electronics from a commercial standpoint (5) is developed through the candidates' employments.

Assessment

Cognitive skills are assessed through examination, assignment work and project reports.

C. Practical (Professional or Subject) Skills, able to:

1. Use standard and specialist laboratory instruments, conduct experiments and report on them (P).
2. Apply relevant mathematical methods in developing solutions to problems (US, E).
3. Use computer-based simulation, design and software development tools (D, E).
4. Design, construct, test and evaluate electronic circuits and computer systems (D, P and E).
5. Search a range of sources for information pertinent to technical and professional tasks (P).
6. Plan, manage and undertake a significant engineering project, taking into account constraints (D, P and S).

Learning and Teaching Strategies and Methods

Experimental and project work are used to develop skills in using laboratory instrumentation (1) and in the design of circuits (4). Analytical and design exercises develop the ability to apply mathematics appropriately (2). Use is made of CAD systems to synthesize and evaluate complex designs (3). The ability to research, plan and manage project work (5, 6) is acquired through individual projects and group projects.

Assessment

Laboratory work, simulation work and projects are generally assessed by submission of reports, logbooks, and by observation.

D. Transferable (Graduate and Employability) Skills, able to:

1. Manipulate and present information (D, S).
2. Analyse scientific information in the solution of problems (US, E).
3. Use information technology to handle text and data and for simulation and design (E, D).
4. Develop solutions in a creative manner, sometimes based on inadequate information (D, P).
5. Communicate effectively in a variety of formats (D, S).
6. Work effectively as an individual and as part of a team to achieve goals (D, S).

Learning and Teaching Strategies and Methods

The emphasis is generally on learning through individual and team-based practical and project work, through written reports and through verbal presentations (1, 2, 3, and 5). Scientific and mathematical techniques (1, 2) and familiarity with IT systems (3) are fundamental to the nature of the course. Problem solving (4) is developed through laboratory sessions and group and individual projects. Teamwork (6) is particularly developed in project work.

Assessment

These skills are particularly assessed through individual and group design activities and projects and their associated reports and verbal presentations. The abilities to solve problems are also assessed in assignments and examinations.

14. Course Structure, Progression and Award Requirements

This is a one-year; mainly day-release teaching mode degree apprenticeship that utilises the units and basic structure of the existing BEng (Hons) Electronic Engineering degree. It will be the academic component of the degree apprenticeship standard, Embedded Electronic Systems Design and Development Engineering. The course consists of a mix of lectures, seminars, experimental work and design projects. It makes extensive use of the School's computer suites and electronics laboratories. Whilst the majority of units have a focus on electronic engineering and related technologies, the individual project mainly focuses on product design, ethics and environmental responsibility in a commercial context.

The course consists of 80-credit taught units in addition to a year-long, 40-credit, individual project, which will be carried out in industry at the apprentices' places of work. Personal tutorial sessions; face-to-face and via skype (or similar form) and workplace visits will ensure that contact is maintained between apprentices and their personal tutors.

The course is highly career-focused, owing to its technical content, industry focus and opportunities to develop analytical and design skills. Practical work involves the use of hardware and software systems that are widely used in industry and; therefore; this complements and consolidates the work the candidates engaged in during their employment. The content of the course is periodically discussed with our Industrial Advisory Board and candidates' employers. Career education and guidance is specifically provided via workshops delivered by Purple Door. The business concepts are mainly gained through the apprentices' employment. The School has an Industrial Liaison Officer whose particular role is to maintain contact with employers and there is a Faculty lead dealing with apprenticeships and employer engagement.

Employability Statement
This course is only available to apprentices who are in full-time employment and fully supported by their employers. The apprentices will largely be already employed individual whose companies have decided to give them the opportunity to enhance their experience and qualifications. They are expected to continue with their employment and/or get promoted to a higher position within their current employer or elsewhere.

The course will seek accreditation (partial CEng) from the Institution of Engineering and Technology (IET). Apprentices are also expected to build and maintain a professional development record, which reflects the professional development guidelines (www.pd-how2.org) of four key professional bodies. It includes the University's personal development profiling activities, but, more importantly, builds a clear evidence base for the Apprentice's technical and professional competence. Apprentices will also gain much relevant work experience through their employment.

The School operates an Industrial Advisory Board (IAB)

15. Support for Apprentice Learning

- This programme is managed by a course leader who is responsible for all aspects of course design and delivery across the year of study.
- An extensive induction programme introduces the apprentice to the University and their course.
- Apprentices are visited during their employment, and required to maintain a logbook of work experiences gained.
- Each apprentice has a personal tutor, responsible for pastoral support and academic guidance.
- University support services include careers, financial advice, housing, counselling etc.
- The Academic Skills Unit (ASK).
- The Additional Support and Disability Advice Centre (ASDAC).
- Excellent library facilities.
- Excellent laboratory, computer and network suites.
- The University of Portsmouth has consistently been awarded an excellent rating for apprentice support and guidance in a number of Quality Assurance Agency inspections.
- Apprentice course and unit handbooks provide information about the course structure and University regulations etc.
- Feedback is provided for all assessments.

- Key Skills opportunities are incorporated into all units.
- Personal Development Planning (PDP) for all awards.

16. Admissions Criteria

A. Academic Admissions Criteria

Standard University rules apply but in addition an HND or Foundation Degree at minimum Merit threshold would be expected. Employers' recommendations will be seriously considered if the minimum conditions are not met.

B. Disability

The University makes no distinction in its admissions policy with regard to disability and will endeavour to make all reasonable adjustments in order to make it possible for apprentices to study at Portsmouth on a course of their choice.

17. Evaluation and Enhancement of Standards and Quality in Learning and Teaching

A. Mechanisms for Review and Evaluation

- Course Leader's Annual Standards and Quality Evaluative Review.
- Head of School's Annual Standards and Quality Evaluative Review.
- Unit and Course Level apprentice feedback considered at Board of Studies.
- Unit Assessment Board consideration of apprentice performance for each programme.
- Annual Standards and Quality Reports to Board of Studies, including consideration of Subject and Award External Examiner Reports.
- Periodic Programme Review.
- Apprentice Representatives and Apprentice/Staff Consultative Committees.
- National Student Survey.
- Staff Performance and Development Review.
- Peer Review and Development Framework.
- Faculty Learning and Teaching Committee.

B. Responsibilities for Monitoring and Evaluation

- Unit Co-ordinators for unit content and delivery.
- Course Leader for day-to-day running of course.
- Student Voice Co-ordinator to oversee student surveys, student representation and their involvement in quality assurance and enhancement.
- Board of Studies with overall responsibilities for operation and content of course.
- Head of School.
- Faculty lead - Academic Apprenticeships and Employer Engagement
- Associate Dean (Academic).
- Associate Dean (Students).
- Quality Assurance Committee.
- Unit, Award and Progression Board of Examiners.

C. Mechanisms for Gaining Student Feedback

- Student Representation on Board of Studies.
- Student Staff Consultative Committees.
- Unit and Course level student feedback questionnaires.

- University participates in external student surveys, eg National Student Survey (NSS).

D. Staff Development Priorities

- Academic staff undertake activities related to research, scholarship, teaching and learning and student support and guidance.
- Annual staff performance and development reviews match development to needs.
- Managers undertake a variety of management development programmes.
- All academic staff encouraged to seek Higher Education Academy membership.
- Academic staff new to teaching required to undertake Initial Professional Development Programme (iPROF).
- Support Staff are encouraged to attend short courses in areas such as minute taking and specific IT packages.

18. Assessment Strategy

The apprentices are exposed to a wide variety of assessment methods at all levels, encompassing such methods as traditional closed-book examinations, open-book examinations, computer based tests, video and oral presentations, programming and design projects, reports, on-line course work in a Wiki based environment, and laboratory experiments. In many areas of the curriculum - encompassing both hardware and software related assessment, and particularly in areas of electronics project based learning - the apprentices are also assessed via log book records of their activities. This has the advantages of developing the apprentices' professional practice, encouraging early and continuous engagement with the subject material, and affording opportunities for informal feedback on their work. The apprentices also undertake assessment as individuals, in pairs, or in small groups as appropriate to the nature of the material being assessed.

There is a significant amount of practical work in the course, and the culmination of the apprentices learning results in the final year individual project.

19. Assessment Regulations

Standard university rules apply except for the following IET stipulated exemptions that relate to the interpretation of marks in the degree classification. For all standard university rules the Academic Regulations must be consulted for a full description.

It is an IET accreditation requirement that some of the existing University academic regulations don't apply. The School has Academic Council Approval for these variations to standard university regulations and would also apply to this course.

20. Role of Externals

Subject External Examiners who will:

- oversee unit assessment and usually attend Unit Assessment Boards;
- review unit assessment strategy;
- sample assessment artefacts;
- present report to Unit Assessment Boards.

Award External Examiners (usually also a Subject External Examiner) who will:

- oversee and attend Award/Progression Boards;
- scrutinise and endorse the outcomes of assessment;
- ensure that the standard of the award is maintained at a level comparable with that of similar awards elsewhere in the United Kingdom.

21. Indicators of Standards and Quality

A. Professional Accreditation/Recognition

The course will apply for accreditation for partial CEng under UK-SPEC by the Institution of Engineering and Technology (IET).

B. Periodic Programme Review (or equivalent)

The School of Engineering was the subject of a periodic programme review for the provision which was previously in the Department of Electronic and Computer Engineering, on 11th December 2012. The outcome was that the curriculum was confirmed as being fit for purpose and the annual monitoring and review processes were found to be effective.

C. Quality Assurance Agency

QAA Higher Education Review, March 2015, judgements about standards and quality meet UK expectations (*for full report see Higher Education Review of the University of Portsmouth, March 2015*[1]).

D. Others

The University of Portsmouth has Investors in People recognition.
The School of Engineering is an IET Academic Partner

22. Other Sources of Information

Other sources of information may be found in

- Course Approval Document.
- Student Handbook.
- University of Portsmouth Curricula Framework.
- University of Portsmouth Undergraduate Prospectus.
- Assessment Regulations.
- University of Portsmouth (http://www.port.ac.uk/) and (http://www.port.ac.uk/departments/academic/eng/) websites.
- Course Unit Tables

[1] www.qaa.ac.uk/en/ReviewsAndReports/Documents/University%20of%20Portsmouth/University-of-Portsmouth-HER-15.pdf

Course Title: ***Embedded Electronics Systems Design and Development Engineer Degree Apprenticeship (BEng (Hons) Electronic Engineering) – Top-up***

Unit Assessment Map

UNITS						COURSEWORK				EXAMINATION			
Level	Name	Code	Credit	Delivery	Core/ Option	Total %	Type of Artefact	Duration/ Length	Weighting %	Total %	Open/ Closed	Duration (hrs)	Weighting %
6	Individual project	ENG600 U21407	40	Year	C	100%	Project	8000 – 10000 words	100%				
6	Real-Time Embedded Systems	ENG620 U21410	20	Year	C	50%	PBL Assignment	2500 words	50%	50%	Closed	1.5 hours	50%
6	Advanced Electronic Systems	ENG630 U21413	20	Year	C	40%	Laboratory Exercises	6 hours	20%	60%	Closed	2 hours	60%
							ICT	1 hour	20%				
6	VHDL and FPGA Systems	ENG631 U21414	20	Year	C	100%	PBL Coursework	2000 words	40%				
							PBL Coursework	2000 words	60%				
6	Digital Signal Processing	ENG642 U21417	20	Year	C	40%	CBT	1 hour	20%	60%	Closed	2 hours	60%
							Laboratory Experiments	Continuously Assessed	20%				

Course Title: *Embedded Electronics Systems Design and Development Engineer Degree Apprenticeship (BEng (Hons) Electronic Engineering) – Top-up*

Unit Learning Outcomes Map

UNITS						**LEARNING OUTCOMES[2]**																							
Level	Name	Code	Credits	Delivery[3]	Type[4]	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6
6	INDIVIDUAL PROJECT	ENG600 U21407	40	Year	C	□			□	□	□	□	□	□	□	□	□	□			□	□	□	□	□		□	□	□
6	ADVANCED ELECTRONIC SYSTEMS	ENG630 U21413	20	Year	C	□			□			□	□			□	□	□			□	□		□	□				□
6	DIGITAL SIGNAL PROCESSING	ENG642 U21417	20	Year	C	□	□	□					□				□	□		□				□	□			□	
6	REAL-TIME EMBEDDED SYSTEMS	ENG620 U21410	20	Year	C	□		□	□			□	□	□		□				□	□		□			□	□		□
6	VHDL & FPGA SYSTEMS	ENG631 U21414	20	Year	C	□		□	□			□	□	□			□	□	□	□	□		□		□		□		□

[2] A = Knowledge and Understanding; B = Cognitive (Intellectual) Skills; C = Practical (Subject Specific) Skills; D = Transferable Skills
[3] 1=Teaching Block 1 (Sep-Dec); 2=Teaching Block 2 (Jan-Mar); Year=Both (Sep-Mar); 3=Teaching Block 3 (May-Sep or Apr-Sep if you include the CAP); All=TB1, 2 and 3 (Sep-Sep)
[4] C=Core; O=Option; S=Subject Core Option