Apprenticeship Specification

Apprenticeship Summary Information		
1	**Apprenticeship Title**	Embedded Electronic Systems Design and Development Engineer (Degree) (ST0151) Apprenticeship
2	**BCU Apprenticeship Course Code**	US1025/US1027 US1029/US1031
3	**Awarding Institution**	Apprenticeship Qualification is awarded by the End Point Assessment Organisation chosen by Employers: The Institution of Engineering and Technology (IET) (EPAO055) Birmingham City University, as the training provider, awards the academic qualification.
4	**Teaching Institution(s)** (if different from point 3)	Birmingham City University
5	**Professional Statutory or Regulatory Body (PSRB) accreditation** (if applicable)	Institute for Apprenticeships and Technical Education (IfATE) ST0151 The Institution of Engineering and Technology (IET) *Please see important course accreditation information at the end of section 6, for more information about the IET accreditations.

6	Apprenticeship Description
	The skills shortages in the engineering sector has been recognised by the government, and a report published by the Royal Academy of Engineering in 2016 has reported that the UK will have a shortage of more than one million engineers/technicians by the year 2020 unless action is take. Ongoing updates from the government publications continue to show the need for professionally accredited engineers which the proposed degree apprenticeships will address. This degree apprenticeship is fully informed and supported by industry practice and recognised research in design and delivery of modules by experienced staff who have extensive industry experience. The curriculum is practice led and cultivates problem solving skills, improving communication through effective real-life project work, work experience, and cases. Team working on real life scenarios develop professional competence and prepares you for further employment opportunities and career development. This degree apprenticeship has been developed to provide you with a good knowledge of a range of electrical and electronic principles including embedded systems and control as part of your development to become a fully rounded engineer within this discipline. Throughout this apprenticeship, you'll have access to our state-of-the-art technology and resources, plus you'll have the opportunity to secure yourself an industry placement, giving you instrumental electrical engineering work experience. It will give you an understanding of the social, commercial, legal, ethical, economic and environmental factors associated with engineering, as well as comprehensive knowledge of the science and mathematics associated with the discipline. You will also develop the key transferrable skills that modern employers require, such as problem solving, project planning, presentation and communication. Our competitions, such as the annual Engineering Show, which includes the international micro-mouse competition, gives you the

	opportunity to participate in a range of competitions centered on autonomous and non-autonomous robotic vehicles. This apprenticeship focuses on project-based activities, giving you lots of opportunity to work in teams on projects from design to implementation. This will enhance your practical experience of applying engineering science to real world problems, working in multidisciplinary teams to develop your interpersonal skills, and prepare you for a key aspect of modern engineering practice. Problem solving and project management are key skills for an engineer, and our focus on practical experience will help to improve your skills in these highly sought after areas. The Standard's Assessment Plan is a key component of an Apprenticeship Standard and identifies the End-Point Assessment (EPA) undertaken by the apprentice. The EPA ensures that the apprentice has taken on all the knowledge, skills and behaviours required to do their job role with confidence and is measured against the Knowledge, Skills and Behaviours set out in the standard. The End Point Assessment for this Apprenticeship consists of two phases: Phase 1 - Occupational Competence Interview of Apprentice by Employer and Independent Assessor. Phase 2 – Professional Competence Assessment by Panel of Independent Assessors Important Course Accreditation Information Students completing an IET accredited degree are deemed to have met part or all of the academic requirements for registration as a Chartered or Incorporated Engineer and are in a strong position to move on to achieve professional engineering status after a period of initial professional development in industry. <u>BEng Accreditation Information</u> In order for you to achieve professional accreditation, you must have, on top of your academic qualifications, a minimum of 4 years relevant industrial engineering experience at the appropriate level. Our current BEng courses are accredited at Partial CEng level, meaning that provided you have the relevant industrial experience, you may be eligible to apply for Incorporated Engineer Level. Should you wish to apply for CEng Engineer level, there will be requirement for further learning at PG level, for example, an accredited MSc in the relevant subject. Our MSc courses are accredited at full CEng level.

7	Apprenticeship Awards		
7a	**Apprenticeship Final Award (awarded by End Point Assessment Organisation)**	**Level**	**Credits Awarded**
	Embedded Electronic Systems Design and Development Engineer	6	n/a
7b	**University Awards and Credits Awarded (where applicable)**		
	Bachelor of Engineering with Honours Electronic Engineering	6	360
7c	**Exit Awards and Credits Awarded (where applicable)**		
	Certificate of Higher Education Electronic Engineering Diploma of Higher Education Electronic Engineering Bachelor of Engineering Electronic Engineering	4 5 6	120 240 300

8	Derogation from the University Regulations
	1. For modules with more than one item of assessment, apprentices must achieve a minimum of 30% in each item of assessment in order to pass the module 2. Compensation of marginal failure in up to 20 credits is permitted at each level 3. Condonement of failed modules is not permitted 4. Apprenticeships adhere to University academic regulations for University awards offered within apprenticeship training. Where Educations and Skills Funding Agency (ESFA) regulations specify an alternative requirement for apprenticeship training management, this takes precedence. This is a requirement of the University registration with the ESFA as an apprenticeship training provider and receipt by the University of individual apprenticeship funding.

9	Delivery Patterns		
Mode(s) of Study	**Location**	**Duration of Study**	**Code**
Apprenticeship	City Centre	5 years (plus EPA)	US1025/US1027
Apprenticeship – Advanced Entry to Level 6	City Centre	2 years (plus EPA)	US1029/US1031

10	Entry Requirements
	The admission requirements for this degree apprenticeship are stated on the course page of the BCU website at https://www.bcu.ac.uk/.

11	**Apprenticeship Course Learning Outcomes**
	Science and Mathematics (SM)
SM1i	Knowledge and understanding of the scientific principles underpinning relevant technologies, and their evolution
SM2i	Knowledge and understanding of mathematics and an awareness of statistical methods necessary to support application of key engineering principles
SM1b	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in Electronic engineering, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies
SM2b	Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in Electronic engineering and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems
SM3b	Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their Electronic engineering discipline
	Engineering Analysis (EA)
EA1i	Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement
EA2i	Ability to apply quantitative methods in order to understand the performance of systems and components
EA3i	Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action
EA4i	Ability to apply an integrated or systems approach to engineering problems through know-how of the relevant technologies and their application
EA1b	Understanding of engineering principles and the ability to apply them to analyse key engineering processes
EA2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
EA3b	Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action
EA4b	Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems
	Design (D)
D1i	Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
D2i	Define the problem identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards
D3	Work with information that may be incomplete or uncertain and be aware that this may affect the design
D4i	Apply problem-solving skills, technical knowledge and understanding to create or adapt designs solutions that are fit for purpose including operation, maintenance, reliability etc.
D5i	Manage the design process, including cost drivers, and evaluate outcomes

D6	Communicate their work to technical and non-technical audiences
D1	Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics
D2	Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards.
D3b	Work with information that may be incomplete or uncertain and quantify the effect of this on the design
D4	Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal
D5	Plan and manage the design process, including cost drivers, and evaluate outcomes
Economic, Legal, Social, Ethical and Environmental Context (EL)	
EL1	Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct
EL2	Knowledge and understanding of the commercial, economic and social context of engineering processes
EL3i	Knowledge of management techniques that may be used to achieve engineering objectives
EL4i	Understanding of the requirement for engineering activities to promote sustainable development
EL5	Awareness of the relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
EL6i	Awareness of risk issues, including health & safety, environmental and commercial risk
EL3	Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives
EL4	Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate
EL6	Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, and of risk assessment and risk management techniques
Engineering Practice (P)	
P1i	Knowledge of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc.)
P2i	Understanding of and ability to use relevant materials, equipment, tools, processes, or products
P3i	Knowledge and understanding of workshop and laboratory practice
P4i	Ability to use and apply information from technical literature
P6i	Ability to use appropriate codes of practice and industry standards
P7	Awareness of quality issues and their application to continuous improvement
P11i	Awareness of team roles and the ability to work as a member of an engineering team
P1	Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, application and development of technology, etc.)
P2	Knowledge of characteristics of particular materials, equipment, processes or products
P3	Ability to apply relevant practical and laboratory skills
P4	Understanding of the use of technical literature and other information sources
P5	Knowledge of relevant legal and contractual issues
P6	Understanding of appropriate codes of practice and industry standards
P8	Ability to work with technical uncertainty

P11	Understanding of, and the ability to work in, different roles within an engineering team
Additional General Skills (G)	
G1	Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
G2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
G3i	Plan and carry out a personal programme of work
G4i	Exercise personal responsibility, which may be as a team member

12	**Apprenticeship Course Requirements:**

12a

Level 4:
In order to complete this apprenticeship a learner must successfully complete all the following CORE modules (totalling 120 credits):

Module Code	Module Name	Credit Value
ENG4091	Engineering Principles 1	20
ENG4124	Mathematical Modelling 1	20
ENG4093	Engineering Practice	20
ENG4094	Engineering Principles 2	20
ENG4125	Mathematical Modelling 2	20
ENG4096	Integrated Engineering Project	20

Level 5:
In order to complete this apprenticeship a learner must successfully complete all the following CORE modules (totalling 120 credits):

Module Code	Module Name	Credit Value
ENG5093	Mathematics for Signals and Systems	20
ENG5092	Analogue and Digital Electronics	20
ENG5094	Engineering Electronic Systems	20
ENG5097	Leading Engineering Endeavour	20
ENG5095	Microcontroller System Design and Programming	20
ENG5096	Electronics Project	20

Level 6:
In order to complete this apprenticeship a learner must successfully complete all the following CORE modules (totalling 120 credits):

Module Code	Module Name	Credit Value
ENG6066	Digital Filters and Spectral Analysis	20
ENG6067	Embedded Systems and Control	20
ENG6068	Communication Systems and Networks	20
ENG6069	High Frequency and Power electronics	20
ENG6200	Individual Honours Project	40

12b Structure Diagram

Level 6 Degree Apprenticeship - Embedded Electronic System Design and Development Engineer

Year 1			
Engineering Principles 1 (ENG4091)	Mathematical Modelling 1 (ENG4124)		Sem 1
Engineering Principles 2 (ENG4094)			Sem 2
Year 2			
Engineering Practice (ENG4093)			Sem 1
Integrated Engineering Project (ENG4096)	Mathematical Modelling 2 (ENG4125)		Sem 2
Year 3			
Analogue and Digital Electronics (ENG5092)	Mathematics for Signals and Systems (ENG5093)		Sem 1
Microcontroller Systems Design & Programming (ENG5095)	Leading Engineering Endeavour (ENG5097)		Sem 2
Year 4			
Digital Filters and Spectral Analysis (ENG6066)	Engineering Electronic Systems (ENG5094)		Sem 1
Communications Systems and Networks (ENG6068)	Electronics Project (ENG5096)		Sem 2
Year 5			
Individual Honours Project (ENG6200)	Embedded Systems and Control (ENG6067)		Sem 1
	High Frequency and Power Electronics (ENG6069)		Sem 2

Gateway: Review & Assessment - Undertaken in conjunction with the employer:

- Successful Completion of Degree Course
- Vocational and Behavioural experience and training evidence gathered in Log Book

End Point Assessment

- Occupational Competence Interview of Apprentice by Employer and Independent Assessor.
- Professional Competence Assessment by Panel of Independent Assessors

Apprentices with appropriate Level 4 equivalent qualification such as HNC will be able to join this degree apprenticeship at Year 3 of its delivery

Apprentices with appropriate Level 5 equivalent qualification such as HND or Foundation Degree or Level 5 Apprenticeship will be able to join this degree apprenticeship at Year 4 of its delivery as shown overleaf:

Top Up Apprenticeship Delivery – Embedded Electronic System Design and Development Engineer

Year 1

APL – Examples (HND; Foundation Degree, etc.)		

Year 4

Digital Filters and Spectral Analysis (ENG6066)	Embedded Systems and Control (ENG6067)	Sem 1
Communications Systems and Networks (ENG6068)	High Frequency and Power Electronics (ENG6069)	Sem 2

Year 5

Individual Honours Project (ENG6200)		Sem 1 Sem 2

Gateway: Review & Assessment - Undertaken in conjunction with the employer:

- Successful Completion of Degree Course
- Vocational and Behavioural experience and training evidence gathered in Log Book

End Point Assessment

- Occupational Competence Interview of Apprentice by Employer and Independent Assessor.
- Professional Competence Assessment by Panel of Independent Assessors

13 Overall Apprenticeship Course Workload and Balance of Assessment

Overall apprenticeship course *workload* includes class contact hours, independent learning and assessment activity, with each credit taken equating to a total study time of around 10 hours. While actual contact hours may depend on any optional modules available, the following information gives an indication of how much time apprentices will need to allocate to different course activities at each level of the apprenticeship course.

- *Scheduled Learning* includes lectures, practical classes and workshops, contact time specified in timetable
- *Directed Learning* includes placements, work-based learning, external visits, on-line activity, Graduate+, peer learning
- *Private Study* includes preparation for exams

The *balance of assessment* by mode of assessment (e.g. coursework, exam and in-person) depends to some extent on any optional modules available. The approximate percentage of the apprenticeship course assessed by coursework, exam and in-person is shown below.

Level 4

Workload

% time spent in timetabled teaching and learning activity

Activity	Number of Hours
Scheduled Learning	432
Directed Learning	0
Private Study	768
Total Hours	1200

Balance of Assessment

Assessment Mode	Percentage
Coursework	27%
Exam	47%
In-Person	26%

Level 5

Workload

% time spent in timetabled teaching and learning activity

Activity	Number of Hours
Scheduled Learning	312
Directed Learning	0
Private Study	888
Total Hours	1200

Balance of Assessment

Assessment Mode	Percentage
Coursework	50%
Exam	32%
In-Person	18%

Level 6

Workload

% time spent in timetabled teaching and learning activity

Activity	Number of Hours
Scheduled Learning	210
Directed Learning	12
Private Study	978
Total Hours	1200

Balance of Assessment

Assessment Mode	Percentage
Coursework	40%
Exam	60%
In-Person	0