Assessment Plan
Embedded Electronic Systems Design and Development Engineer
Level 6 Degree Apprenticeship

Contents May need renumbering after amendments agreed. Page

1. Introduction

The Embedded Electronic Systems Design and Development Engineer Apprenticeship typically takes three years or more to complete. It provides a pathway to acquire personal and professional skills and competencies as identified in the Standard (attached as Annex 2).

These are commensurate with those identified in the Engineering Council's UK Standard for Professional Engineering Competence (UK-SPEC) (http://www.engc.org.uk/ukspec.aspx), required in order to register as an Engineering Technician (EngTech), an Incorporated Engineer (IEng) or Chartered Engineer (CEng). Aligning the Standard to the UK-SPEC in this way ensures consistency across the UK and also parity with the existing professional workforce, as well as paving the way for membership of a Professional Engineering Institution (PEI).

An academic award of BSc or BEng Honours Degree, as accredited by a PEI such as The Institution of Engineering and Technology (IET) or The Institute of Measurement and Control (InstMC), will form part of the apprenticeship and underpins workplace occupational competency in a range of high skill industries in a range of rôles, for example:

- Software Engineer;
- Electrical / Electronic Engineer; or
- Systems Engineer.

As well as being suitable for school leavers as an alternative route to gaining a degree, this qualification will strengthen the vocational pathway and be a suitable route for existing apprentices to follow in order to progress further in their chosen career.

Apprentices on this scheme will progressively develop the knowledge, skills and behaviours necessary to become well-rounded engineers; observing a professional code of conduct, with the right professional skill sets required to operate effectively in a wide range of engineering environments at the forefront of UK Engineering.

The proportion and distribution of time spent on academic and vocational education and training will vary according to the HEI and employer but will in all cases be sufficient for the achievement of the Knowledge, Skills and Behaviours (KSBs) as detailed in the Standard.

2. Summary of Assessment / Overview

The assessment of this apprenticeship will include both on-programme assessment and a synoptic, end-point assessment. This document concentrates on the synoptic, end-point

assessment but for clarity and completeness, makes mention of the on-programme assessment.

To protect employers' Intellectual Property Rights (IPR) at all times, any issues for assessment of material relating to company IPR, confidentiality and/or security will be addressed between the HEI, the employer and the apprentice, prior to the course commencement, or, as soon as possible when they arise, to avoid disadvantaging the apprentice.

Where possible, Non-Disclosure Agreements, (NDAs), allowing projects and tasks with business value to be undertaken using real data will be used.

Completion of the apprenticeship will be by end-point assessment which will look holistically at the KSBs developed to determine if the requirements of the Standard have been met.

2.1 On-programme Assessment

2.1.1 Degree

Any Honours Degree in Electronics or Electrical & Electronic Engineering which has been accredited by one of the Professional Engineering Institutions licensed by the UK Engineering Council and offered by a UK university is acceptable for this apprenticeship.

The greater part of the on-programme assessment will be carried out by the HEI, during the delivery and final examination of the Bachelor's Degree.

The assessment approach to the academic element is designed to ensure that apprentices meet both the academic level of knowledge required for the award of the degree undertaken, as well as the skills, knowledge and behavioural outcomes defined in the Standard, allowing them to seek immediate registration as a professional engineer, should they so wish, regardless of which HEI is delivering the programme.

The award issued to apprentices by an HEI is verification that the academic part of the Standard has been met and graded. HEIs will therefore need to work with the PEI to accredit the designed course - many existing degree courses, already accredited, will be used as the academic part of this apprenticeship. This apprenticeship does not require HEIs to make adjustments to either the way in which the degree course is delivered nor the way in which it is assessed.

HEIs should ensure that appropriate assessment of employer identified specialist subjects is included. It is likely that on-programme assessment will include

assignments containing essays, reports, completion of practical tasks and work-based projects, calculations, tests and formal examinations.

HEIs have robust and well established assessment and quality assurance processes, incorporating internal moderation and external examiners to ensure independence across the degree programme and consistency between HEIs.

Passing the degree course will be one of the elements of a gateway to moving on to the end-point assessment. In the event of failure to pass the degree course, completion of the apprenticeship cannot be achieved.

2.1.2 Log Book

The apprentice will complete an individual portfolio of vocational evidence, a Log Book, in order to be able to demonstrate competence in all of the KSBs required for successful completion of this apprenticeship

Whilst it may be either paper or digital media based, it should collate evidence of all tasks undertaken and progress made over the duration of the apprenticeship. The evidence collated in the Log Book will be recorded against each of the KSBs in the Standard and be mapped to the requirements of the UK-SPEC for professional registration. It will also provide evidence of evaluation and feedback from supervisors and management.

The Log Book should contain sufficient evidence / information for the employer to make the end-point assessment of occupational competence and for the independent end-point assessors to judge professional competence.

The Log Book will be developed by the PEI to ensure that a consistent standard is achieved across employers. This process will also specify what level of information should be recorded to be seen as sufficient evidence of each KSB being achieved.

Similar Log Books have already been designed for other engineering sector apprenticeships which have been developed under the Trailblazer programme. It would make sense for an element of standardisation for this type of document to be applied where possible across engineering sectors rather than have many dissimilar styles, layouts and formats. The adaptation and use of existing Log Books and associated documentation for this Embedded Electronic Systems Design and Development Engineer Apprenticeship is therefore recommended.

An example of a Log Book associated with a different apprenticeship is attached as Annex 3, purely for illustrative purposes. This is not the Log Book that will be used for this apprenticeship.

2.1.3 Vocational Training

In order for the apprentice to be able to demonstrate acquisition of / competence in the KSBs, it is likely that various training and education activities will be undertaken during the apprentice's time spent in-company. These may well differ between employers: for example, a large company may be able to move an apprentice between departments of the business to ensure this, whereas a small company may have to purchase external training from specialist third-party training providers.

Examples might include external, Institute of Learning and Management courses with associated Certificates and Diplomas, or internal Six Sigma, Lean or Team working courses. The Standard also mandates that ability in areas such as motivation and ethics should be an integral part of this apprenticeship. This may entail formal or informal training schemes and again be either internally or externally run.

Any formal qualifications gained will be recorded as part of the written evidence in the Log Book.

2.2 End-point Assessment

The end-point assessment is the final assessment of the Embedded Electronic Systems Design and Development Engineer Apprenticeship and a successful assessment will mark completion of the apprenticeship.

The end-point assessment will be in two phases. The first will take the form of examination by interview between the employer, an appropriately qualified individual appointed by the assessment organisation and the apprentice, of the evidence presented in the completed Log Book to determine the occupational competence of the apprentice. It is unlikely that this interview will take less than 2 hours.

The second phase will comprise submission of the Log Book to the PEI. The PEI will appoint an independent assessment panel comprised of a minimum of two appropriately qualified professional engineers, ones holding an IEng or CEng qualification. One member of the panel will be appointed as Chair of the panel and will carry the deciding vote.

This panel will assess the professional competence of the apprentice.

Successful completion of this second phase marks successful completion of the apprenticeship.

2.3 Apprenticeship Flow Diagram

The flow of the elements leading to the completion of the apprenticeship is shown below in figure 1.

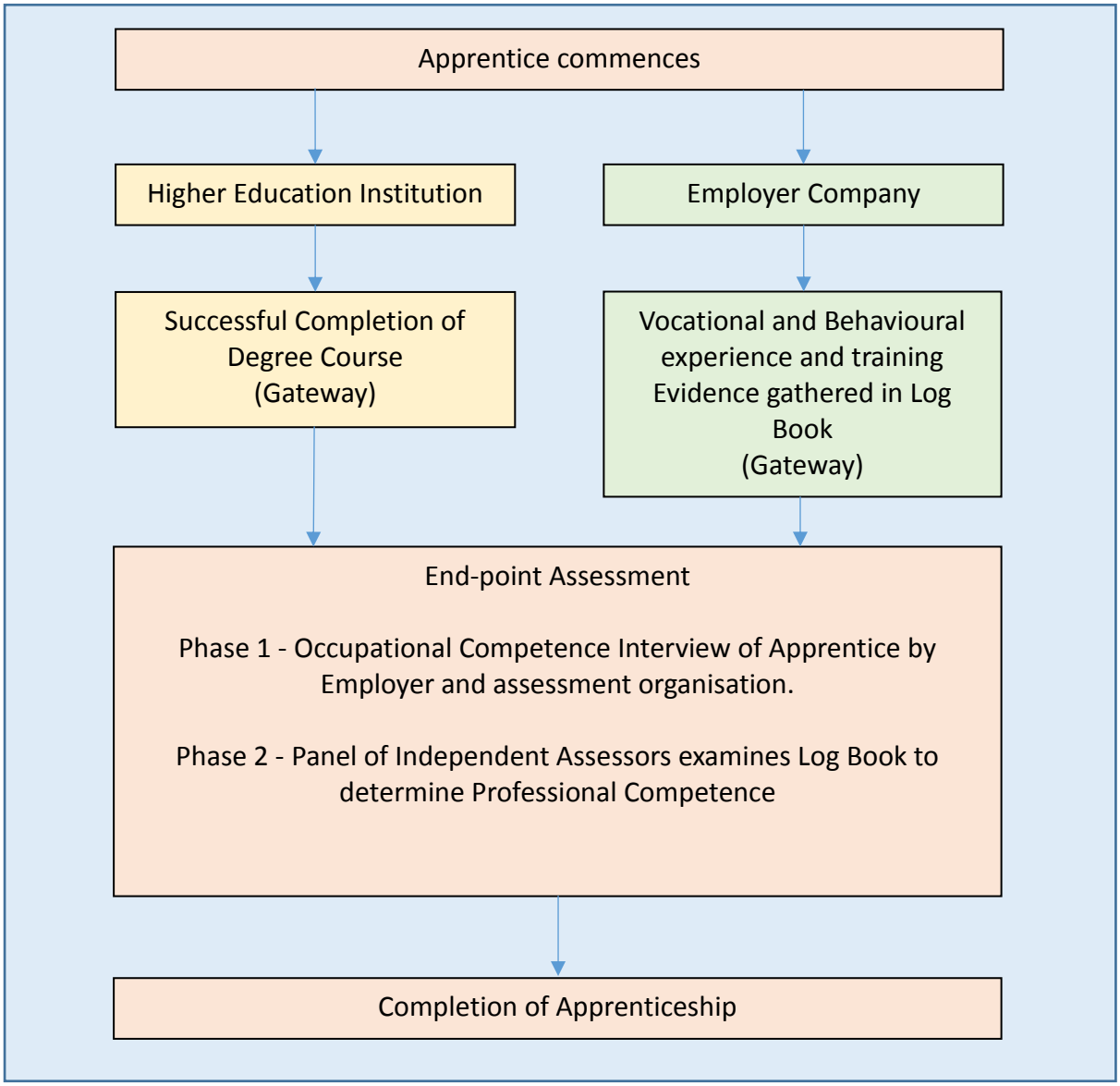

Figure 1 - Apprenticeship Flow Diagram

3. Professional Qualifications

An academic award of BSc or BEng Honours Degree, as accredited by a PEI such as The Institution of Engineering and Technology (IET) or The Institute of Measurement and Control (InstMC).

Passing the degree course will be one element of the gateway to moving on to the end point assessment. In the event of failure to pass the degree course the apprenticeship cannot be achieved.

4. On-programme Assessment

On programme assessment will principally be carried out by the HEI during the delivery and assessment of the degree course element of the apprenticeship.

On-programme vocational and behavioural training will also be undertaken and assessed.

5. Assessment Gateway

As a prerequisite to the end-point assessment, the apprentice will need to have achieved:

- an accredited BSc or BEng Honours Degree;
- completion of the Log Book; and
- Maths and English level 2.

6. End-point Assessment in detail

The Embedded Electronic Systems Design and Development Engineer Apprenticeship Standard contains a table detailing all of the Knowledge, Skills and Behaviours which must be acquired by the apprentice, along with detail of what is required for each topic area and how it will be assessed.

This table is included below as Annex 1 Table of Knowledge, Skills and Behaviours.

Those elements of the KSBs shown in Annex 1 to be assessed as part of the end-point assessment will be evidenced in detail in the Log Book.

6.1 Log Book

Collated over the duration of the apprenticeship, each apprentice will prepare a supporting portfolio of evidence, the Log Book. This Log Book will enable the apprentice to demonstrate to the employer and the assessment panel, the specific work related tasks that they have completed in order to demonstrate how they have achieved both occupational and professional competence as set out in the Standard.

The Log Book will also give the apprentice the opportunity to demonstrate to the employer that they understand the company in terms of their products, processes,

procedures, tools, equipment, materials, documentation and information systems by showcasing what they have done, what they have learnt and how they have applied this knowledge and skills to real work tasks including solving engineering related problems.

The Log Book of evidence will show how the apprentice has demonstrated the knowledge, skills and behaviours required to be a competent Embedded Electronic Systems Design and Development Engineer.

The Log Book will also contain sufficient, valid and reliable evidence which is cross-referenced to the professional competence requirements for an Incorporated Engineer (IEng) as specified in the UK-SPEC.

The Log Book will include as a minimum, examples of competent performance evidence that must include products of the apprentice's work, together with evidence of the way the apprentice carried out the activities to meet the requirements of the Standard, such as assessor observations, supervisor/mentor references/ witness testimonies or authenticated apprentice reports of the activities undertaken.

A Log Book template will be developed by the PEI to ensure that a consistent standard is achieved across employers. This process will also specify what level of information should be recorded to be seen as sufficient evidence of each KSB being achieved.

An example of a Log Book associated with a different apprenticeship is attached as Annex 3, purely for illustrative purposes. This is not the Log Book that will be used for this apprenticeship.

6.2 Occupational Competence Interview

The first phase of the end-point assessment, the Occupational Competence Interview is an interview focused on all the components of the Apprenticeship Standard, which will enable the employer to validate the apprentices' occupational competence.

It is a structured and formal discussion between the apprentice and their employer and an appropriately qualified independent assessor appointed by the assessment organisation, drawing upon a portfolio of evidence, the Log Book, and records of how the apprentice has performed during the Apprenticeship. It covers both what tasks the apprentice has completed in the workplace, the standard of their work, and the behaviours they have demonstrated throughout, such as, being a team player, exhibiting leadership qualities, being a responsible employee and being self-motivated.

This enables the end-point assessment to cover a broad range of knowledge, skills and behaviours, as are detailed in the Standard. It is unlikely that this interview will take less than 2 hours and the deciding vote will be held by the independent assessor. The independent assessor may be present at the face-to-face interview or take part via a remote video / audio link.

The interview will also provide an opportunity to:

- clarify any points and/or probe the apprentice on the evidence they have presented in their portfolio;
- confirm and validate that the portfolio of evidence is the apprentices own work;
- confirm and validate the judgements about the quality of the work the apprentice has completed;
- test the behaviours of the apprentice
- explore particular areas of work presented in the portfolio, how it was carried out, any problems that they encountered and how these were resolved; and
- validate the apprentice's skills and knowledge and understanding of key aspects of the company.

If, following the interview the employer and independent assessor judge that the apprentice is not yet fully occupationally competent, the apprentice and the employer will develop a CPD plan to enable the apprentice to develop the additional competencies/experience required to achieve full occupational competence.

To ensure a consistency of approach, guidance documents on both the structure of the Occupational Competence Interview and also how this should be carried out will be developed by the PEI.

Note: Before the Occupational Competence Interview can take place, the employer must have evidence that the apprentice has completed and will be awarded the mandatory academic qualification, the Bachelor's degree.

6.3 Professional Competence Assessment

This is the second phase of the end-point assessment and will be carried out by submission of the Log Book to the PEI. The PEI will appoint an independent assessment panel comprised of a minimum of two appropriately qualified professional engineers, ones holding an IEng or CEng qualification. One member of the panel will be appointed as Chair of the panel and will carry the deciding vote.

On successful completion of the Occupational Competence Interview the completed Log Book and any supporting evidence, will be sent to the PEI to assess the apprentice's professional competence.

The KSBs of the Standard will be mapped against the 5 UK-SPEC Incorporated Engineer (IEng) competency areas by the PEI. These are:

- Use a combination of general and specialist engineering knowledge and understanding to apply existing and emerging technology.
- Apply appropriate theoretical and practical methods to design, develop, manufacture, construct, commission, operate, maintain, decommission and re-cycle engineering processes, systems, services and products.
- Provide technical and commercial management
- Demonstrate effective interpersonal skills
- Demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment

The professional competence of the apprentice can then be judged against these 5 areas.

For a pass to be awarded, the apprentice must demonstrate that all the KSBs of the Standard have been fully achieved.

Relevant PEIs will work collaboratively taking guidance from the Employer Group, to produce a common approach to assessing the apprentices' evidence as detailed in the Log Book. This approach will explain how the evidence will be assessed and the detail will be made freely, publicly available in order to assist both the apprentice and the employer to fully understand what is required to achieve a pass.

There will be two possible outcomes:

- Not professionally competent

On completion of the assessment if there is a shortfall in the evidence requirements, a 'not pass' decision will be given.

The PEI will then provide detailed feedback on the areas where the apprentice needs to provide more evidence of competence and/or experience to meet the minimum 'pass' requirements. This will enable the apprentice and the employer to develop a CPD plan to enable the apprentice to develop the additional competencies/experience required to be judged professionally competent.

- Professionally competent

On completion of the assessment of the Log Book if sufficient evidence has been presented against all of the criteria laid out in the Standard and all minimum requirements have been met, a 'pass' decision will be given.

The PEI will produce a letter stating that the apprentice has met all the requirements for, and has successfully completed the Level 6 Apprenticeship Standard.

6.4 Professional recognition

The Standard states that completion of the apprenticeship will be recognised by the relevant Professional Engineering Institutions.

On completion of the assessment if the apprentice has provided sufficient initial evidence for all 5 competency areas required for professional registration to be fully met, the apprentice will be advised of the process that they must follow in order to progress to formal application for professional registration, if they so wish.

If the apprentice has not provided sufficient evidence, the PEI will provide detailed feedback on the areas in which the apprentice needs to provide more evidence and they will be encouraged to develop a CPD plan to enable the apprentice to develop the additional competencies / experience required to be ready to apply for full professional recognition.

7. End-point Assessment - Final Judgement

The Chair of the panel of appropriately qualified professional engineers, ones holding an IEng or CEng qualification and appointed by the chosen PEI, will make the decision as to whether or not the requirements of the Standard have been achieved and hence whether the apprenticeship has been achieved. The apprentice will need to meet all of the KSB requirements as set out in the standard.

Should the panel judge that the requirements of the Standard have not been met, the apprentice will be eligible to re-apply for an end-point assessment at some future point when deficiencies have been remedied.

8. Independence

The end-point assessment will be carried out by one of the PEIs licenced by the UK Engineering Council. They must also be registered as an assessment organisation on the Skills Funding Agency's Register of Apprentice Assessment Organisations. The organisation will provide professionally qualified independent assessors holding an IEng or CEng qualification, and will ensure that they have no part in the delivery of the apprenticeship nor any direct connection or relationship to either the employer or the apprentice.

9. End-point Assessment - Summary of rôles and responsibilities

Employer:

- publish and operate a Degree Apprenticeship scheme, mapped to the Standard and underwritten by a PEI;
- support the apprentice to collect the Log Book evidence to go forward to the end-point assessment;
- carry out the Occupational Competence Interview according to the PEI guidelines along with an independent assessor appointed by the assessment organisation.

Apprentice:

- achieve the degree;
- collect the Log Book evidence to go forward to the end-point assessment.

PEI:

- ensure that the HEI academic course is accredited;
- provide adequate mentoring, guidance and support to employers to ensure that apprentices can opt to proceed to professional registration with an appropriate PEI based on satisfactory completion of their apprenticeship;
- develop the criteria for the Occupational Competence Interview and the guidelines as to how the interview should be conducted and provide training to employers where required;
- ensure that the independent assessors hold an IEng or CEng qualification and are trained to carry out end-point assessments;
- provide an appropriately qualified and experienced individual to take part in the occupational competence interview;
- provide the panel of appropriately qualified and experienced assessors to conduct phase two of the end-point assessment - to examine the Log Book submitted by the apprentice to determine whether or not all elements of the KSBs detailed in the Standard have been achieved: whether or not the apprenticeship has been successfully completed.

10. Quality Assurance - internal

Each PEI involved in the assessment of apprentices under this assessment plan will:

- recruit and train assessors who:
  - hold an IEng or CEng qualification;
  - will be trained and experienced in carrying out assessments for professional membership of a PEI against the UK-SPEC;

  - have recent experience of working in a high-level engineering setting;
  - ensure that they have no part in the delivery of the apprenticeship nor any direct connection or relationship to either the employer or the apprentice; and
  - convene assessment panels of these assessors as requested by employers.
- be expected to put in place quality assurance systems that support fair, reliable and consistent assessment across apprenticeships and over time this could include contributing to regional and national standardisation meetings with other PEIs.
- develop and make freely available, the assessment criteria for each of the components of the end-point assessment and guidance on their application.
- provide training for their assessors on the conduct of the assessment and on the consistent application of the criteria by for example carrying out standardisation meetings.
- develop policy and procedures around all aspects of the apprenticeship with which they are involved, for example how complaints should be handled.

11. Quality Assurance - external

The Engineering Council is the UK regulatory body for the engineering profession. It holds the national registers for Engineering Technicians (EngTech), Incorporated Engineers (IEng), and Chartered Engineers (CEng).

In addition, the Engineering Council sets and maintains the internationally recognised standards of professional competence and ethics that govern the award and retention of these titles. This ensures that employers, government and wider society - both in the UK and overseas - can have confidence in the knowledge, experience and commitment of professionally registered engineers and technicians.

The Engineering Council grants licences to professional engineering institutions (PEIs), allowing them to assess candidates for inclusion on the national register of professional engineers and technicians. They can also be licensed to accredit academic programmes and professional development schemes.

There are currently 35 licensed institutions, which are deemed to have sufficient experience, procedures and resources to undertake the following tasks:

- Assess the competence and commitment of candidates for registration
- Monitor the continuing professional development of registrants
- Monitor the conduct of registrants

Each PEI undergoes an annual self-assessment process and every five years have to re-apply for their licence from the Engineering Council. This process ensures that all PEIs maintain appropriate quality assurance processes.

12. End-point - Grading

All of the non-degree course elements of the apprenticeship are evidenced in the Log Book which is examined and judged against the Standard as achieved or not, during the end-point assessment. This is a binary decision: it is either achieved, or not.

The degree course element of the apprenticeship will be subject to the normal grading system used by HEIs: 1st class, 2:1, 2:2, 3 (pass).

For the apprentice to achieve a pass for the whole apprenticeship, the degree course, the occupational competence interview and professional competence assessment must all be passed.

This apprenticeship is designed to be closely aligned to the requirements of the PEIs for membership and professional registration status and as such should be exempt from further grading.

13. Implementation

13.1 Affordability

Preliminary discussions with assessment organisations indicate a cost for the end-point assessment of between 5% - 10 % of the whole cost.

13.2 Professional Body Recognition

The Standard states that completion of the apprenticeship will be recognised by the relevant Professional Engineering Institutions.

By closely aligning the KSBs in the Standard to the UK-SPEC and by using assessment panels made up of appropriately professionally qualified chair and members, completion of this apprenticeship should also substantially reduce the time taken for the apprentice to gain the 'gold star' status of Chartered Engineer.

13.3 Volumes

In the first full-year of operation an estimated 150 apprentices, rising to 750 per year when the programme is mature.

Annex 1 Table of Knowledge, Skills and Behaviours

This is as per the Embedded Electronic Systems Design and Development Engineer Apprenticeship Standard.

Knowledge	What is Required	Assessment Methods
Electrical circuit theory	Understanding of basic electrical theory	Degree / PEI
Electronic components	Knowledge of the method of operation of basic semiconductors and passive components including their most common uses	Degree / PEI
	Also the basic formulas used in their application	Degree / PEI
Analogue and digital design techniques	Understanding of design of both analogue and digital circuits and the basic design rules for mixed analogue and digital circuit boards	Degree / PEI
Structured software	Comprehension of the fundamentals of structured software design	Degree / PEI
Company Specifics	Understanding key aspects of the employer's business and product applications – against a template to be generated by the employer	Log Book

Skills	What is Required	Assessment Methods
Circuit design	Design functional electronic systems and circuits from component level	Degree / PEI
Circuit layout	Utilise modern CAD technology to implement circuit design with understanding of considerations for heat dissipation, electrical interference and other industry specific considerations affecting layout	Degree / PEI
Structured programming for embedded software	Write and document structured code to comply with industry norms and to allow others to understand and subsequently maintain/modify the code	Degree / PEI
Mathematical modelling	Utilise modelling techniques for circuit design, embedded software development and thermal management	Degree / PEI
Design for purpose	Ability to demonstrate an understanding of the principles and practice of design for market, design for manufacturability, design for testability and design for maintainability	Degree / Log Book
Testing methodology	Ability to develop a test plan for a product that they have developed	Degree / Log Book
Product transition	Ability to explain the process by which a product is	Degree / Log

into production	introduced into production, including what aspects are discussed at what stage and with whom and how development gateways work	Book
Project Management	Ability to develop a basic project plan including resource planning, time planning, use of contingencies etc.	Degree / Log Book
	Also techniques for predicting pinch points and strategies for timescale recovery	Degree / Log Book
Compliance	Awareness of international standards and compliance requirements for the products designed by the employer	Log Book
	Ability to discuss the differences between legislative and non-legislative requirements	Log Book
Commercial awareness	Ability to demonstrate knowledge of basic business fundamentals including costs, overheads, gross margin, net margin, profit, and cash	Log Book
Health and Safety	Ability to demonstrate awareness and understanding of basic health and safety principles both in the general workplace and specific to electronic circuit design	Log Book

Behaviours	What is Required	Assessment Methods
Motivation	Self-starter, organised thinker	Log Book
	Works safely and effectively without close supervision	Log Book
Communication	Confident in oral, written and electronic methods	Log Book
	Ability to communicate effectively with all levels of stakeholder	Log Book
Team ethos and leadership	Exhibits leadership behaviour and qualities	Log Book
	Demonstrable ability to work as a member of a team	Log Book
Continuous development	Committed to personal learning and development	Log Book
Problem solving/practicality	Enjoys problem solving	Log Book
	Able to demonstrate practical capabilities in their professional role	Log Book
Responsibility	Accepts responsibility for own work and that of others	Log Book
Ethics and professional standards	Exercises responsibilities in an ethical manner and respects and complies with company rules and guidelines	Log Book
	Able to commit to beliefs, goals, and standards of	Log Book

	their employer and the wider industry and its professional standards	

NB The initials PEI in the Assessment Methods column stand for: Professional Engineering Institution

Annex 2

Embedded Electronic Systems Design and Development Engineer
Level 6 Degree Apprenticeship Standard

Occupation: Embedded Electronic Systems Design and Development Engineer

The role of the Embedded Electronic Systems Design and Development Engineer is to apply their knowledge of electronics and of embedded software to the design of circuits or devices that provide a useful function, that are capable of being manufactured at a competitive cost, and that are reliable and safe in use. This involves the use of the engineer's knowledge of electronics and electronic principles, married to an expertise in the end use of the final product. In electronics this end use can cover a wide spectrum. Examples of industrial sectors that rely heavily on Embedded Systems Design and Development Engineers include Aerospace, Automotive, Automation and Instrumentation, Robotics, Telecommunications, Information and Computer Technology, Defence, Energy (including renewables), Transport and Consumer Electronics. The role provides the basis of learning with potential to specialise as a Hardware Engineer, Software engineer or Systems Engineer in these sectors and can extend from design of integrated circuits through to complete systems.
Embedded Electronic Systems Design and Development Engineers will spend their careers in these industries developing the next generations of products such as smartphones, electric vehicles, communications satellites, smart grids and bringing concepts such as smart cities into reality. For others, an initial grounding in design and development will prove an excellent launch pad for a career in applications engineering, product management, marketing or general management.
The Embedded Electronic Systems Design and Development Engineer must be proficient in a wide range of skills, underpinned by academic understanding, to enable them to work across these sub-sectors and specialisms.

Apprentices will complete a Degree that will support the fundamental scientific and mathematical principles that equip them with the understanding required to operate effectively and efficiently at a high level within any of these sectors. This will be supported by vocational training to develop the required competencies specific to particular roles within the chosen sectors.

Requirements:

A competent Embedded Electronic Systems Design and Development Engineer will meet the following requirements:

Knowledge	**What is required**
Electrical circuit theory	Understanding of basic electrical theory
Electronic components	Knowledge of the method of operation of basic semiconductors and passive components including their most common uses. Also the basic formulas used in their application
Analogue and digital design techniques	Understanding of design of both analogue and digital circuits and the basic design rules for mixed analogue and digital circuit boards
Structured software	Comprehension of the fundamentals of structured software design
Company Specifics	Understanding key aspects of the employer's business and product applications – against a template to be generated by the employer

Skills	What is required
Circuit design	Design functional electronic systems and circuits from component level
Circuit layout	Utilise modern CAD technology to implement circuit design with understanding of considerations for heat dissipation, electrical interference and other industry specific considerations affecting layout
Structured programming for embedded software	Write and document structured code to comply with industry norms and to allow others to understand and subsequently maintain/modify the code
Mathematical modelling	Utilise modelling techniques for circuit design, embedded software development and thermal management
Design for purpose	Ability to demonstrate an understanding of the principles and practice of design for market, design for manufacturability, design for testability and design for maintainability
Testing methodology	Ability to develop a test plan for a product that they have developed
Product transition into production	Ability to explain the process by which a product is introduced into production, including what aspects are discussed at what stage and with whom and how development gateways work
Project Management	Ability to develop a basic project plan including resource planning, time planning, use of contingencies etc. Also techniques for predicting pinch points and strategies for timescale recovery
Compliance	Awareness of international standards and compliance requirements for the products designed by the employer. Ability to discuss the differences between legislative and non-legislative requirements
Commercial awareness	Ability to demonstrate knowledge of basic business fundamentals including costs, overheads, gross margin, net margin, profit, and cash
Health and Safety	Ability to demonstrate awareness and understanding of basic health and safety principles both in the general workplace and specific to electronic circuit design

Behaviours	What is required
Motivation	Self-starter, organised thinker. Works safely and effectively without close supervision
Communication	Confident in oral, written and electronic methods. Ability to communicate effectively with all levels of stakeholder
Team ethos and leadership	Exhibits leadership behaviour and qualities. Demonstrable ability to work as a member of a team.
Continuous development	Committed to personal learning and development
Problem solving/practicality	Enjoys problem solving. Able to demonstrate practical capabilities in their professional role.
Responsibility	Accepts responsibility for own work and that of others
Ethics and professional standards	Exercises responsibilities in an ethical manner and respects and complies with company rules and guidelines. Able to commit to beliefs, goals, and standards of their employer and the wider industry and its professional standards

Duration:

The duration of this apprenticeship is unlikely to be less than 36 months.

Entry Requirements:

Individual employers will set their own entry requirements in terms of prior academic qualifications and experience. Typically candidates will have attained A-Level standard or equivalent, in Maths and at least one further STEM based subject such as Physics, ICT, Computing or Electronics and will have English Language at GCSE (grade C or above).

Level:

The Apprenticeship Standard is at Level 6.

An Honours Degree in Electronics or Electrical & Electronic Engineering which has been accredited by one of the Professional Engineering Institutions licensed by the UK Engineering Council.

Apprentices without a Level 2 English and maths must complete this prior to taking the end-point assessment.

Professional Registration:

Completion of the Apprenticeship will be recognised by the relevant Professional Engineering Institutions.

Review:

The standard will be initially reviewed after three years to ensure it reflects employer demand for changes in the syllabus.

Annex 3 Example Log Book

This is an example of a Log Book associated with a different Apprenticeship, purely for illustrative purposes. This is not the Log Book that will be used for this Apprenticeship.

Aerospace and Aviation Trailblazer Standard
Incorporated Engineer Performance Indicators Recording Form

Apprentice Name **Insert Name**	Apprentice Signature
Apprentice Employee Number if applicable **Insert Number**	
Assessors Name **Insert name**	Assessors Signature
Date of Assessment by Institution **Insert Date**	

The UK Standard for Professional Engineering Competence (UK-SPEC) describes the value of becoming registered as an Incorporated Engineer **(IEng);** it describes the requirements that have to be met by you as an apprentice in order to gain this qualification, and gives examples of ways of doing this. You should download the SPEC for reference, and get more information about the benefits of being an approved Incorporated Engineer: http://www.engc.org.uk/professional-qualifications/standards/uk-spec

Incorporated Engineers maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation.

Incorporated Engineers are able to demonstrate:

• The theoretical knowledge to solve problems in developed technologies using well proven analytical techniques

- Successful application of their knowledge to deliver engineering projects or services using established technologies and methods
- Responsibility for project and financial planning and management together with some responsibility for leading and developing other professional staff
- Effective interpersonal skills in communicating technical matters
- Commitment to professional engineering values.

The Competence and Commitment Standard for Incorporated Engineers. **Incorporated Engineers** must be competent throughout their working life, by virtue of their education, training and experience, to:	The examples given below are intended to help you identify activities you might quote to demonstrate the required competence and commitment for IEng registration. These are not exhaustive. Moreover, you are not required to give multiple examples to demonstrate competence and commitment. Please record your evidence in the boxes below against the criteria highlighted. The reviewers will be looking for evidence that you have the know-how to do the job, and were able to go beyond the immediate requirements and use your initiative and experience to solve a problem or improve a process. **Supporter/Endorser**. Please sign each section to confirm that the evidence is a fair and accurate record. **Comments** - Please indicate your opinion of the candidate's performance in each of the sections.
A: Use a combination of general and specialist engineering knowledge and understanding to apply existing and emerging technology.	
A1 Maintain and extend a sound theoretical approach to the application of technology in engineering practice. *This could include an ability to:*	Engage in formal learning. Learn new engineering theories and techniques in the workplace, at seminars, etc. Broaden your knowledge of engineering codes, standards and specifications.

• *Identify the limits of own personal knowledge and skills*	**Evidence**
• *Strive to extend own technological capability*	**Evidence**
• *Broaden and deepen own knowledge base through new applications and techniques.*	**Evidence**
Supporter/Endorser Signature and Comments	
A2 **Use a sound evidence-based approach to problem-solving and contribute to continuous improvement.** *This could include an ability to:*	Manage/contribute to market research, and product and process research and development. Involvement with cross-disciplinary working. Conduct statistically sound appraisal of data. Use evidence from best practice to improve effectiveness. Apply root cause analysis.
• *Use market intelligence and knowledge of technological developments to promote and improve the effectiveness of engineering products, systems and services*	**Evidence**
• *Contribute to the evaluation and development of continuous improvement systems*	**Evidence**
	Evidence

• *Apply knowledge and experience to investigate and solve problems arising during engineering tasks and implement corrective action.*	
Supporter/Endorser Signature and Comments	
B Apply appropriate theoretical and practical methods to design, develop, manufacture, construct, commission, operate, maintain, decommission and re-cycle engineering processes, systems, services and products.	
B1 Identify, review and select techniques, procedures and methods to undertake engineering tasks. *This could include an ability to:*	Contribute to the marketing of and tendering for new engineering products, processes and systems. Contribute to the specification and procurement of new engineering products, processes and systems. Develop decommissioning processes. Set targets, and draft programmes and action plans. Schedule activities.
• *Establish users' requirements for improvement*	**Evidence**
• *Select a review methodology*	**Evidence**
• *Fully exploit and implement current technology*	**Evidence**

• *Review the potential for enhancing engineering practices, products, processes, systems and services, using evidence from best practice*	**Evidence**
• *Establish an action plan to implement the results of the review.*	**Evidence**
Supporter/Endorser Signature and Comments	
B2 Contribute to the design and development of engineering solutions. *This could include an ability to:*	Contribute to theoretical and applied research. Manage/contribute to value engineering and whole life costing. Work in design teams. Draft specifications. Find and evaluate information from a variety of sources, including online. Develop and test options. Identify resources and costs of options. Produce detailed designs. Be aware of IP constraints and opportunities.
• *Contribute to the identification and specification of design and development requirements for engineering products, processes, systems and services*	**Evidence**
• *Identify operational risks and evaluate possible engineering solutions, taking account of cost, quality, safety, reliability, appearance, fitness for purpose, security, intellectual property (IP) constraints and opportunities, and environmental impact*	**Evidence**

• *Collect and analyse results*	**Evidence**
• *Carry out necessary tests*	**Evidence**
Supporter/Endorser Signature and Comments	
B3 Implement design solutions and contribute to their evaluation. *This could include an ability to:*	**Follow the design process through into product manufacture. Operate and maintain processes, systems etc. Contribute to reports on the evaluation of the effectiveness of the designs, including risk, safety and life cycle considerations. Contribute to product improvement. Interpret and analyse performance. Contribute to determining critical success factors**
• *Secure the resources required for implementation*	**Evidence**
• *Implement design solutions, taking account of critical constraints, including due concern for safety and sustainability*	**Evidence**
• *Identify problems during implementation and take corrective*	**Evidence**

action	
• Contribute to recommendations for improvement and actively learn from feedback on results.	**Evidence**
Supporter/Endorser Signature and Comments	
C. Provide technical and commercial management	
C1. Plan for effective project implementation. *This could include an ability to:*	Manage/contribute to project planning activities. Produce and implement procurement plans. Contribute to project risk assessments. Collaborate with key stakeholders. Plan programmes and delivery of tasks. Identify resources and costs. Prepare and agree contracts/work orders.
• Identify factors affecting the project implementation	**Evidence**
• Carry out holistic and systematic risk identification, assessment and management	**Evidence**
• Prepare and agree implementation plans and method statements.	**Evidence**

• *Secure the necessary resources and confirm roles in project team*	**Evidence**
• *Apply the necessary contractual arrangements with other stakeholders (client, subcontractors, suppliers, etc)*	**Evidence**
Supporter/Endorser Signature and Comments	
C2 Manage tasks, people and resources to plan and budget. *This could include an ability to:* • *Operate appropriate management systems*	**Manage/contribute to project operations. Manage the balance between quality, cost and time. Manage contingency processes. Contribute to the management of project funding, payments and recovery. Satisfy legal and statutory obligations.** **Manage tasks within identified financial, commercial and regulatory constraints.**
• *Operate appropriate management systems*	**Evidence**
• *Work to the agreed quality standards, programme and budget, within legal and statutory requirements*	**Evidence**

• *Manage work teams, coordinating project activities*	**Evidence**
• *Identify variations from quality standards, programme and budgets, and take corrective action*	**Evidence**
• *Evaluate performance and recommend improvements*	**Evidence**
Supporter/Endorser Signature and Comments	
C3 Manage teams and develop staff to meet changing technical and managerial needs. *This could include an ability to:*	**Carry out/contribute to staff appraisals. Plan/contribute to the training and development of staff. Gather evidence from colleagues of the management, assessment and feedback that you have provided. Carry out/contribute to disciplinary procedures.**
• *Agree objectives and work plans with teams and individuals*	**Evidence**
• *Identify team and individual needs, and plan for their development*	**Evidence**

• *Reinforce team commitment to professional standards*	**Evidence**
• *Manage and support team and individual development*	**Evidence**
• *Assess team and individual performance, and provide feedback.*	**Evidence**
Supporter/Endorser Signature and Comments	
C4 Manage continuous quality improvement. *This could include an ability to:*	Promote quality. Manage/contribute to best practice methods of continuous improvement, e.g. ISO 9000, EFQM, balanced scorecard. Carry out/contribute to quality audits. Monitor, maintain and improve delivery. Identify, implement and evaluate changes to meet quality objectives.
• *Ensure the application of quality management principles by team members and colleagues*	**Evidence**

• *Manage operations to maintain quality standards*	**Evidence**
• *Evaluate projects and make recommendations for improvement*	**Evidence**
Supporter/Endorser Signature and Comments	
D. Demonstrate effective interpersonal skills	
D1 Communicate in English with others at all levels. *This could include an ability to:*	Reports, letters, emails, drawings, specifications and working papers (e.g. meeting minutes, planning documents, correspondence) in a variety of formats. Engaging or interacting with professional networks.
• *Contribute to, chair and record meetings and discussions*	**Evidence**
• *Prepare communications, documents and reports on technical matters*	**Evidence**
	Evidence

• *Exchange information and provide advice to technical and non-technical colleagues.*	
Supporter/Endorser Signature and Comments	
D2 Present and discuss proposals *This could include an ability to:* .	Presentations, records of discussions and their outcomes.
• *Prepare and deliver appropriate presentations*	**Evidence**
• *Manage debates with audiences*	**Evidence**
• *Feed the results back to improve the proposals*	**Evidence**
• *Contribute to the awareness of risk*	**Evidence**

Supporter/Endorser Signature and Comments	
D3 Demonstrate personal and social skills. *This could include an ability to:* *.*	**Records of meetings. Evidence from colleagues of your personal and social skills. Contribute to productive working relationships. Apply diversity and anti-discrimination legislation.**
• Know and manage own emotions, strengths and weaknesses	**Evidence**
• Be aware of the needs and concerns of others, especially where related to diversity and equality	**Evidence**
• Be confident and flexible in dealing with new and changing interpersonal situations	**Evidence**
• Identify, agree and work towards collective goals	**Evidence**
• Create, maintain and enhance productive working relationships, and	**Evidence**

resolve conflicts	
Supporter/Endorser Signature and Comments	
E. Demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment	
E1 Comply with relevant codes of conduct. *This could include an ability to:*	**Contribute to the affairs of your institution. Work with a variety of conditions of contract.**
• Comply with the rules of professional conduct of the Royal Aeronautical Society	**Evidence**
• Manage work within all relevant legislation and regulatory frameworks, including social and employment legislation	**Evidence**
Supporter/Endorser Signature and Comments	
E2 Manage and apply safe systems of	Undertake formal health and safety training. Work with health and safety legislation and best

work *This could include an ability to:*	practice. In the UK, examples include HASAW 1974, CDM regulations, OHSAS 18001:2007 and company safety policies. Carry out safety audits. Identify and minimise hazards. Assess and control risks. Deliver health and safety briefings and inductions
• Identify and take responsibility for own obligations for health, safety and welfare issues	**Evidence**
• Manage systems that satisfy health, safety and welfare requirements	**Evidence**
• Develop and implement appropriate hazard identification and risk management systems and culture	**Evidence**
• Manage, evaluate and improve these systems	**Evidence**
• Apply a sound knowledge of health and safety legislation	**Evidence**
Supporter/Endorser Signature and Comments	

E3 Undertake engineering activities in a way that contributes to sustainable development. *This could include an ability to:*	Carry out/contribute to environmental impact assessments. Carry out/contribute to environmental risk assessments. Manage best practice environmental management systems, e.g. ISO 14000. Manage best practice risk management systems e.g. ISO 31000. Work within environmental legislation. Adopt sustainable practices. Contribute to social, economic and environmental outcomes.
• *Operate and act responsibly, taking account of the need to progress environmental, social and economic outcomes simultaneously*	**Evidence**
• *Provide products and services which maintain and enhance the quality of the environment and community, and meet financial objectives*	**Evidence**
• *Understand and encourage stakeholder involvement in sustainable development*	**Evidence**
• *Use resources efficiently and effectively*	**Evidence**
Supporter/Endorser Signature and Comments	

E4 Carry out and record continuing professional development (CPD) necessary to maintain and enhance competence in own area of practice including:	**Keep up to date with national and international engineering issues. Maintain CPD plans and records. Involvement with the affairs of your institution. Evidence of your development through on-the-job learning, private study, in-house courses, external courses and conferences.**
Undertake reviews of own development needs	**Evidence**
Plan how to meet personal and organisational objectives	**Evidence**
Carry out planned (and unplanned) CPD activities	**Evidence**
Maintain evidence of competence development	**Evidence**

Evaluate CPD outcomes against the action plans	**Evidence**
Assist others with their own CPD.	**Evidence**
Supporter/Endorser Signature and Comments	
E5 Exercise responsibilities in an ethical manner.	**Please refer to the Statement of Ethical Principles on page 33 of UK SPEC:: http://www.engc.org.uk/professional-qualifications/standards/uk-spec**
Give an example of where you have applied ethical principles	**Evidence**
Give an example of where you have applied/upheld ethical principles as defined by your organisation or company, which may be in its company or brand values.	**Evidence**

Supporter/Endorser Signature and Comments	

Education

Knowledge and understanding are important components of professional competence. Formal education is the usual, though not the only, way of demonstrating the necessary knowledge and understanding, and the following qualifications exemplify the required knowledge and understanding for Incorporated Engineers:

• An accredited Bachelors or honours degree in engineering or technology
• or a Higher National Diploma or a Foundation Degree in engineering or technology, plus appropriate further learning to degree level*
• or an NVQ4 or SVQ4 which has been approved for the purpose by a licensed professional engineering institution, plus appropriate further learning to degree level*.

*See www.qaa.ac.uk for qualification levels and HE reference points.

The Engineering Council website provides searchable databases of accredited programmes. Please check the Engineering Council website: www.engc.org.uk/courses

Applicants who do not have exemplifying qualifications may demonstrate the required knowledge and understanding in other ways, but must clearly demonstrate they have achieved the same level of knowledge and understanding as those with exemplifying qualifications.

Ways to demonstrate this include:

• Taking further qualifications, in whole or in part, as specified by the institution to which they are applying
• Completing appropriate work-based or experiential learning
• Writing a technical report, based on their experience, and demonstrating their knowledge and understanding of engineering principles
• Until 2011, taking Engineering Council examinations.

Applicants should consult their institution for advice on the most appropriate option.

Tick as appropriate: **Apprentice has met the Eng Tech criteria**	**Apprentice requires further development**
Assessor name **Date**	