Pearson

Apprenticeships in

Engineering and Manufacturing

Pearson Level 7 End-point Assessment for

Systems Engineer (2019)

Specification date: **November 2022**
First assessment date: **January 2022**
Issue 2

About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to learners, educational institutions, employers, governments and other partners globally. We are committed to helping equip learners with the skills they need to enhance their employability prospects and to succeed in the changing world of work. We believe that wherever learning flourishes so do people.

The title of this End-point Assessment includes in parentheses the year the updated Systems Engineer standard was published by The Institute for Apprenticeships (IfATE) to differentiate with the previously published Pearson Level 7 End-point Assessment for Systems Engineering.

This specification is Issue 2. Key changes are summarised on the next page. We will inform centres of any changes to this issue. The latest issue can be found on our website.

Publication code: VQ000158

Summary of changes to *Pearson Level 7 End-point Assessment for Systems Engineer (2019)* specification

Summary of changes made between previous issue and this issue	**Page number(s)**
Wording regarding EPA period updated, specifically use of 'maximum' changed to 'typically'	4, 25, 27
Added 'presentation' so it reads 'project presentation' in *Delivery and Conduct for Project* section	10
Wording corrected to clarify that a retake does not require further learning, whereas a resit does	16
Paragraph added for both the portfolio requirements and the project to make clear that the portfolio and project can be viewed on site prior to the apprentice and independent assessor meeting	30, 32
Change in % time for additional questioning within the Project Assessment Method updated from 20% to 10%	33

If you need further information on these changes or what they mean, please contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

Contents

1 The Systems Engineer Apprenticeship

What are Pearson End-point Assessments?

End-point assessment (EPA) takes place at the end of the apprenticeship programme when the apprentice has passed through gateway and been signed off as ready for the assessment by their employer. It is a synoptic assessment of the knowledge, skills and behaviours (KSBs) outlined in the Apprenticeship Standard learnt throughout the apprenticeship programme.

Purpose

The purpose of the EPA is to confirm that the apprentice has met the required level of knowledge, skills and behavioural standards set by employers and that they are competent in their role as a systems engineer.

Systems engineering is an interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles. The occupation is found in any sector where complex engineered systems are defined, developed and/or operated; some examples are transport (e.g. rail, aviation, automotive, maritime), defence and security, telecommunications, health, manufacturing, construction, and infrastructure. Systems Engineers are found in all parts of the supply chain from small medium enterprises (SMEs) to multinational businesses, and in commercial and public sector organisations.

The broad purpose of systems engineering is to create and execute an interdisciplinary process to ensure that customer and stakeholder needs are satisfied in a high quality, trustworthy, cost efficient and schedule compliant manner throughout a system's entire life cycle. Systems Engineers integrate multiple technological elements in complex systems that, in the case of socio-technical systems, may also include organisational elements and human interactions. Socio-technical systems include requirements that span hardware, software, personnel, and community aspects (e.g. a rail network includes human considerations at many different levels).

In their daily work, an employee in this occupation interacts with project managers or personnel from business development and/or sales functions. They may assemble and manage teams of domain specialists (such as mechanical, electrical, electronics, software engineers, etc.) and subject matter experts in specific technology or scientific areas.

A Systems Engineer will often work in a customer-facing role ensuring that the system meets customer and user needs and preferences, often with responsibility for technical and business communication. Mostly the occupation is office based, although site visits may be needed during implementation of designed systems.

An employee in this occupation will be responsible for overall technical management and coordination within a programme or project and contribute to safety, security and quality of outputs. They may be responsible for specific processes within the life cycle as, for example, a Requirements Engineer, Systems Architect, or Integration Engineer. For larger programmes or projects, Systems Engineers will typically be responsible for staff and budgets.

Jobs typically held by individuals undertaking this occupation include Lead Engineer, Project Engineer, Technical Lead, Acquisition Engineer, Systems Engineer, Test Engineer, Requirements Engineer, Requirements Manager, Systems Architect, Systems Designer, Systems Analyst, Engineering Manager, Systems Specialist, Technical Manager, In-service Engineer, Through-life Systems Engineer, Operation and Support Engineer, Acceptance Engineer, Integration Engineer, Interface Manager.

Industry support and recognition

Pearson has worked in close collaboration with sector experts from professional bodies and training providers in developing the assessment tools for this EPA. We are grateful to all who have generously shared their time and expertise to help us in the development process.

In particular, we are grateful to INCOSE UK Ltd for permission to incorporate the Systems Engineering Competencies Framework (v3 2010) and associated guidance into our assessment instruments and guidance documents.

2 Summary of End-point Assessment

EPA Title	Pearson Level 7 End-point Assessment for Systems Engineer (2019)
Qualification number (QN)	610/0192/2
Regulation start date	01/01/2022
First Pearson assessment	01/01/2022
Relationship with previous EPA	The Institute for Apprenticeships (IfATE) published an updated Systems Engineer Apprenticeship Standard in April 2019. The title of this End-point Assessment includes 2019 in parenthesis to differentiate with the previously published *Pearson Level 7 End-point Assessment for Systems Engineering.*
Assessment methods	• Method 1: Project Report, Presentation, and Questioning • Method 2: Professional Discussion, underpinned by Portfolio of Evidence *Refer to Section 5 for detailed information about each method.*
Grading	Pass/Distinction *Refer to Section 3 for detailed information.*
Duration of apprenticeship programme	The typical duration for this apprenticeship is 48 months on-programme before gateway, but this will depend on the individual apprentice's previous experience and access to opportunities to gain the full range of competences.

EPA Title	Pearson Level 7 End-point Assessment for Systems Engineer (2019)
Gateway requirements	• Employer confident that the apprentice is ready. • Apprentices are required to have achieved a Master's degree in System Engineering (i.e. 180 CATS credits at Level 7). • Apprentices without English and mathematics at Level 2, must achieve Level 2 prior to taking their EPA. For those with an education, health and care plan or a legacy statement, the English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualifications are an alternative to English qualifications for whom this is their primary language. • Apprentices must have completed up to three work-based projects to underpin the Project Report, Presentation and Questioning. • Apprentices must have completed a Portfolio of Evidence to underpin the Professional Discussion.
Time period for completion of EPA	The EPA must be completed within an EPA period lasting typically four months, after the apprentice has met the EPA gateway requirements.
Apprenticeship certification	The certificate for the apprenticeship is awarded by the Institute for Apprenticeships and Technical Education (IfATE), through a process administered by the Education and Skills Funding Agency (ESFA). As the end-point assessment organisation (EPAO), Pearson will claim certificates on behalf of apprentices.

3 EPA structure

Pearson Level 7 End-point Assessment for Systems Engineer (2019)

The EPA for the Systems Engineer Apprenticeship consists of the following two assessment methods:

- Method 1: Project Report, Presentation, and Questioning
- Method 2: Professional Discussion, underpinned by Portfolio of Evidence.

The table below gives a summary of the structure of the end-point assessment.

End-point assessment methods	Duration	Assessment method grading
Project Report, Presentation, and Questioning	Report: up to 7,500 words Presentation: 30 minutes Questioning: 30 minutes	Pass/Distinction
Professional Discussion, underpinned by Portfolio of Evidence	60 minutes	Pass/Distinction

EPA Grading

The grading for this EPA is Pass/Distinction. Both assessment methods must achieve a minimum of a Pass in order to pass the overall EPA.

The minimum requirements for Pass and Distinction grades are outlined in the table below for the two assessment methods.

The occupation duties and associated knowledge, skills and behaviours (KSBs) are mapped to INCOSE competencies, which are graded in the INCOSE framework at five levels: Awareness, Supervised Practitioner, Practitioner, Lead Practitioner, and Expert (attainment at Lead Practitioner or Expert levels is not required for this assessment plan). At least the Awareness level must be achieved for all KSBs. The assessment criteria are based on those defined by INCOSE.

The KSBs have been assigned to six groups of competencies (see *Minimum Requirements for Pass and Distinction* table, below). Both assessment methods assess KSBs across the six groups of competencies. These are listed in Table 4 through to Table 9, which can be found in the assessment plan in *Annexe B* and in the *EPA Resource Pack*.

To pass the assessment, apprentices must demonstrate the Awareness, Supervised Practitioner and Practitioner grading criteria in the combinations as indicated in the *Minimum Requirements for Pass and Distinction* table, below.

Performance in a group of competencies across both assessment methods will determine whether a Distinction is awarded for that group of competencies. Distinction must be demonstrated in all groups of competencies for a Distinction to be awarded overall.

Apprentices will fail the assessment where they do not demonstrate the minimum grading criteria required for a group of competencies.

The minimum requirements for Pass and Distinction grades are summarised in the table below. To achieve a Distinction, the apprentice must achieve the minimum levels as defined for a Pass plus any additional levels as defined for the Distinction.

Minimum Requirements for Pass and Distinction

<table>
<tr><th>Competency</th><th>Pass</th><th>Distinction</th></tr>
<tr><td colspan="3">Group 1 (Table 4)</td></tr>
<tr><td>Systems Thinking</td><td>Practitioner</td><td>Practitioner</td></tr>
<tr><td>Requirements Definition</td><td>Practitioner</td><td>Practitioner</td></tr>
<tr><td>Ethics and Professionalism</td><td>Supervised Practitioner</td><td>Practitioner</td></tr>
<tr><td colspan="3">Group 2 (Table 5)</td></tr>
<tr><td>Life Cycles</td><td rowspan="3">1 at Practitioner
1 at Supervised Practitioner
1 at Awareness</td><td rowspan="4">As per minimum profile for a Pass with an additional competency at Supervised Practitioner instead of Awareness level</td></tr>
<tr><td>Capability Engineering</td></tr>
<tr><td>Critical Thinking</td></tr>
<tr><td>Systems Modelling and Analysis</td><td rowspan="2">1 at Practitioner
1 at Awareness</td></tr>
<tr><td>General Engineering</td></tr>
<tr><td colspan="3">Group 3 (Table 6)</td></tr>
<tr><td>Communications</td><td>Supervised Practitioner</td><td rowspan="3">As per minimum profile for a Pass with any of the three competencies increased to Practitioner level</td></tr>
<tr><td>Technical Leadership</td><td rowspan="2">1 at Supervised Practitioner
1 at Awareness</td></tr>
<tr><td>Negotiation</td></tr>
</table>

Competency	Pass	Distinction
Group 4 (Table 7)		
Design for…	1 at Practitioner 1 at Awareness	As per minimum profile for a Pass with selected competencies increased resulting in: 4 at Practitioner 2 at Supervised Practitioner 2 at Awareness
Verification		
System Architecting	1 at Practitioner 2 at Supervised Practitioner 3 at Awareness	
Integration		
Interfaces		
Validation		
Transition		
Operation and Support		
Group 5 (Table 8)		
Planning	1 at Practitioner 1 at Supervised Practitioner	As per minimum profile for a Pass
Risk and Opportunity		
Monitoring and Control	1 at Practitioner 1 at Supervised Practitioner 1 at Awareness	As per minimum profile for a Pass with an additional competency at Supervised Practitioner instead of Awareness level
Information Management		
Configuration Management		
Group 6 (Table 9)		
Project Management	Supervised Practitioner	As per minimum profile for a Pass with selected competencies increased resulting in: 1 at Practitioner 1 at Supervised Practitioner 2 at Awareness
Finance	3 at Awareness	
Logistics		
Quality		

4 Assessment

Assessment plan

Pearson's approach to assessing this EPA is set by the assessment plan for the Apprenticeship Standard. This document is available in *Annexe B*.

Language of assessment

Apprentices must use English only during the assessment of this EPA.

An apprentice taking the EPA may be assessed in British Sign Language for the purpose of reasonable adjustment.

Further information on the use of language in assessment is available in our *Use of languages in qualifications policy*, available on our website.

Gateway

Before progressing to the EPA from on-programme, all apprentices must be signed off by their employer, through the 'gateway'. This gateway sign off confirms that apprentices have the level of occupational knowledge, skills and behaviours required to achieve the apprenticeship.

The EPA-specific requirements for gateway are stated in *Section 2: Summary of End- point Assessment* and the assessment plan in *Annexe B.*

Employers must complete a *Gateway Declaration Form* (see *Annexe A*) with the apprentice. The form and the associated gateway evidence to prove apprentices have met the requirements must be supplied to Pearson before the EPA can take place.

5 End-point Assessment Methods

Method 1: Project Report, Presentation and Questioning

Structure

The Project Report, Presentation and Questioning assesses apprentices' knowledge, skills and behaviours from the Apprenticeship Standard, in line with the assessment plan requirements. It is assessed by a Pearson Independent End-point Assessor (IEA).

Project	
Summary	The apprentice must produce a report, prepare and present a presentation and undertake questioning in relation to a work-based project(s). The work-based project(s) will be completed during the on-programme period; the report and presentation production must take place post-gateway.
Grading	Pass/Distinction The grading criteria for this method can be found in the assessment plan in *Annexe B* and in the *EPA Resource Pack.* *Please also see overall grading information on page 5-6*
Preparation	Apprentices must use the documents published in the *EPA Resource Pack* to support their preparation.
Delivery and conduct	Apprentices must produce a report of up to 7,500 words (maximum) based on a work-based project(s), which relates to their particular work domain. The apprentice will prepare and deliver a presentation on their work-based project(s). The presentation must last 30 minutes. Following the presentation, the Independent End-point Assessor (IEA) will ask a minimum of five open questions to confirm that the apprentice has achieved the KSBs assigned to this assessment method and to confirm their depth of understanding to assess performance against the grading criteria. The Independent End-point Assessor (IEA) may ask follow-up open questions to probe further or seek clarification. The duration of the questions and answers will be up to 30 minutes.

Project	
	The project presentation is delivered under controlled conditions, which should include a room free from distractions and influence, with sufficient space for all present. It is anticipated a room will be sourced at training provider or employer premises.
Assessment	The apprentice will complete the report under the conditions that are specified in the *EPA Specification* alone and submit to the IEA. The presentation and questioning will be made to the Independent End-point Assessor (IEA), in the presence of a representative from the apprentice's employer.

Standards Assessed

The Project Report, Presentation and Questioning assesses the following outcomes from the Apprenticeship Standard.

Apprenticeship Standard outcomes	
K1	Systems engineering life cycle processes
K2	The role a system plays in the super system of which it is a part
K3	The characteristics of good quality requirements and the need for traceability
K4	The distinction between risk, issue, and opportunity and the different forms of treatment available
K8	Non-functional design attributes such as manufacturability, testability, reliability, maintainability, affordability, safety, security, human factors, environmental impacts, robustness and resilience, flexibility, interoperability, capability growth, disposal, cost, natural variations, etc.
K11	Systems verification against specified requirements and characteristics and the need to execute it in a logical sequence
K17	The elements of a project management plan (including statement of work, work breakdown structure, resource allocation, scheduling, management plan, monitoring, risk management, change requests, record keeping, and acceptance)
K19	The role of systems engineering planning as part of an overall project/programme plan
S1	Select appropriate life cycle for a system or element of a system and establish its lifecycle stages and the relationships between them
S2	Define context of a system from a range of viewpoints including system boundaries and external interfaces
S3	Use appropriate methods to analyse stakeholder needs to produce good quality, consistent requirements with acceptance criteria and manage them throughout system development
S4	Identify, analyse, recommend treatment, and monitor and communicate risks and opportunities throughout project
S10	Define verification plans (including tests) to obtain objective evidence that a system of system element fulfils its specified requirements and characteristics
S12	Communicate effectively with all stakeholders of the project using the most appropriate medium and techniques including written and verbal presentation

Apprenticeship Standard outcomes	
S16	Create and maintain project management plan, including work breakdown structure, scheduling, and risk management
S20	Define, coordinate, and maintain effective and workable plans across multiple disciplines
B1	Adopt and encourage within the team and holistic thinking approach to system development
B3	Adopt and encourage within the team a critical thinking approach using a logical critique of work including assumptions, approaches, arguments, conclusions, and decisions

Typically, the project(s) will also cover aspects of the following duties, as given in the Apprenticeship Standard:

1 Define and manage the system life cycle for a project

2 Define and manage project requirements

3 Manage project risk

5 Generate solution concepts

8 Plan and execute system verification

13 Support technical aspects of project management.

Method 2: Professional Discussion, underpinned by Portfolio of Evidence

Structure

The Professional Discussion, underpinned by Portfolio of Evidence assesses apprentices' knowledge, skills and behaviours from the Apprenticeship Standard, in line with the assessment plan requirements. It is assessed by a Pearson Independent End-point Assessor (IEA).

Professional Discussion	
Summary	The Professional Discussion will be a one-to-one conversation, underpinned by the Portfolio. Both the IEA and the apprentice will have access to the Portfolio during the discussion.
Duration	60 minutes
Portfolio	Apprentices are required to provide work-based evidence in a Portfolio to validate and support their responses in the Professional Discussion. This Portfolio is submitted prior to the Professional Discussion.
Grading	Pass /Distinction The grading criteria for this method can be found in the assessment plan in *Annexe B* and in the *EPA Resource Pack.* *Please also see overall grading information on pg5-6*
Preparation	Apprentices must use the documents published in the *EPA Resource Pack* to support their preparation.
Delivery and conduct	The Professional Discussion will be conducted face to face or remotely. The Independent End-point Assessor (IEA) must ask 12 open questions, covering the KSB groups specified in Table 4 through to Table 9 in the assessment plan in *Annexe B* and in the *EPA Resource Pack.* The IEA must formulate the questions, following review of the Portfolio of Evidence, so as to address the KSBs assessed by this assessment method. IEAs may ask additional open follow-up questions to probe further or seek clarification where required. This must take place in a quiet environment away from the apprentice's normal working environment. The IEA will take notes and the Professional Discussion will be audio or video recorded.
Assessment	The IEA will review the apprentice's responses against the Pass and Distinction grade criteria using the evidence requirements in the *EPA Resource Pack* as guidance.

Standards Assessed

The Professional Discussion assesses the following outcomes from the Apprenticeship Standard.

Apprenticeship Standard outcomes	
K5	The benefits and risks associated with modelling and analysis
K6	How creativity, ingenuity, experimentation and accidents or errors, often lead to technological and engineering successes and advances
K7	Different types of systems architecture and techniques used to support the architectural design process (i.e. the specification of systems elements and their relationships)
K9	Integration as a logical sequence to confirm the system design, architecture, and interfaces
K10	Interface management and its potential impact on the integrity of the system solution
K12	The relationship between verification, validation, and acceptance
K13	The purpose and importance of system validation in relevant commercial context
K14	Scientific, technical, engineering, and mathematics fundamentals and a broad technical domain knowledge for the relevant industry
K15	How to take account of health and safety legislation and sustainable development requirements in the relevant industry
K16	The relationship of service quality to user satisfaction and cost, risk, and availability of the operational system
K18	The commercial and financial environment in which a project is being executed (e.g. procurement model, interest rates, exchange rates)
K20	The legal, commercial, and security constraints that affect the management of data and information (e.g. General Data Protection Regulation, handling of specific commercial contract restrictions)
K21	Support and sustainability needs of a deployed system or product
S5	Generate a physical, mathematical, or logical representation of a system entity, phenomenon or process
S6	Apply creativity, innovation and problem-solving techniques to system development or operation
S7	Define the systems architecture and derived requirements to produce an implementable solution that enables a balanced and optimum result that considers all stakeholder requirements across all stages of the life cycle

Apprenticeship Standard outcomes	
S8	Identify, define, and control interactions across system or system element boundaries
S9	Assemble a set of system elements and aggregate into the realised system, product, or service using appropriate techniques to test interfaces, manage data flows, implement control mechanisms, and verify that elements and aggregates perform as expected
S11	Provide objective evidence that the operational system fulfils its business or mission objectives and stakeholder requirements and expectations.
S13	Integrate a system into its operational environment, including the provision of support activities (e.g. specification of site preparation, training, logistics, etc.)
S14	Define and collect operation data for monitoring and control of a system
S15	Initiate design change proposals in response to system failure or degradation
S17	Balance project scope, time, cost, risk, and resources to optimise product or service quality and return on investment
S18	Manage and control system elements and configuration over the project or programme lifecycle ensuring overall coherence of the design is maintained in a verifiable manner throughout the life cycle
S19	Plan, execute, and control the storage and provision of information to stakeholders
S21	Identify concepts and ideas in sciences, technologies and engineering disciplines beyond their own discipline that could benefit the project solution
S22	Partition between discipline technologies and work with specialists to derive discipline specific requirements
B2	Perform negotiations with stakeholders recognising different styles of negotiating parties and adapts own style accordingly
B4	Take personal responsibility for health and safety practices and sustainable development
B5	Operate with integrity and in an ethical manner, and ensure that team members perform with integrity and in an ethical manner
B6	Take a proactive and systematic approach to resolving operational issues
B7	Maintain awareness of developments in sciences, technologies and related engineering disciplines

6 Delivery of End-point Assessment

End-point assessment planning and scheduling

Employers and/or training providers must have an agreement in place to conduct EPAs with Pearson, and apprentices must be registered on the ACE360 system. Once the gateway evidence has been uploaded to ACE360, this will alert the IEA to review the evidence and start the planning and scheduling process.

The purpose of the EPA planning meeting is to share information with the IEA in order to support the assessment process and to agree a plan for the upcoming assessment activities for the apprentices. The IEA will agree a plan and schedule for each assessment activity. The end-point assessment planning meeting can be conducted remotely using appropriate technology.

All methods of the end-point assessment must be completed within the time period specified in *Section 2: Summary of End-point Assessment*.

Reassessment

Reassessment, including both resit and retake, is permitted in agreement between Pearson and the employer. The timescale will be agreed on a case-by-case basis with Pearson. As part of that agreement, any reassessments must not provide an apprentice with an unfair advantage over others.

Apprentices who fail one or more assessment methods will be offered the opportunity to take a resit or retake. A resit does not require further learning, whereas a retake does.

Apprentices must have a supportive action plan to prepare for a resit or retake.

An apprentice who fails an assessment method, and therefore the EPA, will be required to resit/retake any failed assessment methods only.

Resits and retakes are not offered to apprentices wishing to move from Pass to Distinction.

Where any assessment method has to be resat or retaken, the apprentice will be awarded the maximum grade of Pass, unless the EPA determines there are exceptional circumstances requiring a resit or retake.

For additional EPA-specific requirements, refer to the assessment plan in *Annexe B.*

Booking reassessment

Reassessment is requested using the ACE360 system. Once the request is confirmed, the allocated IEA will liaise with the key contact to start the scheduling process.

Appeals

The *End-point assessment enquiries and appeals policy* is available on the Pearson website and ACE Knowledge Base. This has full information about what will happen if an apprentice or centre wishes to query the result of an assessment.

7 Access to assessment

Access to assessment for apprentices with disabilities or specific needs

Equality and fairness are central to our work. Our *Equality, diversity and inclusion policy* requires all apprentices to have equal opportunity to access our assessments, and that our EPAs are awarded in a way that is fair to every apprentice.

We are committed to making sure that:

- apprentices with a protected characteristic (as defined by the Equality Act 2010) are not, when they are taking one of our assessments, disadvantaged in comparison to apprentices who do not share that characteristic
- all apprentices achieve the recognition they deserve from their EPA and that this achievement can be compared fairly to the achievement of their peers.

For apprentices with disabilities and specific needs, the assessment of their potential to achieve the EPA must identify, where appropriate, the support that will be made available to them during delivery and assessment.

Centres must deliver the EPA in accordance with current equality legislation. For full details of the Equality Act 2010, please visit www.legislation.gov.uk

Reasonable adjustments

A reasonable adjustment relates to an adjustment that helps to reduce the effect of a disability or a physical or mental health condition, which may place the apprentice at a disadvantage compared to others. If an apprentice requires any adjustment to their assessment than this must be recorded within the ACE360 system to support the discussion at the EPA planning meeting.

Pearson will apply the *Reasonable adjustment matrix* published by the Institute for Apprenticeships and Technical Education (IfATE).

8 Malpractice

Dealing with malpractice in assessment

'Malpractice' refers to acts that undermine the integrity and validity of assessment, the certification of qualifications and/or may damage the authority of those responsible for delivering the assessment and certification.

Pearson does not tolerate actual or attempted actions of malpractice by learners, centre staff or centres in connection with Pearson qualifications. Pearson may impose penalties and/or sanctions on learners, centre staff or centres where malpractice or attempted malpractice has been proven.

Malpractice may occur or be suspected in relation to any unit or type of assessment within a qualification. For further details on malpractice and advice on preventing malpractice by learners, please see Pearson's *Centre Guidance: Dealing with Malpractice*, available on our website.

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Learners must be given information that explains what malpractice is for internal assessment and how suspected incidents will be dealt with by the centre. The *Centre Guidance: Dealing with Malpractice* document gives full information on the actions we expect you to take.

Pearson may conduct investigations if we believe a centre is failing to conduct internal assessment according to our policies. The above document gives further information and examples, and details the penalties and sanctions that may be imposed.

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice.

Learner malpractice

The head of centre is required to report incidents of suspected learner malpractice that occur during Pearson qualifications. We ask centres to complete *JCQ Form M1* (www.jcq.org.uk/malpractice) and email it with any accompanying documents (signed statements from the learner, invigilator, copies of evidence, etc) to the Investigations Processing team at candidatemalpractice@pearson.com. The responsibility for determining appropriate sanctions or penalties to be imposed on learners lies with Pearson.

Learners must be informed at the earliest opportunity of the specific allegation and the centre's malpractice policy, including the right of appeal. Learners found guilty of malpractice may be disqualified from the qualification for which they have been entered with Pearson.

Failure to report malpractice constitutes staff or centre malpractice.

Teacher/centre malpractice

The head of centre is required to inform Pearson's Investigations team of any incident of suspected malpractice (which includes maladministration) by centre staff, before any investigation is undertaken. The head of centre is requested to inform the Investigations team by submitting a *JCQ M2 Form* (downloadable from www.jcq.org.uk/malpractice) with supporting documentation to pqsmalpractice@pearson.com. Where Pearson receives allegations of malpractice from other sources (for example Pearson staff, anonymous informants), the Investigations team will conduct the investigation directly or may ask the head of centre to assist.

Pearson reserves the right in cases of suspected malpractice to withhold the issuing of results/certificates while an investigation is in progress. Depending on the outcome of the investigation, results and/or certificates may not be released or they may be withheld.

You should be aware that Pearson may need to suspend certification when undertaking investigations, audits and quality assurances processes. You will be notified within a reasonable period of time if this occurs.

Sanctions and appeals

Where malpractice is proven, we may impose sanctions or penalties, such as:

- mark reduction for affected external assessments
- disqualification from the qualification
- debarment from registration for Pearson qualifications for a period of time.

If we are concerned about your centre's quality procedures we may impose sanctions such as:

- working with centres to create an improvement action plan
- requiring staff members to receive further training
- placing temporary suspensions on certification of learners
- placing temporary suspensions on registration of learners
- debarring staff members or the centre from delivering Pearson qualifications
- suspending or withdrawing centre approval status.

The centre will be notified if any of these apply.

Pearson has established procedures for considering appeals against penalties and sanctions arising from malpractice. Appeals against a decision made by Pearson will normally be accepted only from the head of centre (on behalf of learners and/or members or staff) and from individual members (in respect of a decision taken against them personally). Further information on appeals can be found in the JCQ Appeals booklet (https://www.jcq.org.uk/exams-office/appeals).

9 Further information

Edexcel, BTEC and Pearson Work Based Learning contact details:

- https://qualifications.pearson.com/en/contact-us.html

Books, software and online resources for UK schools and colleges:

- www.pearsonschoolsandfecolleges.co.uk

Documents that further support the information in this specification:

- *EPA Service Guide* (Pearson, this is made available to approved centres).

10 Glossary

Term	Description
Apprenticeship Standard	A short document prepared by a Trailblazer group that sets out concisely the requirements to be competent in a job role. All Apprenticeship Standards are published on www.gov.uk.
Assessment Plan	This document is also prepared by a Trailblazer group and sets out the requirements that end-point assessment organisations must follow when assessing the EPA.
Cut Score	The standard mark set for a multiple-choice test pass/merit/ distinction that remains in place for a period of time, usually the life of the EPA. These may be stated on the assessment plan or determined internally by Pearson.
Competence	The minimum knowledge, skills and behaviours (KSBs) required to perform a job role effectively.
End-point Assessment	A synoptic assessment of the knowledge, skills and behaviours outlined in the Apprenticeship Standard that have been learned throughout the apprenticeship programme. The apprentice has to pass the EPA to be successful in their apprenticeship programme and demonstrate competence.
Gateway	The point at which the apprentice is identified as being competent by their employer and therefore ready to plan to take their end-point assessment. There are requirements for maths and English to enter gateway and there may be other requirements, such as mandatory qualifications, that vary depending on the Apprenticeship Standard.
Independent End-point Assessor	The assessor appointed by Pearson to work with the apprentice and employer to plan their EPA during gateway and then assess the apprentice in the final EPA.
Methods	The different assessments that form the overarching EPA. Most EPAs will typically have between two and four methods that assess set parts of the overarching standard.
On-programme	The first and main part of the apprenticeship when the apprentice is developing their KSBs towards competence. 20% of on-programme is required to be off-the-job training.
Retake	An apprentice requires further learning after failing a method before they can be re-entered for it.

Term	Description
Resit	An apprentice fails a method but is able to be re-entered immediately without any further learning.
Trailblazer group	A group of employers who have worked together to agree the Apprenticeship Standard and write the associated assessment plan.
Institute for Apprenticeships and Technical Education (IfATE)	IfATE is a non-departmental public body that oversees the development, approval and publication of Apprenticeship Standards and assessment plans. In addition, the institute is responsible for technical education, including T Levels.

Annexe A: Gateway Declaration Form

Apprentice name:	
On-programme start date:	
Gateway date:	

Evidence	**Y/N**	**Comments (if applicable)**
English and maths certificates (L2)*		
Master's degree in System Engineering		
Up to three work-based projects completed		
Portfolio of Evidence completed		

* For those with an education, health and care plan or a legacy statement, the English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualifications are an alternative to English qualifications for whom this is their primary language.

Employer declaration

I confirm that the apprentice has:

- achieved the occupational knowledge, skills and behaviours required to achieve the apprenticeship.
- produced their Portfolio of Evidence to the specified criteria.
- achieved the prerequisites listed above and is ready for their end-point assessment.

Name:_____ Date:_____

Signature:_____

Apprentice declaration

I confirm the gateway evidence is my own and I agree to be put forward for my EPA.

Signature:_____ Date:_____

Annexe B: Assessment Plan

Introduction and overview

This document sets out the requirements for the End-Point Assessment (EPA) for the Systems Engineer Apprenticeship Standard. It is for End-Point Assessment Organisations (EPAOs) to know how the EPA for this apprenticeship must operate. It will also be of interest to systems engineer degree apprentices, their employers and training providers.

Full-time apprentices will typically spend 48-months on-programme (before the gateway) working towards the occupational standard. All apprentices must have a minimum of 12 months on-programme training.

The EPA period must only start, and the EPA be arranged, once the employer is satisfied that the apprentice is consistently working at or above the level set out in the occupational standard, all of the pre-requisite gateway requirements for EPA have been met and that they can be evidenced/available to an EPAO. As gateway requirements, apprentices must have achieved a Master's degree in systems engineering. They must have completed a report on up to three work-based projects and a Portfolio of Evidence, which will underpin the EPA. In addition, apprentices without English and mathematics at Level 2, must achieve Level 2 prior to taking their EPA[1].

The EPA must be completed within an EPA period lasting typically four months, after the apprentice has met the EPA gateway requirements.

The EPA must be conducted by an organisation approved to offer services against this Apprenticeship Standard, as selected by the employer, from the Education & Skills Funding Agency's Register of End-Point Assessment Organisations (RoEPAO).

The EPA consists of two discrete assessment methods, with the following grades: Assessment method 1 – Project Report, Presentation and Questioning

- Pass
- Distinction
- Fail.

[1] For those with an education, health and care plan or a legacy statement the apprenticeships English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualifications are an alternative to English qualifications for whom this is their primary language

Assessment method 2 – Professional Discussion, underpinned by Portfolio of Evidence

- Pass
- Distinction
- Fail.

Performance in the EPA will determine the overall apprenticeship grade of:

- Pass
- Distinction
- Fail.

The INCOSE Competency Framework[2], which reflects the Systems and Software Engineering Life cycle Standard[3], underpins this Apprenticeship Standard.

[2] INCOSE 2018. Systems Engineering Competency Framework

[3] ISO/IEC/IEEE. (2015). Systems and software engineering – System Life Cycle Processes (Vol. 15288:2015). London

Table 1 – EPA Summary

On-programme (typically 48-months)	Training to develop the systems engineer occupation standard's knowledge, skills, and behaviours (KSBs) Training towards Master's degree in systems engineering Compilation of a Portfolio of Evidence Undertaking up to three work-based projects that develop and demonstrate the required KSBs Training towards English and mathematics Level 2, if required
End-point assessment gateway	Employer is satisfied the apprentice is consistently working at, or above, the level of the systems engineer occupational standard Achieved Master's degree in systems engineering Apprentices must have completed up to three work-based projects, to underpin the Project Report, Presentation and Questioning Apprentices must have completed a Portfolio of Evidence, to underpin the Professional Discussion Achieved English and mathematics at Level 2, as a minimum
End-point assessment (typically four-months)	Assessment method 1: Report, Presentation and Questioning, graded Pass, Distinction, Fail Assessment method 2: Professional Discussion, underpinned by Portfolio of Evidence, graded Pass, Distinction, Fail Overall EPA/apprenticeship graded Pass, Distinction, Fail

Length of end-point assessment period

The EPA (including all assessment methods) must be completed within four months of the first part of the EPA commencing.

Order of assessment methods

The assessment methods can be delivered in any order. The result of one assessment method does not need to be known before an apprentice starts the next one. It is anticipated that the project presentation and questioning components and Professional Discussion, underpinned by a Portfolio of Evidence will be conducted on the same day to aide efficiency.

Gateway

The EPA period should only start once the employer is satisfied that the apprentice is consistently working at or above the level set out in the occupational standard, that is to say they have achieved occupational competence. In making this decision, the employer may take advice from the apprentice's training provider(s), but the decision must ultimately be made solely by the employer.

In addition, an apprentice must have completed the following gateway requirements prior to beginning the EPA:

- achieved a Master's degree in systems engineering (i.e. 180 CATS[4] credits at Level 7)
- for the Project Report, Presentation and Questioning, the apprentice will be required to select up to three completed work-based projects – see requirements below
- for the Professional Discussion, underpinned by Portfolio of Evidence, the apprentice will be required to have completed and submitted a Portfolio of Evidence – see requirements below
- apprentices without English and mathematics at Level 2 must achieve Level 2, as a minimum. For those with an education, health and care plan or a legacy statement the English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualifications are an alternative to English qualifications for whom this is their primary language.

[4] Credit Accumulation and Transfer Scheme (UK)

Work-based project requirements:

- application of systems engineering to a project in the workplace
- in order to demonstrate examples and evidence across the required set of KSBs, the apprentice may select up to three projects undertaken during the on-programme period
- the Master's degree dissertation project could be used provided it relates to the apprentice's work domain, but the report for EPA assessment must be a separate report started after the gateway. In general, projects that are completely theoretical would be unsuitable for consideration in the EPA
- an apprentice's selected project(s) may or may not underpin Master's degree work completed on-programme (i.e. the work may have been undertaken as part of the apprentice's work for their employer). However, the report must be produced post -gateway and must not be marked in relation to the Master's degree
- the project(s) must enable the report to demonstrate and clearly reference the following KSBs to the levels defined in the assessment criteria – see Table 4 through to Table 9:
  - K1, K2, K3, K4, K8, K11, K12, K17, K19
  - S1, S2, S3, S4, S10, S12, S16, S20
  - B1, B3
- typically, the project(s) will cover aspects of duties: 1, 2, 3, 5, 8, and 13
- although the project(s) may be conducted within a team, the apprentice must be able to evidence direct experience in all the required knowledge, skills and behaviours (KSBs)
- typically, the selected project(s) would have required a total of at least 500 person hours effort by the apprentice.

Example project titles include:

- Development of a system to…
- Upgrade of system to…
- Performance improvement through system development of…
- Service support system development for…
- Development of a prototype…
- Redesign of a system to…
- A systems approach to improving…

The choice of work-based project(s) will be agreed by the apprentice with the employer using EPAO guidance. Due attention must be paid to the need to demonstrate the required KSBs.

Portfolio of evidence requirements:

- apprentices must compile a Portfolio of Evidence during the on-programme period of the apprenticeship
- the Portfolio of Evidence should contain no more than 10 discrete pieces of work:
  - the project artefacts used in assessment method 1 may be included as one of the 10 pieces of work, if it is also needed for KSBs assessed in assessment method 2
- it must contain sufficient evidence to explicitly demonstrate the following KSBs that will be assessed by the Professional Discussion to the levels defined in the assessment criteria - see Table 4 through to Table 9:
  - K5, K6, K7, K9, K10, K13, K14, K15, K16, K20, K21
  - S5, S6, S7, S8, S9, S11, S13, S14, S15, S17, S18, S19, S21, S22
  - B2, B4, B5, B6, B7
- evidence must be mapped against the KSBs
- evidence may be used to demonstrate more than one KSB; a qualitative as opposed to quantitative approach is required
- evidence sources may include:
  - management and technical reports
  - documents
  - presentations
  - journal/logbook entries
  - systems engineering artefacts
  - published articles
  - annotated photographs
  - webpages
  - media associated with a developed system

  (This is not a definitive list; other evidence sources are allowable.)
- it cannot include any methods of self-assessment or witness testimonies
- a table mapping the KSBs to be assessed and referencing the evidence sources must be provided
- the evidence provided must be valid and attributable to the apprentice; the Portfolio of Evidence must contain a statement from the employer confirming this
- the Portfolio of Evidence must be submitted to the EPAO at the gateway point.
- in exceptional circumstances, where national security clearance is required to review the information within the portfolio (or project), the independent assessor should review the portfolio (or project) on the employer's premises in advance of the assessment methods commencing. In these circumstances, the portfolio (project) does not need to be submitted to Pearson at the gateway.

Assessment method 1: Project Report, Presentation and Questioning

Overview

This assessment method has three components: report, presentation and questioning.

Apprentices must produce a report, prepare and present a presentation and undertake questioning in relation to a work-based project. The work-based project will be completed during the on-programme period; report and presentation production must take place post- gateway.

The evidence from the report, presentation and questioning components must be assessed holistically against the KSBs assigned to this assessment method by an Independent End-point Assessor (IEA) who will determine the grade, using the grading criteria in Table 4 through to Table 9 (see end of document).

The rationale for this assessment method is:

- a work-based project enables demonstration of practitioner abilities in a real setting, and also has business benefits
- end-to-end knowledge of systems development will be tested
- systemic and systematic thinking must be demonstrated practically
- presentation and questioning components enable the checking of underpinning knowledge and aspects not covered in sufficient depth in the report.

Requirements for the report and presentation and questioning components are detailed below.

Delivery

Report

Apprentices must produce a report of up to 7,500 words (maximum) excluding references, diagrams, and attachments, based on a work-based project, which relates to their particular domain.

All work relating to the report write-up, must be completed during the EPA period.

The general form of the report is a commentary on attached evidence (from the project) and reflections on its execution. The project report will include:

- Project overview:
  - describing aims, objectives, scope, and principal outcomes
- Commentary on evidence:
  - referring to attachments the rationale and execution of the various project elements is discussed
- Reflection on the systems approach used in the project:
  - An holistic view of the project and the way that its various elements were combined
- KSB table:
  - A table of all 19 KSBs assessed in this assessment method with references to the paragraphs and attachments that are relevant to each
- Employer Annexe:
  - A statement from the employer authenticating the apprentice's evidence and achievements
- All paragraphs in the report must be numbered
- All attachments must be numbered.

The apprentice must provide supporting evidence relating to the project in the attachments. Evidence could include Systems Engineering Management Plan (SEMP), project plan, risk management plan, systems engineering artefacts, costings, diagrams, requirements documents, etc. This list is not definitive and other relevant sources are permissible. It is expected that some pieces of evidence will cover multiple KSBs.

The project report must be submitted by the end of month three of the apprentice's EPA period at the latest, to allow for review ahead of the presentation and questioning components.

In exceptional circumstances, where national security clearance is required to review the information within the project, the independent assessor should review the project on the employer's premises in advance of the presentation and questioning commencing. In these circumstances, the project does not need to be submitted to the EPAO, though the employer must confirm it was completed by the appropriate date.

Presentation and questioning

Apprentices must prepare and deliver a presentation on their work-based project. The presentation must be prepared after the gateway and generally will be prepared after submission of the project report. Apprentices must have at least two weeks to prepare the presentation after the submission of the project report.

The presentation will be made to their Independent End-point Assessor (IEA), in the presence of a representative from the apprentice's employer. The employer representative's role is only to provide technical input in relation to the apprentice's workplace policy and procedures and confirm authenticity of their apprentice's work. They must not provide information on behalf of the apprentice, ask the apprentice questions or influence the apprentice in any way. The EPA judgement lies solely with the Independent End-point Assessor (IEA).

The presentation must cover: the project scope, outcomes/achievements, any difficulties faced/lessons learnt and recommendations.

The presentation must last 30 minutes. The Independent End-point Assessor (IEA) has the discretion to increase the time of the presentation by up to 10% to allow the apprentice to complete the presentation.

There are no restrictions on how apprentices deliver the presentation or support resources/materials used. However, any equipment requirements, for example PowerPoint, whiteboard, flip chart facilities, must be agreed with the EPAO, at least two weeks in advance of the date of the presentation.

Following the presentation, the Independent End-point Assessor (IEA) will ask a minimum of five open questions to confirm that the apprentice has achieved the KSBs assigned to this assessment method and to confirm the apprentice's depth of understanding to assess performance against the grading criteria. The IEA may ask follow-up open questions to probe further or seek clarification. IEAs will devise the questions according to the evidence presented via the report and presentation; the EPAO will provide guidance on the scope and typical examples of questions to support consistency.

The duration of the questions and answers will be up to 30 minutes. The IEA has the discretion to increase the time of the questioning by up to 10%, to allow the apprentice to complete an answer.

The IEA must record questions and responses, using EPAO documentation.

Venue

The work-based project presentation and questioning components must take place in a controlled environment; a room free from distractions and influence, with sufficient space for all present. It is anticipated a room will be sourced at training provider or employer premises to minimise cost.

It may be conducted in-person or via a suitable online platform, for example video conferencing. EPAOs must ensure appropriate methods to prevent misrepresentation are in place. For example, screen share and 360-degree camera function with an Independent End-point Assessor (IEA) when the presentation and questioning are conducted remotely.

Supporting material

EPAOs must produce the following material to support this assessment method:

- assessment recording documentation including a matrix for recording the assessed levels of competence achieved
- guidance for apprentices and employers
- guidance for Independent End-point Assessors (IEA) on the scope and typical examples of questions.

Assessment method 2: Professional Discussion, underpinned by Portfolio of Evidence

Overview

The evidence from the Professional Discussion must be assessed against the KSBs assigned to this assessment method, by an Independent End-point Assessor (IEA) who will determine the grade, using the grading criteria in Table 4 through to Table 9.

The rationale for this assessment method is:

- that it enables the apprentice to demonstrate the application of KSBs tailored to their workplace domain
- using the Portfolio of Evidence, the apprentice can discuss evidence from several projects if not all KSBs have been addressed in a single project
- that it enables domain-specific aspects of systems engineering to be assessed effectively.

Requirements for the Professional Discussion are detailed below.

Delivery

An Independent End-point Assessor (IEA) will conduct the Professional Discussion, in the presence of a representative from the apprentice's employer. The employer representative's role is only to provide technical input in relation to the apprentice's workplace policy and procedures and confirm authenticity of their apprentice's work. They must not provide information on behalf of the apprentice, ask the apprentice questions or influence the apprentice in any way. The EPA judgement lies solely with the IEA.

Apprentices must refer to evidence in their Portfolio of Evidence when answering questions, see above.

The Professional Discussion will last 60 minutes. The IEA has the discretion to increase the time of the Professional Discussion by up to 10%, to allow the apprentice to complete an answer.

The IEA must ask 12 open questions, covering the KSB groups specified in Table 4 through to Table 9.

The IEA must formulate the questions, following review of the Portfolio of Evidence, so as to address the KSBs assessed by this assessment method. IEAs may ask additional open follow-up questions to probe further or seek clarification where required. The EPAO will provide guidance on the scope and typical examples of questions to support consistency.

The IEA must record questions and responses, using EPAO documentation.

The EPAO must be provided with a copy of the apprentice's Portfolio of Evidence at least seven days prior to the Professional Discussion.

Venue

The Professional Discussion must take place in a controlled environment, a room free from distractions and influence, with sufficient space for all present. It is anticipated a room will be sourced at training provider or employer premises to minimise cost.

It may be conducted in-person or via a suitable online platform, for example videoconferencing. EPAOs must ensure appropriate methods to prevent misrepresentation are in place. For example, screen share and 360-degree camera function with an Independent End-point Assessor (IEA) when the Professional Discussion is conducted remotely.

Supporting material

EPAOs must produce the following material to support this assessment method:

- assessment recording documentation including a matrix for recording the assessed levels of competence achieved
- guidance for apprentices and employers
- guidance for Independent End-point Assessors on the scope and typical examples of questions
- training of assessors in the devising of open, holistic, and competency-based questions.

Reasonable adjustments

The EPAO must have in place clear and fair arrangements for making reasonable adjustments for this Apprenticeship Standard. This should include how an apprentice qualifies for reasonable adjustment and what reasonable adjustments will be made. The adjustments must maintain the validity, reliability and integrity of the assessment methods outlined in this EPA plan.

Weighting of assessment methods

All assessment methods are weighted equally in their contribution to the overall EPA Pass and Distinction grade.

Grading

The grading criteria are shown in Table 4 through to Table 9 for the two assessment methods.

The occupation duties and associated KSBs are mapped to INCOSE competencies, which are graded in the INCOSE framework at five levels: Awareness, Supervised Practitioner, Practitioner, Lead Practitioner, and Expert (attainment at lead practitioner or expert levels is not required for this assessment plan). At least the Awareness level must be achieved for all KSBs[5]. The assessment criteria are based on those defined by INCOSE[6].

The KSBs have been assigned to six groups of competencies (see Table 2). Both assessment methods assess KSBs across the six groups of competencies. These are listed in Table 4 through to Table 9.

To pass the assessment, apprentices must demonstrate the Awareness, Supervised Practitioner and Practitioner grading criteria in the combinations indicated in Table 2.

Performance in a group of competencies across both assessment methods will determine whether a Distinction is awarded for that group of competencies. Distinction must be demonstrated in all groups of competencies for a Distinction to be awarded overall.

Apprentices will fail the assessment where they do not demonstrate the minimum grading criteria required for a group of competencies.

The minimum requirements for Pass and Distinction grades are summarised in Table 2. To achieve a Distinction, the apprentice must achieve the minimum levels as defined for a Pass plus any additional levels as defined for the Distinction.

[5] Note that Awareness criteria are not listed for KSBs that must be achieved at either Supervised Practitioner or Practitioner level.

[6] INCOSE 2018. Systems Engineering Competency Framework

Table 2 – Minimum Requirements for Pass and Distinction

<table>
<tr><th>Competency</th><th>Pass</th><th>Distinction</th></tr>
<tr><td colspan="3">Group 1 (Table 4)</td></tr>
<tr><td>Systems Thinking</td><td>Practitioner</td><td>Practitioner</td></tr>
<tr><td>Requirements Definition</td><td>Practitioner</td><td>Practitioner</td></tr>
<tr><td>Ethics and Professionalism</td><td>Supervised Practitioner</td><td>Practitioner</td></tr>
<tr><td colspan="3">Group 2 (Table 5)</td></tr>
<tr><td>Life Cycles</td><td rowspan="3">1 at Practitioner
1 at Supervised Practitioner
1 at Awareness</td><td rowspan="4">As per minimum profile for a Pass with an additional competency at Supervised Practitioner instead of Awareness level</td></tr>
<tr><td>Capability Engineering</td></tr>
<tr><td>Critical Thinking</td></tr>
<tr><td>Systems Modelling and Analysis</td><td rowspan="2">1 at Practitioner
1 at Awareness</td></tr>
<tr><td>General Engineering</td></tr>
<tr><td colspan="3">Group 3 (Table 6)</td></tr>
<tr><td>Communications</td><td>Supervised Practitioner</td><td rowspan="3">As per minimum profile for a Pass with any of the three competencies increased to Practitioner level</td></tr>
<tr><td>Technical Leadership</td><td rowspan="2">1 at Supervised Practitioner
1 at Awareness</td></tr>
<tr><td>Negotiation</td></tr>
</table>

Competency	Pass	Distinction
Group 4 (Table 7)		
Design for…	1 at Practitioner 1 at Awareness	As per minimum profile for a Pass with selected competencies increased resulting in: 4 at Practitioner 2 at Supervised Practitioner 2 at Awareness
Verification		
System Architecting	1 at Practitioner 2 at Supervised Practitioner 3 at Awareness	
Integration		
Interfaces		
Validation		
Transition		
Operation and Support		
Group 5 (Table 8)		
Planning	1 at Practitioner 1 at Supervised Practitioner	As per minimum profile for a Pass
Risk and Opportunity		
Monitoring and Control	1 at Practitioner 1 at Supervised Practitioner 1 at Awareness	As per minimum profile for a Pass with an additional competency at Supervised Practitioner instead of Awareness level
Information Management		
Configuration Management		
Group 6 (Table 9)		
Project Management	Supervised Practitioner	As per minimum profile for a Pass with selected competencies increased resulting in: 1 at Practitioner 1 at Supervised Practitioner 2 at Awareness
Finance	3 at Awareness	
Logistics		
Quality		

Resits and retakes

Apprentices who fail one or more assessment method will be offered the opportunity to take a resit or a retake. A resit does not require further learning, whereas a retake does.

Apprentices should have a supportive action plan to prepare for the resit or a retake. The apprentice's employer will need to agree that either a resit or retake is an appropriate course of action.

An apprentice who fails an assessment method, and therefore the EPA, will be required to resit/retake any failed assessment methods only.

Resits and retakes are not offered to apprentices wishing to move from Pass to Distinction.

Where any assessment method has to be resat or retaken, the apprentice will be awarded a maximum EPA grade of Pass, unless the EPAO determines there are exceptional circumstances requiring a resit or retake.

Roles and responsibilities

Table 3 – Roles and Responsibilities

Role	Responsibility
Apprentice	• complete the on-programme requirements of the apprenticeship • prepare for and complete the EPA
Employer	• identify when the apprentice is ready to pass the gateway and undertake their EPA • notify the EPAO that the apprentice has passed the gateway
EPAO	As a minimum EPAOs should: • appoint IEAs • provide training and CPD to IEAs • have no direct connection with the apprentice, their employer or training provider, i.e. there must be no conflict of interest • have processes in place to conduct internal quality assurance and do this on a regular basis • organise standardisation events and activities • organise and conduct moderation of IEAs' marking • have, and operate, a complaints and appeals process
Independent End-point Assessor (IEA)	As a minimum an IEA should: • be independent of the apprentice, their employer and training provider(s), i.e. there must be no conflict of interest • meet the experience and qualification requirements in accordance with this plan and have had training from their EPAO in terms of good assessment practice, operating the assessment tools and grading • attend EPAOs standardisation and training events
Training provider (University)	As a minimum the training provider should: • work with the employer to ensure that the apprentice is given the opportunities to develop the KSBs outlined in the occupational standard and monitor their progress during the on-programme period • advise the employer, on request, on the apprentice's readiness for EPA prior to the gateway but plays no part in the EPA itself

Internal Quality Assurance (IQA)

The EPA must be conducted by an organisation approved to offer services against this Apprenticeship Standard, as selected by the employer, from the Education & Skills Funding Agency's Register of End-Point Assessment Organisations (RoEPAO).

Internal quality assurance refers to the requirements that EPAOs must have in place to ensure consistent (reliable) and accurate (valid) assessment decisions. EPAOs for this EPA must:

- appoint IEAs who:
    - are senior systems engineers currently working in industry or government, or have recent experience (within the last three-years) and can evidence current knowledge and skills, i.e. through continued professional development (CPD). As such, they will usually be chartered engineers and have sufficient experience to be considered as an 'expert' level systems engineer, according to the description provided in the INCOSE Competency Framework.
- provide training for IEAs in terms of good assessment practice, operating the assessment tools and grading to ensure consistency across the IEAs. Mandatory induction and standardisation training will be provided before the IEA undertakes an assessment for the first time, with mandatory standardisation training made available annually.
- have robust quality assurance systems and procedures that support fair, reliable and consistent assessment across the organisation and over time.
- operate moderation of assessment decisions based on risk, with a minimum of 20% of an IEAs' decisions moderated.

Affordability

Affordability of the EPA will be ensured by using at least some of the following practice:

- using an employer or training providers premises for presentation and questioning components and Professional Discussion
- project should be of benefit to the apprentice's workplace.

Assessment Criteria for Knowledge, Skills and Behaviours

In Table 4 through to Table 9 below the criteria for assessing KSBs at different levels of competence are presented. These are grouped by the assessment method to be used to assess these competencies. Note that Table 2 defines the minimum attainment levels required for Pass and Distinction grades.

Definitions

In Table 4 through to Table 9 below, the following definitions apply:

- 'Working under supervision' means that the apprentice carries out the task in full, but with supervisory guidance to set the task and timeline, to define activities, and inform decision criteria
- 'Working under a mentor' means that the apprentice carries out the task in full and, possibly, sets their own timelines and activity plan, but that technical guidance is provided by the mentor
- 'Working independently, or supervising others', means that the apprentice has carried out the task with authority to make all decisions and set activities and expected outcomes
- 'Can describe' means that the apprentice can provide a detailed description of the task, process, entity, etc. but without necessarily being able to explain the reasoning or theory that underpins the task, process, entity, etc.
- 'Can identify' means that using an example system (usually one on which the apprentice has worked) particular features can be distinguished and named
- 'Can explain' means that the entity can be described in detail with well-argued reasons for choices or decisions and references to theory or practice where appropriate
- 'Can evidence' means that based on the Portfolio of Evidence content, the apprentice can show their contribution clearly and explain it in detail
- 'Can justify' means that the apprentice can list alternatives and provide a reasoned argument for the choice of one alternative over others
- 'Can show' means that based on the Portfolio of Evidence content the relationships between entities or parts of a process can be mapped
- The terms 'small problem/system' and 'complex problem/system' must be determined according to the typical level of complexity in the business sector.
  In general, a small problem/system is likely to be a system element entirely managed by the apprentice and a complex or large problem/system will be part of system element being addressed by a team (usually multi-disciplinary).

Table 4: Group 1 – Competencies

Group 1 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Systems Thinking S2 Define context of a system from a range of viewpoints including system boundaries and external interfaces	• N/a	• N/a	Has • Selected and applied appropriate systems thinking approaches to demonstrate this skill • Led a team systems thinking activity aligned to purpose of an activity in which they were involved
B1 Adopt an holistic thinking approach to system development	• N/a	• N/a	Can explain • Enterprise and technology issues affecting design of a system and their application of systems thinking techniques to address them

Group 1 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
			Can identify • Systems concepts in the behaviour of a complex project or system and identify and apply systems methods to resolve issues Can evidence • Leadership of systems thinking activities in acomplex project

Group 1 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Requirements definition K3 The characteristics of good quality requirements and the need for traceability	• N/a	• N/a	Can define • Governing requirements elicitation and management plans, processes and appropriate tools Can explain • Elicitation and validation of stakeholder requirements • How to establish acceptance criteria for requirements • How to establish a complete and consistent requirement set for the system of interest • How to assess the impact of changes to requirements on the solution and program Can describe • Qualities of good, consistent requirements

Group 1 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S3 Use appropriate methods to analyse stakeholder needs to produce good quality, consistent requirements with acceptance criteria and manage them throughout system development			Has • Demonstrated this skill independently or has managed others • Written good quality and consistent requirements for a system of interest, including resolution and negotiation where applicable

Group 1 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Ethics and Professionalism K15 How to take account of health and safety legislation and sustainable development requirements in the relevant industry	• N/a	Can describe • How systems engineering activities are performed with integrity • Health and safety considerations relevant to systems development	Can identify • Appropriate health and safety legislation relevant to development of a specific system or system element
B4 Take personal responsibility for health and safety practices and sustainable development	• N/a	Evidence of • Health and safety considerations and sustainable development considerations in system design activities, carried out under supervision	Evidence of • Health and safety considerations and sustainable development considerations in system design activities, carried out independently or supervising others
B5 Operate with integrity and in an ethical manner, and ensure that team members perform with integrity and in an ethical manner	• N/a	Can describe • Ethical considerations and appropriate behaviours with reference to real or hypothetical projects in employer's business domain	Can explain with reasoned argument • Ethical considerations and appropriate behaviours with reference to real or hypothetical projects in employer's business domain

Table 5: Group 2 – Competencies

Group 2 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Life cycles K1 Systems engineering life cycle processes	Can describe • Different life cycles and their characteristics	Can describe • Systems engineering life cycle processes Can identify • Life cycle processes on a project upon which they are working and the suitable activities at system or systems element level Can explain • Advantages and disadvantages of different systems development life cycles and where to apply them advantageously • Importance of considering future life cycle stages during the current stage	Can identify • Project, enterprise and technology needs that affect choice of life cycle model governing a project • Dependencies between life cycle stages of different system elements requiring alignment in a project Can explain • Plans for transitions between life cycle stages in a project • Application of enterprise-level policies, procedures, guidance, and best practice to life cycle • selection in a project

Group 2 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S1 Select appropriate life cycle for a system or element of a system and establish its life cycle stages and the relationships between them	Can explain • Why selection of life cycle is important • Why an appropriate life cycle process model should be defined • Why different engineering approaches are required in different life cycle phases	Has • Demonstrated this skill under supervision or in the role of assistant	• Preparation of future life cycle phases, taking into account the impact on current phase and improvement of current activities Has • Demonstrated this skill independently or has managed others • Used enterprise-level policies, procedures, guidance and/or best practice to select life cycles governing the project and defined dependencies and transitions between life cycle stages

Group 2 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Capability Engineering K2 The role a system plays in the super system of which it is a part	Can explain • The concept of capability and how it is useful to characterise systems • How capability requirements may be satisfied by integrating several systems • How super system capability needs may impact the development of contributing systems	Can identify • Capability issues from the wider system that will affect the design of the system of interest Can explain • How super system capability needs impact on the development of each system that contributes to the capability. Can describe • Different elements that make up capability within a project	Can identify • Capability issues of the wider (super) system which affect the design of a system and translate them into system requirements Can describe • Assessment of existing super system capability and identification of gaps, leading to recommendations for reduction or elimination of deficit

Group 2 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Critical Thinking B3 Adopt a critical thinking approach using a logical critique of work including assumptions, approaches, arguments, conclusions, and decisions	Can explain • Why ideas, arguments, and solutions need to be critically evaluated • Why bias may occur in arguments	Evidence in technical approach of • Clear statement of assumptions • Careful selection of methods • Logical deductions and conclusions	Evidence in technical approach of • Examination of impact of assumptions or weak logic and looks for substantive arguments • Effective challenging of team assumptions, decisions and/or conclusions • Constructs robust and detailed logical argument

Group 2 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Systems Modelling and Analysis K5 The benefits and risks associated with modelling and analysis	Can explain • Why systems representations are needed and the benefits they offer • Relevance of model outputs and how these relate to system development Can describe • Scope and limitations of models • Different types of modelling and simulation	Can explain • Why models are developed for a specific purpose or use and provides examples • Why models and simulations have a limit of valid use, and the risks of using models and simulations outside those limits • How modelling or simulation have been used to represent a specific system or system element, including choice of tools and techniques, model development, analysis and interpretation	Can define • Governing modelling and analysis plans, processes and appropriate tools for a project, and explain their use to monitor and control systems modelling and analysis activities for a system or system element • Management strategy for models produced within a project Can explain • Selection of appropriate representation of a specific systems or systems element and appropriate tools and techniques for its modelling and analysis

Group 2 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S5 Generate a physical, mathematical, or logical representation of a system entity, phenomenon or process	Can describe • A variety of system analysis techniques which can be used to derive information about a system.	Has • Demonstrated this skill by applying scientific or engineering principles • under supervision or mentor	Has • Demonstrated this skill independently, as leader of a team, or as a • technical mentor to others
General Engineering K14 Scientific, technical, engineering, and mathematics fundamentals and a broad technical domain knowledge for the relevant industry	Has • Knowledge of core principles of science and engineering	Can describe • Application of suitable scientific or engineering theory, methods, and tools for system development	Can explain and justify • Determination of scientific and mathematical theory for use in system development • Application of suitable scientific or engineering theory, methods, and tools for system development • Engineering decisions underpinned by engineering principles and theory

Table 6: Group 3 – Competencies

Group 3 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Communications S12 Communicates effectively with all stakeholders of the project	• N/a	Can provide evidence of • Effective communication using appropriate media and means to influence project outcomes	Can provide evidence of • Effective communication using appropriate media and means to influence project outcomes • Development of communicating culture within team or stakeholder group

Group 3 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Technical Leadership K6 How creativity, ingenuity, experimentation and accidents or errors, often lead to technological and engineering successes and advances	Can explain • The role of technical leadership in systems engineering • The importance of collaboration in systems engineering • Why understanding strategy is important to systems engineering leadership	Can describe • How creativity, ingenuity, experimentation, an accidents or error has led them to a solution or engineering success • How their innovative ideas have been communicated to peers and other stakeholders • How ideas have been modified or developed as a result of peer review or criticism	Can describe and explain • An exemplar of their use of creativity, innovation, or problem-solving techniques to develop strategies or resolve team or project issues Can explain • The interpretation of a vision for a project team and how to gain acceptance across the team • How constructive criticism enabled self- improvement and modification or development of strategy or ideas

Group 3 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S6 Apply creativity, innovation and problem-solving techniques to system development or operation	Can explain • How creativity, ingenuity, and experimentation leads to technological and engineering success	Has • Demonstrated this skill for a small project or systems, within the context of the business and can identify the creative, innovative, or key problem-solving steps	Has • Demonstrated this skill for a complex project or system within the context of the business or led an innovation team. • Can identify the creative, innovative, or key problem-solving steps
S21 Identify concepts and ideas in sciences, technologies and engineering disciplines beyond their own discipline that could benefit the project solution	Can explain • How different sciences impact the technology and engineering domain	Evidence of • Maintaining knowledge of across engineering and/or scientific disciplines	• Not required at Practitioner level; use same criterion as Supervised Practitioner
B7 Maintain awareness of developments in sciences, technologies and related engineering disciplines	Can describe • How to keep abreast of science and technology advances	Can evidence • Ongoing technical learning, drawing on examples from logbook	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 3 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Negotiation B2 Perform negotiations with stakeholders recognising different styles of negotiating parties and adapts own style accordingly	Can describe • When negotiation may be necessary and what it entails	• Not applicable: this is required at practitioner level where claimed	Evidence of • Successful negotiations conducted within a system development or operation activity, conducted independently or in a leadership role

Table 7 Group 4 Competencies

Group 4 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Design for… K8 Non-functional design attributes such as manufacturability, testability, reliability, maintainability, affordability, safety, security, human factors, environmental impacts, robustness and resilience, flexibility, interoperability, capability growth, disposal, cost, natural variations, etc.	Can explain • Why the requirements of all life cycle stages must be accommodated • The importance of integrating design specialties into the solution and how this may lead to conflicting requirements Can describe • Relationships between 'ilities'	Can explain • The process and tools selection to manage and control selected specialty engineering activities • Selection and balancing of design attributes in support of specialty engineering needs • How techniques and tools are used to ensure design meets specialty needs	Can explain • Definition of governing specialty engineering plans, processes and appropriate tools to monitor and control specialty engineering activities • How to select and balance design attributes throughout the design process in support of specialty engineering needs

Group 4 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
		Can identify • Design attributes and how they influence the design • Relationships pertinent to the integration of specialisms within a project Can describe • The operational environment in ways appropriate to support specialty engineering activities • How trade studies influence characteristics of proposed solutions	• Selection and application of appropriate techniques to characterise the operational environment and trade studies to determine and characterise specialty characteristics of proposed solutions • The integration of specialisms within a project Can justify • Trade-offs involving conflicting demands from design specialisms

Group 4 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Verification K11 Systems verification against specified requirements and characteristics and the need to execute it in a logical sequence	Can explain • The purpose of verification • Why there is a need to verify a system in a logical sequence	Can describe • The verification environment Can identify • Required evidence for verification of small projects Can explain • Verification plans, including selection of standards, methods, and definition of timing for small projects, in context of business domain • How evidence establishes that a system meets requirements	Can explain • How to define governing verification plans, processes and select tools to monitor and control verification activities • How to write verification plans, including selection of standards, methods, and definition of timing for complex systems or projects, in context of business domain • How to write detailed verification procedures Can identify • Suitable verification environment • Required evidence for verification of complex projects Can show • Traceability between verification requirements and system requirements

Group 4 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S10 Define verification plans (including tests) to obtain objective evidence that a system of system element fulfils its specified requirements and characteristics	Can explain • Why verification should be planned	Has • Assisted with the development of verification plans • Written verification plans independently for small projects of systems • Carried out verification tasks under supervision	Has • Developed verification plans independently or as supervisor to others • Written verification plans and procedures for complex systems • Carried out verification tasks independently or as supervisor of others

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Systems Architecting K7 Different types of systems architecture and techniques used to support the architectural design process (i.e., the specification of systems elements and their relationships)	Can describe • The principles of architectural design • Different types of architecture	Can explain • The choice of architecture type and techniques used for a specific system or systems element • How analysis techniques have been used in the architectural design process • How architectural attributes relate to requirements • How functional analysis is conducted for a specific system Can describe • Concept feasibility and design trade-off applied to a system or systems element	Can explain • How to define governing systems architecting plans, processes, and appropriate tools for system architectural design activities • How to partition a system into realisable system elements that can be brought together to meet the requirements • Monitoring or an evolving design solution and how key aspects are used to adjust the architecture of a system

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
			Can justify • Choice of techniques, architectural analysis and selection of an optimum solution based on an example system
S7 Define the systems architecture and derived requirements to produce an implementable solution that enables a balanced and optimum result that considers all stakeholder requirements across all stages of the life cycle	Can explain • The need for functional models of a system • The process and key artefacts of functional analysis • How outputs from functional analysis lead to overall system design	Has • Contributed to the architectural design process through provision of solely produced artefacts as a team member or under supervision	Has • Contributed substantially to the architectural design process, offering alternative designs, and conducting analysis to support decision making. • Worked independently or supervised others
S22 Partition between discipline technologies and work with specialists to derive discipline specific requirements	Can explain • Why alternative discipline technologies can be used to satisfy the same requirement	Has • Applied systems architecting approaches to derive discipline specific requirements	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Integration K9 Integration as a logical sequence to confirm the system design, architecture, and interfaces	Can explain • Why integration is important and how it confirms the systems design, architecture and interfaces • Why a system should be integrated in a logical sequence	Can explain • The development of integration plans for a small project, within the context of their business domain, including applicable methods and timing Can identify • Evidence to be gathered during integration in support of downstream test and acceptance activities • Simple faults typically found during integration activities and describe how they will be documented and communicated to stakeholders	Can explain • How to define governing integration plans, processes and appropriate tools to monitor and control integration activities • How to develop integration plans for larger, more complex systems or projects, within the context of their business domain including applicable methods and timing and how standards influence the plans • The management of integration activities for a system, product or service

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
		• Appropriate corrective actions for typical faults found during integration activities Can describe • The integration environment for a small project within the context of their business domain	Can identify • Evidence to be gathered during integration in support of downstream test and acceptance activities • Complex faults typically found during integration activities and describe how they will be documented and communicated to stakeholders • Appropriate corrective actions for typical faults found during integration activities Can describe • The integration environment for a more complex systems or projects, within the context of their business domain

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S9 Assemble a set of system elements and aggregate into the realised system, product, or service using appropriate techniques to test interfaces, manage data flows, implement control mechanisms, and verify that elements and aggregates perform as expected	Can explain • Why planning and management of integration is necessary	Has • Assisted in the development of integration plans and carried out integration tasks under supervision	Has • Developed integration plans and carried out integration tasks independently or as supervisor of others

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Interfaces K10 Interface management and its potential impact on the integrity of the system solution	Can explain • The impact of interface definition on the system solution	Can explain • How to identify and define simple interfaces Can describe • Governing processes to manage and control interfaces	Can explain • Definition of governing interface management plans, processes, and tools to monitor and control interface management activities Can describe • Possible sources of complexity for interface definition and management Can identify • System element interfaces and define them • Consequences of changes to interfaces at systems element, system, or systems of systems level
S8 Identify, define, and control interactions across system or system element boundaries	Can describe • How an interface may be defined	Has • Identified and defined simple interfaces	Has • Identified and defined multiple types of interface in complex systems

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Validation K12 The relationship between verification, validation, and acceptance	Can describe • The relationship between verification, validation, and acceptance	Can describe • Appropriate verification, validation, and acceptance tests for a system • How evidence gathered in verification and validation testing supports qualification, certification, and acceptance testing	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
K13 The purpose and importance of system validation in relevant commercial context	Can explain • The purpose of validation	Can describe • Development of validation plans based on standards and corporate processes Can explain • Use of terminology for validation to engage customer and end user appropriately • Procedures used to record results, identify anomalies, and resolve failures during validation	Can explain • How to define governing validation plans, processes and select tools to monitor and control validation activities • How to write validation plans, including selection of standards, methods, and definition of timing for complex systems or projects, in context of business domain • How to write detailed validation procedures • Use of terminology for validation to engage customer and end user appropriately Can show • Traceability between validation requirements and user and customer requirements

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S11 Provide objective evidence that the operational system fulfils its business or mission objectives and stakeholder requirements and expectations	Can explain • How validation should be planned	Has • Assisted with the development of validation plans • Conducted validation activities under supervision	Has • Developed validation plans independently or as supervisor of others • Interacted with customer effectively • Carried out validation activities independently or as the supervisor of others
Transition K12 The relationship between verification, validation, and acceptance	Can describe • The relationship between verification, validation, and acceptance	Can describe • Appropriate verification, validation, and acceptance tests for a system • How evidence gathered in verification and validation testing supports qualification, certification, and acceptance testing	• Not required at practitioner level; use same criterion as supervised practitioner

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S13 Integrate a system into its operational environment, including the provision of support activities (e.g. specification of site preparation, training, logistics, etc.)	Can explain • How transition may be performed Can list • Activities and work products required for transition	Has • Carried out transition activities in accordance with plan and under supervision	Has • Developed transition plan independently or as supervisor to others • Interacted with user effectively • Carried out transition activities independently or as supervisor to others

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Operation and Support K16 The relationship of service quality to user satisfaction and cost, risk, and availability of the operational system	Can describe • Support needed for systems or products in service • Management of obsolescence and upgrade	Can describe • The governing processes and tools to plan and control a system, product or service operations, maintenance and support related activities Can identify • Appropriate operational data for collection in order to assess system performance • Design changes to improve system performance or overcome system failure Can identify and evaluate • Evolving user needs, new technologies, and obsolescence issues, and recommend system updates in response	Can explain how to • Define governing operation and support plans, processes and appropriate tools to monitor and control system, product or service operation, maintenance and support activities • Monitor and address changes to system operational environment or external interfaces • Ensure technical support data (e.g. procedures, guidelines, checklists, training and maintenance materials) remain current

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
			Can identify • Data to be collected in order to assess system, product or service operational performance • System elements approaching obsolescence and explain how to conduct studies to identify suitable replacements
S15 Initiate design change proposals in response to system failure or degradation	Can describe • Difference between preventative and corrective maintenance	Has • Assisted in operation and support activities to assess systems performance, failures, and obsolescence, and evolving user needs, and new technology opportunities to initiate system design changes and update	Has • Managed, independently or as supervisor of others, operation and support activities to assess systems performance, failures, and obsolescence, and evolving user needs, and new technology opportunities to initiate system design changes and update

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S14 Define and collect operational data for monitoring and control of a system	Can identify • Data needs and collection methods for operational support	Has • Assisted with monitoring and control of systems engineering activities, including measurement assessment and reporting of tasks against plans • Identified corrective actions if necessary	Has • Monitored and controlled systems engineering activities, including measurement assessment and reporting of tasks against plans independently or as supervisor of others • Identified and applied corrective action if necessary • Managed and traded technical margins horizontally and/or vertically through the project hierarchy, if needed

Group 4 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
B6 Take a proactive and systematic approach to resolving operational issues	Can explain • How to identify and rectify system faults	Can evidence • Examples of activities during operation carried out to identify in advance and avoid operational issues, under supervision Can describe • Key system features or behaviours that ensure user satisfaction	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Table 8: Group 5 – Competencies

Group 5 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Planning K19 The role of systems engineering planning as part of an overall project/programme plan	• N/a	Can describe • Development of systems engineering plan for a project • Linkage of systems engineering plan to project management plan Can identify • Key design parameters required to track critical aspects of design during development	• Not required at Practitioner level; use same criterion as Supervised Practitioner
S20 Coordinate and maintain effective and workable plans across multiple disciplines	• N/a	Has • Assisted in the development and implementation of systems engineering plans under supervision	Has • Developed and implemented systems engineering plans independently or as a supervisor of others

Group 5 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Risk and Opportunity K4 The distinction between risk, issue, and opportunity and the different forms of treatment available	• N/a	Can describe • Governing processes for risk and opportunity • Management Communication of risk and opportunity status to affected stakeholders. Can explain • Application of risk and opportunity processes (including identification, assessment, analysis, treatment) to a specific project monitoring and management of systems engineering risks and opportunities to a specific project	Can explain • The definition of risk and opportunity management • plans, processes, and tools used to control and monitor risk and opportunity management activities in a specific project • The project risk and opportunity profile including context, likelihood, consequences, thresholds, priority and risk action and status of a specific project • The generation of a risk action plan for risks that exceed the threshold for a specific project

Group 5 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S4 Identify, analyse, recommend treatment, and monitor and communicate risks and opportunities throughout project	• N/a	Has • Assisted with preparation of risk and opportunity processes • Assisted with risk and opportunity management activities, including identification, assessment, analysis, treatment, mitigation, monitoring, and communication of risk and opportunity status	Has • Established a project risk and opportunity profile including context, probability, consequences, thresholds, priority and risk action and status • Carried out risk and opportunity management activities independently or has managed others

Group 5 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Monitoring and Control K14 Scientific, technical, engineering, and mathematics fundamentals and a broad technical domain knowledge for the relevant industry	Can explain • The role of monitoring and control in a project Can describe • Typical systems engineering metrics • Different types of technical and non- technical review across the system life cycle	Can describe • Application of suitable scientific or engineering theory, methods, and tools for system development	Can explain and justify • Determination of scientific and mathematical theory for use in system development • Application of suitable scientific or engineering theory, methods, and tools for system development • Engineering decisions underpinned by engineering principles and theory

Group 5 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Information Management K20 The legal, commercial, and security constraints that affect the management of data and information (e.g. General Data Protection Regulation, handling of specific commercial contract restrictions)	Can identify • Relevant legal and commercial constraints on information management	Can describe • The principles for obtaining, transferring, distributing, maintaining, and transforming data in accordance with integrity, security, privacy requirements and data rights • The principles and methods through which valid sources of information and associated authorities are defined • The principles through which data and information is retired, archived and curated	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 5 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S19 Plan, execute, and control the storage and provision of information to stakeholders	Can describe • Various types of information that should be managed in a systems engineering process and how it should be managed	Has • Assisted with information management at all stages of information life cycle • Assisted with provision of information to stakeholders • Assisted with sharing lessons learned beyond the project boundary	Has • Conducted information management at all stages of the information life cycle, working independently or supervising others • Determined appropriate media choices and processes for information provision • Provided lessons learned beyond the project boundary

Group 5 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Configuration Management K20 The legal, commercial, and security constraints that affect the management of data and information (e.g. General Data Protection Regulation, handling of specific commercial contract restrictions)	Can identify • Relevant legal and commercial constraints on information management	Can describe • The principles for obtaining, transferring, distributing, maintaining, and transforming data in accordance with integrity, security, privacy requirements and data rights • The principles and methods through which valid sources of information and associated authorities are defined • The principles through which data and information is retired, archived and curated	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 5 Assessment 2: Professional Discussion			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
S18 Manage and control system elements and configuration over the project or programme life cycle ensuring overall coherence of the design is maintained in a verifiable manner throughout the lifecycle	Can explain • How configuration management supports design integrity Can describe • Key activities performed as part of configuration management	Has • Assisted with configuration management under supervision or with mentor support • Generated documentation for change control activities	Has • Lead configuration control activities, including selection of configuration items and associated documentation, conducting change control review with customer, and configuration status accounting reports and audits

Table 9 Group 6 Competencies

Group 6 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Project Management K17 The elements of a project management plan (including statement of work, work breakdown structure, resource allocation, scheduling, management plan, monitoring, risk management, change requests, record keeping, and acceptance)	• N/a	Can describe • Project scheduling and resourcing, work breakdown structure, monitoring and control, initiating and terminating project	Can explain • How to conduct project scheduling and resourcing, work breakdown structure, monitoring and control, initiating and terminating project

Group 6 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
K19 The role of systems engineering planning as part of an overall project/programme plan	• N/a	Can describe • Development of systems engineering plan for a project • Linkage of systems engineering plan to project management plan Can identify • Key design parameters required to track critical aspects of design during development	Can explain • How to define governing process and appropriate tools to plan and control systems engineering activities for a project • Linkage of systems engineering plan to overall project management plan • How to estimate and secure sufficient systems engineering effort for a project Can identify • Key design parameters required to track critical aspects of design during development
S16 Create and maintain project management plan, including work breakdown structure, scheduling, and risk management	• N/a	Has • Assisted with development of a project plan for a substantial project and with implementation of the plan including monitoring, control, and reviews	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 6 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Finance K18 The commercial and financial environment in which a project is being executed (e.g. procurement model, interest rates, exchange rates)	Can explain • Why it is necessary to estimate budgets and control costs • Impact of project decisions on costs	Can describe • Cost estimation, budget determination and funding requirements, life-cycle cost planning, cost monitoring, and corrective actions to manage finance	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 6 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Logistics K21 Support and sustainability needs of a deployed system or product	Can explain • The importance of considering logistics support during system design • The concept of life cycle costs Can list • Key logistics support activities	Can describe • How to analyse supportability requirements for a system, or system element • How to manage and control spares, repairs, and supplies for a deployed system • How to assess packing, handling and transportation required for system sustainment Can identify and analyse • Data and documentation needed for sustainment of a system	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Group 6 Assessment 1: Report, Presentation and Questions			
Competency/KSB	**Awareness**	**Supervised Practitioner**	**Practitioner**
Quality S17 Balance project scope, time, cost, risk, and resources to optimise product or service quality and return on investment	Can list • Appropriate quality standards Can describe • Purpose and importance of quality assurance Can explain • Impact of project decisions on system or product quality	Has • Assisted with identification, measurement, monitoring, and analysis of quality measures and characteristics to improve project quality • Assisted with verification of product or system conformity to appropriate standard	• Not required at Practitioner level; use same criterion as Supervised Practitioner

Pearson