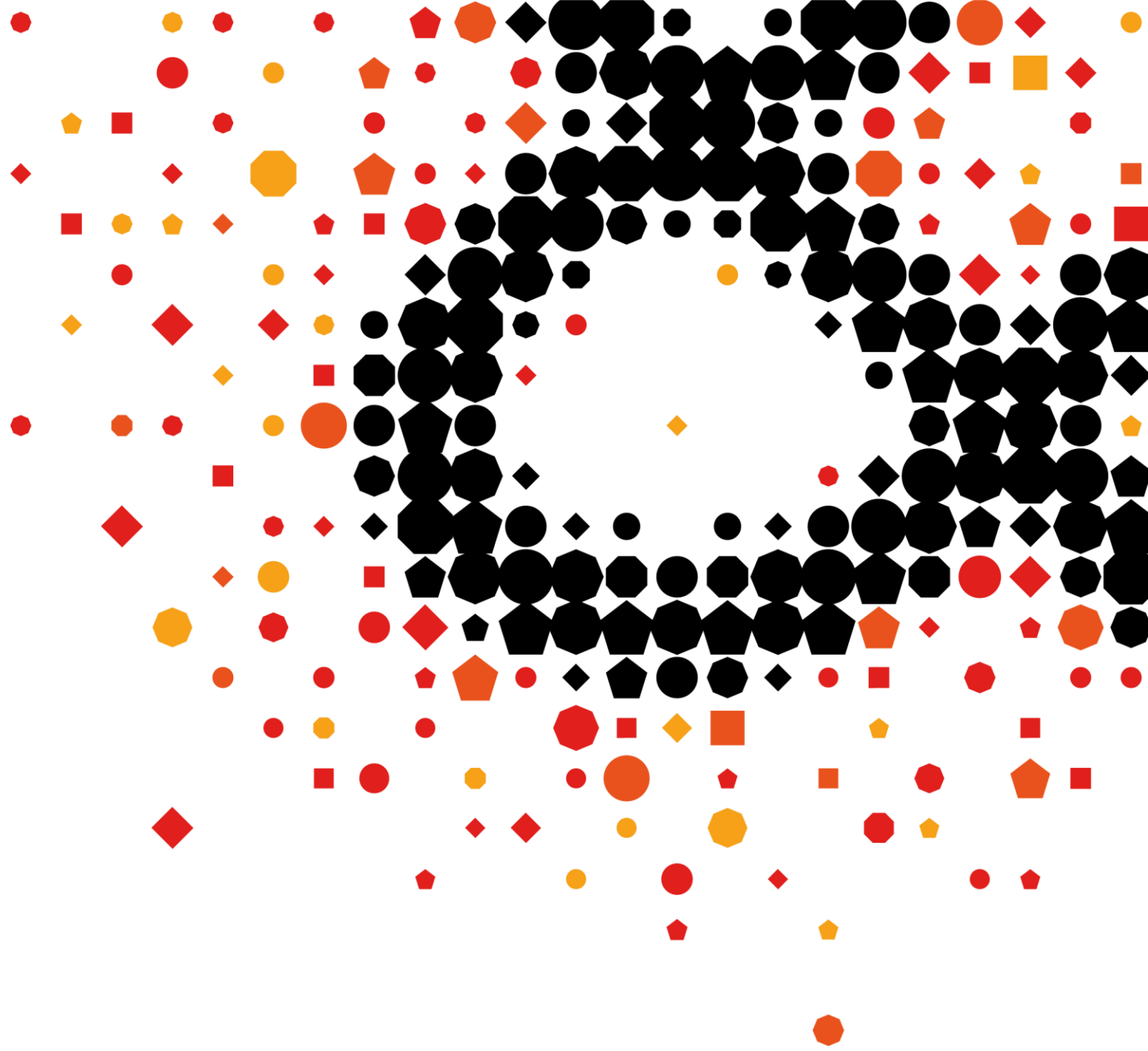
Welcome to the T Level Engineering & Manufacturing

The webinar will begin shortly

March 2021

T-LEVELS | Institute for Apprenticeships & Technical Education

Welcome to the T Level Engineering & Manufacturing



City & Guilds | eal

Using the webinar platform

Send any questions in the question area throughout the webinar

All attendees will be set to mute

Webinar resources will be shared on our website shortly after

Agenda

- Welcome
- Background to the E&M T Level
- Engineering & Manufacturing T Levels and its development
- Q&A

Welcome – Industry Team for Engineering & Manufacturing

Scott Wilkins – Industry Manager
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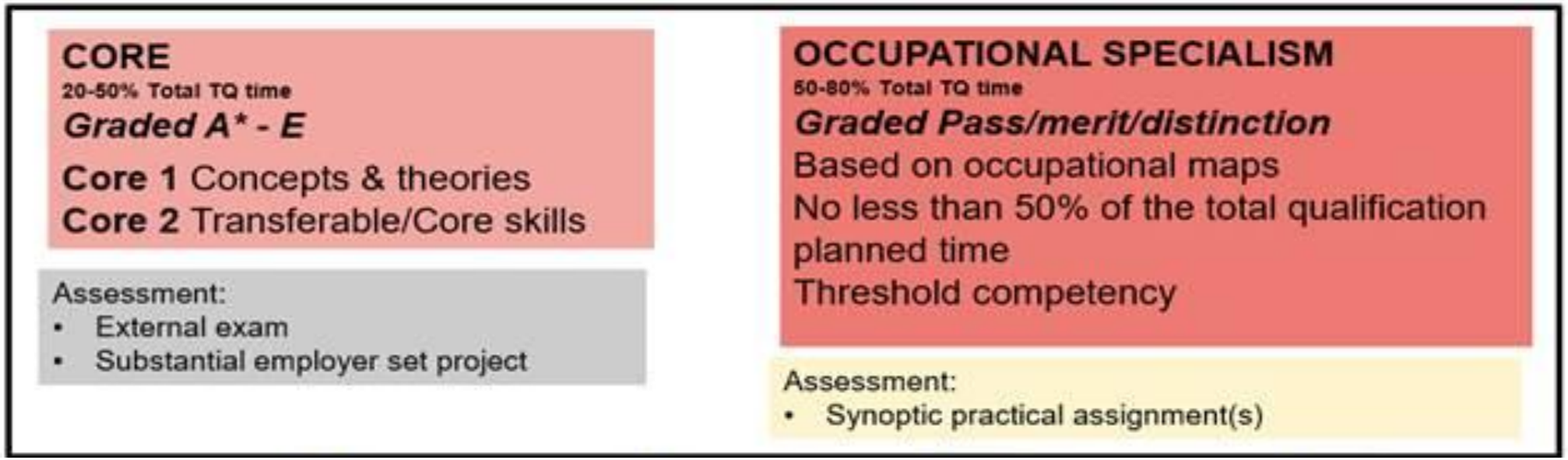
Background

- October 2020 City & Guilds won 3 contracts to develop the E&M TQs in D&D, MIR and MPC, in partnership with EAL – 5 year contract.
- Eligible providers must be approved by DfE in the first instance.
- Each TQ is based on content developed by an employer panel.
- The Institute are the certificating authority and own the Intellectual Property not the Awarding Organisation.
- Feedback and validation from providers and employers (be it positive or negative) is a key part of the TQ development

T Level programme composition

1800 hours over two years. Achievement of T Level must include all components.
UCAS points will be attached and will be equivalent to 3 A levels.



WORK PLACEMENT
315-420 hours
Min 45-60 days

Maths, English and digital skills
GCSE or Functional Skills Level 2

LTP
(other requirements set by T Level panel)

Enrichment

Employer and Provider Engagement Strategy

Whilst we have good relationships with employers and providers, activity is ongoing to widen the pool of contacts to ensure appropriate input at all stages of the TQ development and for the Occupational Specialisms, from a variety of different sized organisations

Employer Engagement

- 230 Employer/Industry Body contacts
- Leverage existing Apprenticeship contacts
- Employer Industry Board
- Engage T Level Panel members to review and validate TQ materials
- Raise awareness via social media, word of mouth, email bulletins
- T Level Employer awareness webinars
- Schedule activities to ensure phased employer involvement in TQ development, including coverage of Occupational Specialisms
- Ongoing monitoring and recruitment

Provider Engagement

- 101 Provider contacts
- Recruit Subject Matter Experts from provider networks to write, review & validate TQ materials
- Cross-reference ESFA approved provider lists with C&G provider lists
- T Level Provider awareness webinars
- Engage employers through provider networks
- Raise awareness via social media, word of mouth, email bulletins

HEI Engagement

C&G has relationships with:

- University of Vocational Awards Council (UVAC) – Alison Whittle, C&G Post 16 Technical Adviser, is a member of their Higher Education and Awarding Organisation Vocational Qualifications Committee
- Russell Group Qualifications Network
- UCAS – broad understanding of UCAS tariffs and entry requirements, and how the different grading systems align to traditional academic GCEs
- Universities - Head of admissions, admission managers and teams, academics and OVCs
- Institute of Education –University College London (UCL)

TQ overview for Engineering: this is how we started

Engineering Core Component

Pathway Core Component

Learners must complete:

- Engineering Core
- 1 Pathway Core
- 1 Occupational specialism within a pathway

Pathways:

Maintenance, Installation & Repair

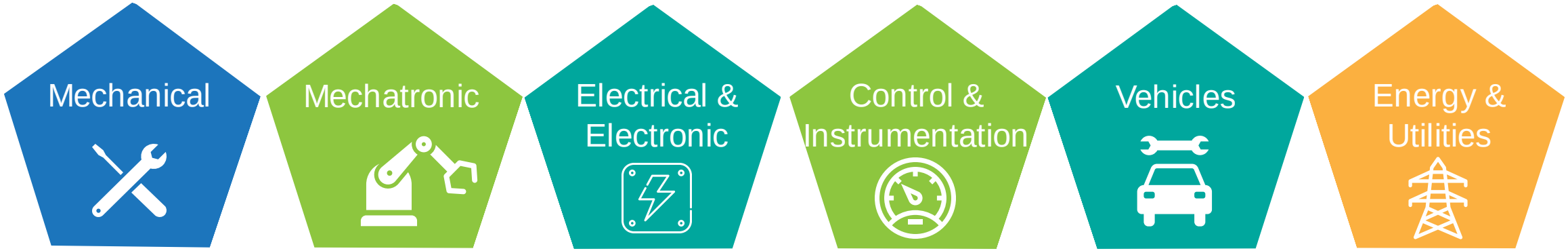
Manufacturing, Processing and Control

Design & Development

Route: Engineering and Manufacturing

PATHWAY - Maintenance, Installation and Repair

Occupational Specialisms



Route: Engineering and Manufacturing

PATHWAY - Design and Development

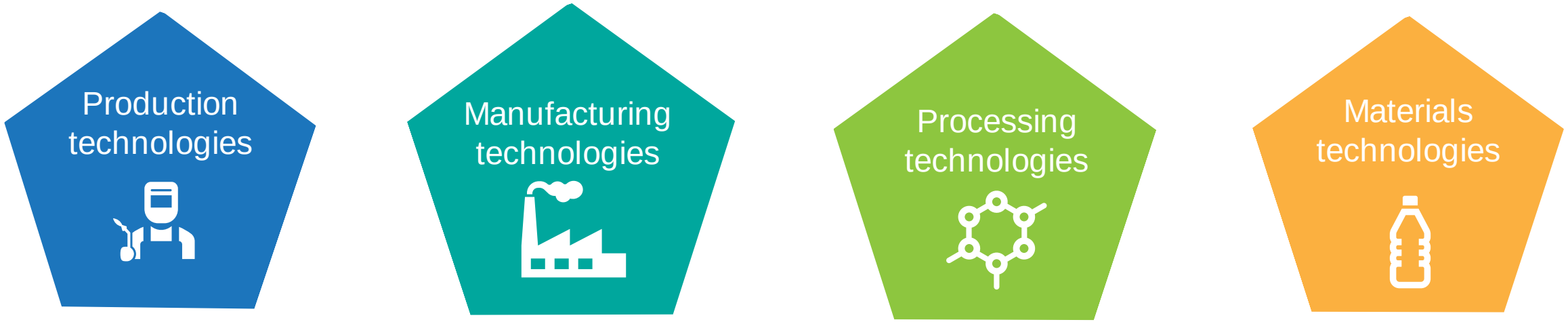
Occupational Specialisms

- Mechanical Engineering
- Electrical & Electronic Engineering
- Control & Instrumentation Engineering
- Structural Engineering

Route: Engineering and Manufacturing

PATHWAY - Manufacturing, Processing and Control

Occupational Specialisms



Review of E&M T Level Documentation

Core knowledge and understanding across Engineering and Manufacturing Route

Element		Content
Working within the Engineering and Manufacturing Sectors	**1.1**	**Engineering and manufacturing design practices** An understanding of: • Key principles, tools and methodologies in engineering and manufacturing design practice and processes; • How materials, conditions and context influence engineering and manufacturing design processes and products; • How user requirements are translated into engineering and manufacturing designs, i.e. inclusive design; • How research and testing, and different research and testing methodologies, support effective design practices and outcomes.
	1.2	**Maintenance, installation and repair practices** An understanding of: • The roles, functions and operations in this area of engineering and manufacturing practice, and how they relate to the sectors generally; • The key principles, techniques and methodologies relevant to engineering and manufacturing maintenance, installation and repair; • The tools and equipment used in maintenance, installation and repair; • Key innovations, changing practices, and trends relevant to maintenance, installation and repair.
	1.3	**Manufacturing, processing and control practices** An understanding of: • Key principles and practices that apply in manufacturing, processing and control; • Key manufacturing, processing and control tools, equipment, infrastructure, systems and operations; • The relationship between manufacturing, processing and control, and engineering design, and engineering maintenance, servicing, installation and repair.
Engineering and manufacturing past, present, and future	**2.1**	An understanding of: • Engineering and manufacturing from an historical perspective, including awareness of important technological advances across different sectors, and significant periods of change;

Occupational Specialism: Design and Development (Mechanical Engineering)

Performance Outcome 1: Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications

Knowledge specific to performance outcome	Skills specific to performance outcome
Common design methodologies, practices, processes, applications and integration, relevant to contemporary mechanical engineering contexts. Engineering representations, symbols, conventions, and annotations (e.g. geometrical dimensions, tolerances, limits, fits and finishes, terminology and nomenclature), specifically in mechanical engineering contexts and activities. Engineering standards and regulatory requirements relevant to mechanical engineering. Mathematical theory and methods and their application in mechanical engineering contexts. Scientific principles relevant to mechanical engineering activities.	Access, examine, review, interpret and respond effectively to mechanical design projects and tasks and requirements from different sources (e.g. specifications, concepts, stakeholders). Critique, challenge and confirm design project expectations and requirements appropriately, including requirement risks. Interpret information in a range of formats, media and technology (e.g. BIM; PIM; CAD). Interpret mechanical process and instrument diagrams, critically appraising and effectively responding to relevant technical information. Identify inaccuracies or discrepancies in engineering drawings and specifications, make necessary amendments, and propose solutions. Verify mechanical design concepts, briefs and specifications, in relation to context, function and specific requirements (e.g. components, materials, application, location, risk and environment). Use appropriate technology to review, analyse and interpret mechanical design elements in proposals, representations, systems, components, assemblies, products and processes.

Guided Learning Hours

Review of Core and OS content

Engineering and Manufacturing								
Design and Development			Maintenance, Installation and Repair			Manufacturing, Processing and Control		
Core Content (GLH)	**Pathway Core (GLH)**	**Occupational Specialism (GLH)**	**Core Content (GLH)**	**Pathway Core (GLH)**	**Occupational Specialism (GLH)**	**Core Content (GLH)**	**Pathway Core (GLH)**	**Occupational Specialism (GLH)**
900 – 1100	150	540 – 600	900 – 1100	150	540 – 600	900 – 1100	250	1000-1725
1590 - 1850			1590 - 1850			2150 - 3075		

- To put this into context:
  - 3 x A Levels = 1080 hours, with three 1.5 to 2.5 hrs exams assessing 360 hours of content for each
  - There is currently too much content for the manageable delivery and assessment of the T Level based on GLH and breadth of content

TQ Development Consultation & Validation Activity to MS1

Date	Purpose of Session
27 and AM/PM 29 October	Consult MIR, D&D and MPC T Level Panels on Outline Content and Intentions
7, 10, 11 December	Consult MPC, D&D and MIR T Level Panels on findings from amplification of Outline Content
9 December	Consult Employer Industry Board on findings from amplification of Outline Content
10 December	Consult NFEC members on findings from amplification of Outline Content
7 to 11 December	Consult C&G Providers on findings from amplification of Outline Content
12 January	Consult C&G Providers on proposals to rationalise Core Content and MIR/MPC OS
13, 14, 15 January	Consult MPC, D&D and MIR Employer Panels on high level proposals to rationalise Core Content and MIR/MPC OS
2 AM/PM and 3 February	Consult D&D, MPC and MIR Panels on detailed proposals to move Pathway Core Content
5 February	Update NFEC members on T Level development and proposals to rationalise Core Content and MIR/MPC OS
10 February	Consult Employer Industry Board on TQ Specification/Content
16 AM/PM, 17 February	Consult D&D, MPC and MIR Panels on TQ Specification/Content

22+ consultation and validation sessions on TQ Content to date

Proposed TQ overview for Engineering:

Engineering Core Component

Pathways:

Maintenance, Installation & Repair

Manufacturing, Processing and Control

Design & Development

Learners must complete:

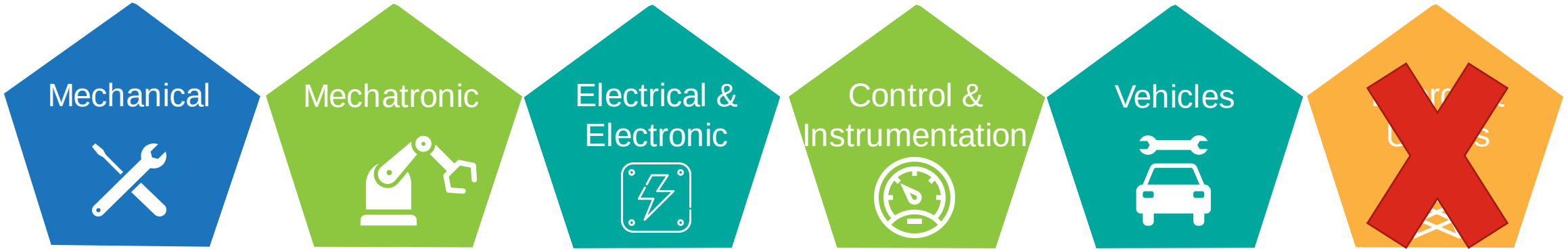
- Engineering Core
- 1 Occupational specialism within a pathway

Proposed TQ overview for MIR pathway:

Route: Engineering and Manufacturing

PATHWAY - Maintenance, Installation and Repair

Occupational Specialisms



Guided Learning Hours

New Proposal for Core and OS content

Engineering and Manufacturing					
Design and Development		Maintenance, Installation and Repair		Manufacturing, Processing and Control	
Core Content (GLH)	**Occupational Specialism (GLH)**	**Core Content (GLH)**	**Occupational Specialism (GLH)**	**Core Content (GLH)**	**Occupational Specialism (GLH)**
720	400 – 500	720	360– 570	720	1290 – 1736
1120-1220		1080 - 1290		2010 - 2456	

- To put this into context:
  - 3 x A Levels = 1080 hours, with three 1.5 to 2.5 hrs exams assessing 360 hours of content for each
  - There is still currently too much content for the manageable delivery and assessment of the T Level based on GLH and breadth of content.

Examples of feedback and response

Feedback on the Core Content
"720 GLH in the core in addition to the other GLH from the course is excessive. The 720 GLH needs to be reduced. The core covers a wide range of topic areas and has the expectation that a 16-18 learner will be able to flex between the areas. Is this a skill that a young learner will possess?"

Review the detail of the amplified content with a group of employers and providers to agree the level/depth required, with the aim of reducing GLH to 500/600 hours so TQ can be delivered by providers within T Level Qualification timelines.

Feedback on the MPC Production Technologies OS Content
"The overall content is too large. May even be big enough to scare some learners away? Yes, we need to fine tune the content to achieve the GLH targets but will this be by removing content or diluting the existing content. Diluting content may not then achieve Level 3."

Proposal to rationalise the Production OS content consulting with employers and providers and ensuring content is at Level 3.

Feedback on the D&D Structural Engineering OS Content
"A lot of the details is old school wording. Also the 3D CAD details refer to wholly mechanical items rather than structural features that are used in software such as Revit.
There is a lot of branded software called out in this section - i.e. numerous suppliers, this should be copied to combat my earlier comment on mechanical only calling out SolidWorks. Or it's removed and genericised (e.g. Mechanical CAD)"

Feedback on the Structural Engineering OS Specification
"Software side include AutoCAD, auto Revit – from architectural POV.
Under the range of 4.2 CAD is 3D software only, replace 3D CAD with Revit – examples given here are not the right ones."

Review and address comments ahead of MS4.

Specification Content

Exemplar Specifications

To achieve the **T Level Technical Qualification in Engineering and Manufacturing: Maintenance, Installation and Repair (Level 3) (delivered by City & Guilds)** learners must complete the **three** components of the Technical qualification. These are known as the core component and the occupational specialism:

- (300) plus one from (311 – 316)

T Level Technical Qualification in Engineering and Manufacturing: Maintenance, Installation and Repair (Level 3)			
City & Guilds component number	**Component title**	**Component level**	**GLH**
Mandatory			
300	Engineering common core	3	720
Choose one standalone occupational specialism			
Standalone			
311	Maintenance engineering technologies: Mechanical	3	520
312	Maintenance engineering technologies: Mechatronic	3	570
313	Maintenance engineering technologies: Electrical and Electronic	3	520
314	Maintenance engineering technologies: Control and Instrumentation	3	360
315	Vehicles	3	340
316	Energy and Utilities Technologies	3	570

Technical qualification scheme of assessment overview

Core Component – Learners must complete **all** assessment components						
Assessment component	**Method**	**Duration**	**Marks**	**Weighting**	**Marking**	**Grading**
Exam paper 1	Externally set exam	2 hours	102	35%	Externally marked	This component will be awarded on the grade scale A* - E
Exam paper 2	Externally set exam	2 hours	102	35%	Externally marked	
Employer-set project	Externally set project	21 hours	100	30%	Externally marked	
Occupational Specialism Component - Learners must complete **one** assessment component						
Assessment component	**Method**	**Duration**	**Marks**	**Weighting**	**Marking**	**Grading**
Maintenance engineering technologies: Mechanical	Externally set assignment	tbc	tbc	tbc	Externally moderated	All occupational specialism components will be awarded on the grade scale P, M, D
Maintenance engineering technologies: Mechatronic	Externally set assignment	tbc	tbc	tbc	Externally moderated	
Maintenance engineering technologies: Electrical and Electronic	Externally set assignment	tbc	tbc	tbc	Externally moderated	
Maintenance engineering technologies: Control and Instrumentation	Externally set assignment	tbc	tbc	tbc	Externally moderated	
Vehicles	Externally set assignment	tbc	tbc	tbc	Externally moderated	
Energy and Utilities Technologies	Externally set assignment	tbc	tbc	tbc	Externally moderated	

Exemplar Specifications

1 Working within the engineering and manufacturing sectors

1.1 **Principles** of design in engineering and manufacturing.

Range:

Principles – Types of manufacturing process (wasting, forming, shaping, joining, finishing, additive), fitness for purpose (influences on design and manufacture, functional requirements, environmental requirements), user requirements (design brief, specification, needs to be met), approaches to design (linear design, iterative design, inclusive design, user centred design, ergonomic design, design for manufacture, design for assembly, sustainable design, 6Rs (reduce, refuse, rethink, repair, reuse, recycle)), research and testing methodologies.

What do learners need to learn?	Skills
How types of process change the form of materials. How different requirements affect the design and manufacture of a product. The purpose and suitability of different approaches to design. How to interpret anthropometric data. The steps of the linear and iterative design processes and the contribution that testing makes to achieving an effective design. Methods of communicating design requirements to technical and non-technical audiences.	MIR-CSA MIR-CSE

Core knowledge and understanding across Engineering and Manufacturing Route

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Core Examinations Content Consultation

Overall assessment contribution (Core)

Assessment	Overall contribution
Core examination 1	35%
Core examination 2	35%
Employer-set project	30%

These proposals were shared with the T Level Panels that compiled the outline content in October and December 2020.

Core Content split

- **Paper 1** – Maths and Science Principles for Engineering
- **Paper 2** – Engineering in Context

- As well as considering the content split based on overall purpose, we also considered the content balance, based on the overall glh size of the sections covered by each exam.

- The allocated hours provide a good indicator that the content split in each paper is appropriate.

	Element	GLH
4	Essential mathematics for engineering and manufacturing	90
5	Essential science for engineering and manufacturing	90
6	Materials and their properties	75
7	Mechanical principles	45
8	Electrical and electronic principles	60
	Total	360

	Element	GLH
1	Working within the engineering and manufacturing sectors	30
2	Engineering and manufacturing past, present, and future	30
3	Engineering representations	30
9	Mechatronics	30
10	Engineering and manufacturing control systems	30
11	Quality management	30
12	Health and safety principles and coverage	60
13	Business, commercial and financial awareness	30
14	Professional responsibilities, attitudes, and behaviours	15
15	Stock and asset management	15
16	Continuous improvement	30
17	Project and programme management	30
	Total	360

Exemplar Core Examinations

Multi-mark questions

Question

A crane is holding a crate of mass 200 kg a height of 9 m above the floor.

a. Calculate the potential energy of the crate. (2 marks)

b. The crate is dropped by the crane. Calculate its velocity at the moment it is about to hit the floor. (4 marks)

Additional information: The value of gravity is 9.8 m s^{-2}.

Mark Scheme

a. PE = mgh = 200 x 9.8 x 9 [1] = 17640 J [1]

b. KE = ½ mv^2 [1]

From the principle of conservation of energy KE = PE = 17640 J [1]

Rearranging the formula for KE, v = √ ((2 x KE) / m) = √ ((2 x 17640) / 200) [1]

v = 9.39 m s^{-1} [1]

Total marks	6
AO	AO1 = 0 AO2 = 2 (for a) + 4 (for b) AO3 = 0
Qual spec reference	Common core 7.2
Lines	a: 4 lines b: 8 lines

Paper 2: Engineering in Context

Example question types

Single-mark questions

Question

What is the main requirement of the Regulatory Reform Fire Safety Order 2005? (1 mark)

Mark Scheme

1 mark for any of the following:

- Eliminate or reduce the risk of fire as far as is reasonably practical.
- Provide general fire precautions to deal with any risk.
- Take additional measures to ensure fire safety where flammable or explosive materials are used or stored.
- Create a plan to deal with any emergency and where necessary record any findings.

Accept any other appropriate response.

Total marks	1
AO	AO1 = 1 AO2 = 0 AO3 = 0
Qual spec reference	Common core 12.1
Lines	2 lines

Employer Set Project Content - Consultation

Exemplar Employer Set Project

Design specification

Performance requirements for the bollard

Train Express Limited wish to develop a bespoke bollard to be sited in public realm spaces outside their stations across the UK (refer to Photograph 1). The company wish to 're-engineer' the standard self-righting internally illuminated bollard (refer to Photograph 2) used frequently in streetscapes across the UK. The new bollard is also required to monitor the number of people using a station and should be energy efficient. The specific performance requirements of the bollard are:

- The bollard shall have an overall height of 1000 mm and width of 300mm.
- Each bollard needs to be able to sustain an impact loading from a vehicle. The force applied to the barrier should be calculated in accordance with BS EN 1991-1-1:2002 (refer to Table 1).
- The bollard is to be manufactured from a recycled or sustainable material.
- The bollard is to be fitted with technology that is able to count human presence.
- The bollard is to be lit by a low energy lighting source.
- The bollard is to have an internal light source like the original, which ensures that it is highly conspicuous from all sides.
- The overall aesthetic design of the bollard is to be modern and reflect the intended siting outside a railway station.
- The bollard shell should be able to withstand a minor vehicle impact and be easily replaceable.
- Train Express Limited wish to limit or eliminate any mains power source to the bollard.
- The bollard should be designed as far as possible to be vandal proof.

Table 1: Loading applied to the bollard

The horizontal characteristic force F (in KN) should be equal to that delivered by the impact of a vehicle given by: $$F = \frac{0.5\, m\, v^2}{\partial c + \partial b}$$ Where: m is the gross mass of the vehicle in (kg) v is the velocity of the vehicle (in m/s) normal to the barrier. ∂c is the deformation of the vehicle (in mm) ∂b is the deformation of the bollard (in mm)

Photographs

Photograph 1: Typical area outside a Train Express Limited Station

(Source of image: Shutterstock)

Key Milestones for TQ Development

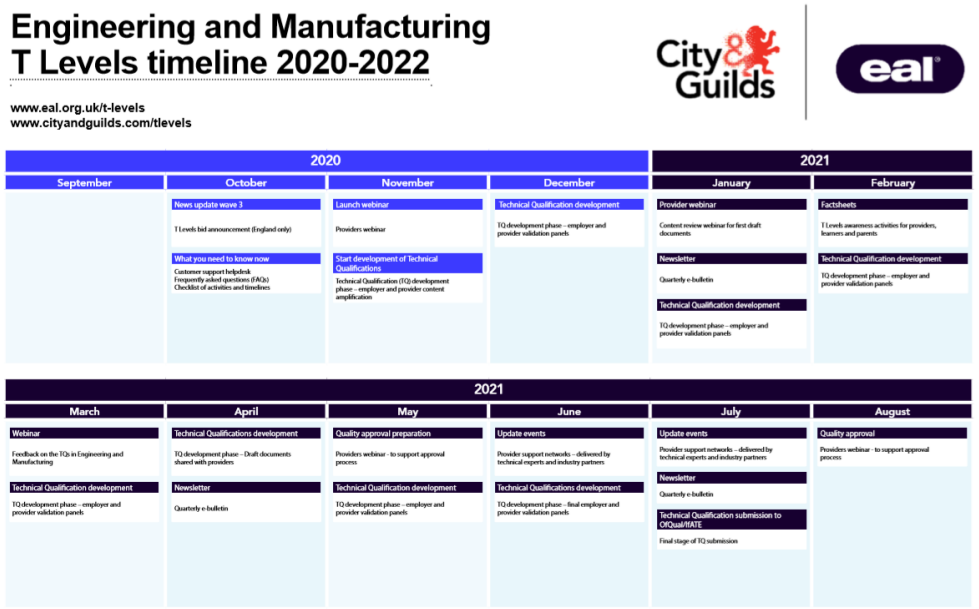
- **Milestone 4** – TQ Specification, TQ Assessment Material, Assessment Strategy, Implementation Plan, Resource plan
- **Milestone 5** – TQ Assessment Materials
- **Milestone 6** – TQ Assessment Materials
- **Milestone 7** – Final Approval – TQ Specification, TQ Assessment Material, Assessment Strategy, Implementation Plan, Resource plan, Exemplification Materials.

Support and Guidance

Ready to Support eligible providers and stakeholder engagement

- New Webpages for T Levels
- Timelines
- Webinar for eligible providers
- Provider focus groups
- Employer Industry Boards
- E-bulletins
- Draft specification
- Dedicated technical advisors

City & Guilds: cityandguilds.com/tlevels/engineering
EAL: eal.org.uk/T-Levels



Websites to Support Providers

T Levels next step for providers
https://www.gov.uk/guidance/t-levels-next-steps-for-providers#selecting-providers-to-deliver-t-levels-from-september-2023

Approaches to delivery
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904518/Annex_A_different_models_and_approaches_to_delivery.pdf

Industrial placement
https://www.gov.uk/government/publications/t-level-industry-placements-delivery-guidance

Industrial placement objectives
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/897109/IP_Development_Objective_Template_-_Engineering_and_Manufacturing.pdf

T Level capital funding
https://www.gov.uk/government/publications/t-levels-capital-fund

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Questions & Answers

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