HM Government

T-LEVELS

8730-032
T Level Technical Qualification(s) in Engineering and Manufacturing (Level 3)
Core: Exam Paper 2

If provided, stick your candidate barcode label here.

Date of exam: TBC
Duration: 2 hours 30 minutes

Candidate name (first, last)

First

Last

Candidate enrolment number

Date of birth (DDMMYYYY)

Gender (M/F)

Assessment date (DDMMYYYY)

Centre number

Candidate signature/declaration*

- If additional answer sheets are used, enter the additional number of pages in this box. ➡
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- Please ensure that you staple additional answer sheets to the back of this answer booklet, clearly labelling these with your full name, enrolment number, centre number and qualification number in BLOCK CAPITALS.
- All candidates need to use a **black/blue** pen. **Do not** use a pencil or gel pen, unless otherwise instructed.
- If provided with source documents, these documents **will not** be returned to City & Guilds and will be shredded. Do not write on the source documents.
- *** I declare that I had no prior knowledge of the questions in this examination and that I will not divulge to any person any information about the questions.**

You should have the following for this examination
- a pen with blue or black ink

General instructions
- The marks for questions are shown in brackets.
- This examination contains **14** questions. Answer all questions.
- Answer the questions in the spaces provided. Answers written in margins or on blank pages will not be marked.
- Cross through any work you do not want to be marked.

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This exam has been split into **two** sections. Below details the types of questions and marks available for each section. Please allow time for each section accordingly.

Section A is made up of **67** marks and includes **11** short answer and medium answer questions.

Section B is made up of **33** marks and includes **3** extended response questions.

Quality of extended responses will be assessed in questions marked with an asterisk (*****).

Section A

1 A company manufactures and assembles gear boxes. Identify **two** methods to reduce human error that could occur during production. (2 marks)

2 (a) Figure 1 shows one view of a component in a product. The dimension of the indicated feature is 37 mm. Using the standard conventions for an orthographic drawing, write this value in the correct location on Figure 1. (1 mark)

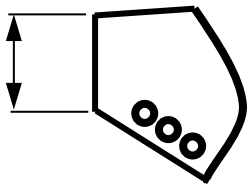

Figure 1

(b) What does the symbol in Figure 2 represent on an orthographic drawing? (1 mark)

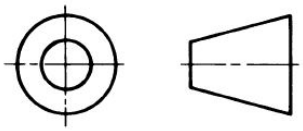

Figure 2

(c) What does this type of line represent on an orthographic drawing? (1 mark)

(d) What does the abbreviation AF mean on an orthographic drawing? (1 mark)

(e) What does the geometric dimensioning and tolerancing (GDT) symbol in Figure 3 mean? (1 mark)

Figure 3

3 When managing risks in a manufacturing environment, a hierarchy of control is used. The first step in the hierarchy is elimination of risk.
State the other **four** steps in order of the hierarchy. (1 mark)

4 Explain the purpose of a wiring diagram. (2 marks)

5 A company manufactures parts for car engines on a production line.

(a) Explain **two** reasons why the company may use condition-based monitoring rather than preventative maintenance for the machines on the production line. (4 marks)

(b) State **two** legal responsibilities for health and safety that apply to the employees operating the machining processes on the production line. (2 marks)

(c) The company currently inspects every machined part to ensure that it meets the requirements. Explain **two** ways in which changing from 100% inspection of every machined part to statistical process control could affect the company. (4 marks)

(d) During an inspection, the company found crack defects in the manufactured parts. Explain how a cause and effect diagram could be used when investigating this defect. (3 marks)

6 Explain **one** advantage of using a kanban system for managing work in progress to a company that carries out batch manufacturing. (2 marks)

7 Give **three** ways in which continuous professional development (CPD) can motivate employees of an engineering company. (3 marks)

8 A multinational company is planning a project to develop a new product.
The design will be developed at three sites: the ideas generation and engineering drawings for the project will be carried out by teams in the UK and India; prototype testing will be carried out in the USA.

(a) Explain **one** benefit and **one** limitation of collaborative working for the design activity.

(4 marks)

(b) The manufacturing of the components will be carried out at different sites in China and Europe. An engineer at this company has been asked to produce a project plan, running from the start of the design activity up to the commercial availability of the product.

Explain why critical path analysis (CPA) would be used for the planning of this project.

(3 marks)

9 A pressure vessel is used for manufacturing chemicals. It has a single access hatch. The hatch is 1 metre in diameter. A modification is required to the interior of the vessel, which is classed as a confined space.

Explain **two** health and safety considerations required to carry out this activity. (4 marks)

10 An engineer wants to start up a company to assemble and sell a machine that allows organisations to recycle paper products on-site to make usable paper.

The company needs to:

- raise finance
- purchase appropriate premises with a limited budget
- source components
- build a good reputation.

(a) Discuss the use of shares as a source of finance for this company. (6 marks)

(b) The machine is assembled from 50 parts, each of which is bought from different suppliers. It is anticipated that 100 machines must be delivered each month to meet customer requirements. The company plans to use Just In Time (JIT) as their inventory management system.

Explain **two** advantages of adopting the Just In Time approach for the company. (4 marks)

(c) Explain **two** benefits to this engineering company of implementing ISO 14001. (4 marks)

11 A company designs and manufactures robot arms to package eggs.

(a) The factory that manufactures the parts of the robot arm has a variety of manually controlled wasting and joining processes. The arms are assembled by human workers.

Explain **one** way in which 'design for manufacture and assembly' may have influenced the design of the robot arm. (2 marks)

(b) The gripper on the robot arm picks up eggs individually from a conveyor belt. The robot arm moves and places the eggs in boxes on a separate conveyor belt. Sensors ensure that the eggs are not broken and are placed in the correct position.

Explain **three** benefits of using a closed loop system to control the robot arm in this application. (6 marks)

(c) The processes in the factory are organised in a functional arrangement. Parts are moved between processes on pallets using forklift trucks. At least one day's work is queued at each process, so they do not stop production.

Explain using examples how the company could use value stream mapping to improve the performance of their manufacturing activity. (6 marks)

Section B

12 Analyse how the internal combustion engine has contributed to the social and economic development of the UK. (9 marks)

13* Evaluate how emerging trends in augmented reality (AR) could change engineering and manufacturing activities in the following sectors:

- Design
- Maintenance
- Manufacturing

(12 marks)

14* The UK has committed to achieving a net-zero greenhouse emissions target through a range of policy changes, in order to create a more sustainable society.

Discuss how environmental considerations affect the design, manufacture and maintenance activities in the engineering industry. (12 marks)

End of Assessment

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