Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A LEVEL – NEW

2601U10-1

S19-2601U10-1

DESIGN AND TECHNOLOGY – AS unit 1
Engineering Design

MONDAY, 13 MAY 2019 – AFTERNOON

2 hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**8**	
3.	**8**	
4.	**8**	
5.	**8**	
6.	**40**	
Total	**80**	

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01

ADDITIONAL MATERIALS

A calculator, ruler, pencil and coloured pencils.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Answer **ALL** questions.

Write your name, centre number and candidate number in the spaces at the top of this page.

Write your answers in the spaces provided in this booklet. If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question. You are advised to divide your time accordingly.

The total number of marks available is 80.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question **2**.

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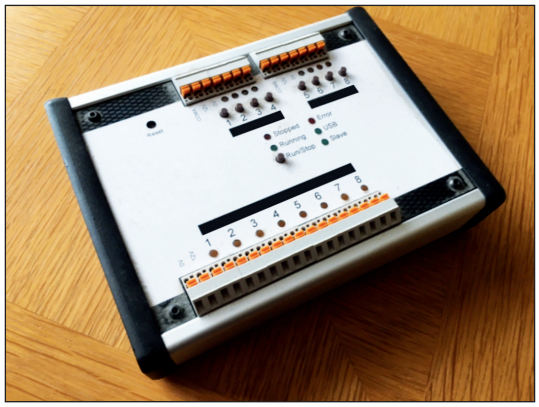
Answer **all** *questions.*

1. Automated manufacturing systems are often controlled by Programmable Logic Controllers (PLCs) similar to the one shown below using ladder logic.



(a) Explain **two** reasons why PLCs have largely replaced discrete components such as relays when controlling automated manufacturing systems. 2 x [2]

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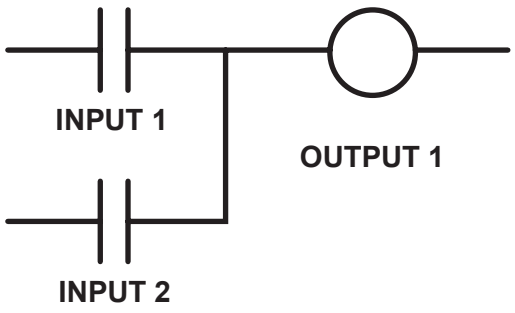
(b) (i) A simple ladder logic diagram is show below. Explain how the inputs in this system combine in order to control the output. [2]



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(ii) In the space below, use the symbols from the diagram in (i) to sketch a ladder logic diagram that will activate an output only when both inputs are turned on. [2]

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2. Jonathan Ive has led Apple's Design Team since 1996 and became Chief Design Officer of Apple in 2015. He has been responsible for the design of many iconic products which have been described as 'functionally clean, aesthetically pleasing, and remarkably popular'.

Evaluate the different products for which Jonathan Ive has been responsible and discuss the influences on his design thinking. [8]

Marks will be awarded for the content of the answer and the quality of written communication.

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3. Describe how the use of smart and modern materials has affected the design and marketability of named electronic and mechanical products. [8]

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4. Concurrent engineering was pioneered by the automotive and aerospace industries in the 1990s. Today many manufacturing companies employ this strategy when developing products.

Discuss the benefits of using concurrent engineering in the design, manufacture and development of new products. [8]

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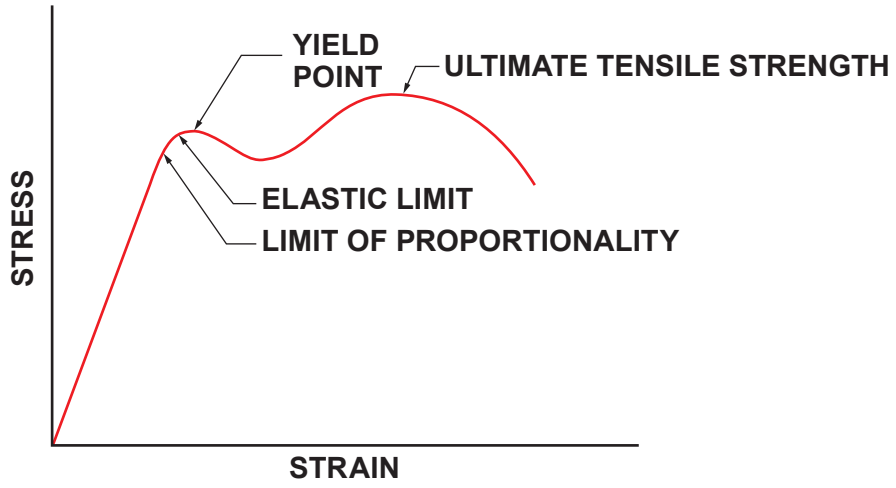
5. In engineering design materials are tested under control conditions. The graph below shows the results of a tensile test on a ductile material.



(a) Explain what is happening at **each** point on the graph.

(i) The Limit of Proportionality [1]

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(ii) The Elastic Limit [1]

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(iii) The Yield Point [1]

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(iv) The Ultimate Tensile Strength [1]

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(b) Name a material that would be described as ductile and explain why it would be suitable for use in the manufacture of a specific engineered product. [4]

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Examiner only

6. The image below shows a sliding gate that allows vehicles to access a property only when it is activated by the owner. The gate should open when a sensor is activated, remain open until the vehicle has passed and then close automatically as soon as it is safe to do so.

(a) Analyse the following specification points and justify why they would be included when designing the sliding gate. 4 x [2]

Specification Point 1: The device should use a sustainable source of power.

Justification:

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Specification Point 2: When closed the gate should automatically lock and remain locked until activated by the owner.

Justification:

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Specification Point 3: The gate should be manufactured from durable materials.

Justification:

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Specification Point 4: The gate should be safe to use by anyone who wishes to enter or exit the property.

Justification:

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Examiner only

(b) In the box below draw a detailed annotated diagram of a mechanical system that when activated would allow the gate to slide in either direction. [8]

Marks will be awarded for:

- a suitable mechanical system;
- justified selection of suitable materials.

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(c) The mechanism that controls the gate is powered by a 24 Volt DC Motor. In the box below draw a suitable circuit diagram that will enable the motor to be reversed. [8]

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(d) The gate mechanism is to be controlled by an Infrared Emitter held by the car driver, a Key Pad that can be used from inside the property and two Limit Switches.

In the box below draw a block diagram that shows how the motor is activated and accurately controlled by the input sensors. [8]

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(e) Discuss the ways in which the sliding gate mechanism could be further developed to improve security for the owner. [8]

END OF PAPER

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For continuation only.