Pearson Edexcel GCE

Engineering

Unit 4: Applied Engineering Systems
Candidate Brief

June 2014 series

Paper Reference
6934/01

You do not need any other materials.

Advice to Candidates

- This brief is the **only** vehicle for the assessment of this unit.
- Apart from this document there will be **no examination paper** for this unit.
- Candidates' work must be carried out individually in a suitable environment, such as the workshop, and under strictly controlled/managed conditions.
- The three activities may be started at anytime after the brief has been published on the Pearson website, at the centre's discretion.
- Candidates should spend no more than a total of ten hours in completing the three activities.
- You must enter your details and sign and date the candidate authentication document stating it is your own work.
- The task labelled with an asterisk (*) is the one where the quality of your written communication will be assessed.

Advice to Centre Staff

- The evidence to be submitted for assessment must demonstrate compliance with the requirements of the assessment criteria grid.
- Assessment will be carried out by centre assessors, whose decisions will be subject to moderation by Pearson's external moderators. For this purpose, Pearson will require a sample of the candidates' work and moderation will take place during the June examination series.
- The candidates' work must be completed, assessed and submitted to the designated moderator by the end of the published deadline.
- The candidates' mark must be entered on the appropriate OPTEMS forms and returned to Pearson by the published deadline.
- **Centres should note that the marks and candidate work can only be submitted in the June examination series.**
- Centre staff must sign and date the candidate authentication document and return it with the candidate's work.
- Candidates' marks must be recorded on the Unit 4 Mark Record Sheet, which must be attached to the candidates' work when submitted to Pearson for moderation. This form can be found on page 8 of the Candidate Brief.

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Practical activity brief

Activity 1

It is important for engineers to know the forces acting in members of load-bearing structures and the strength of the materials from which they are made. In this activity you will be asked to carry out a destructive tensile test on a structural material to determine its load-bearing properties. You will also be asked to analyse a loaded framed structure to determine how its members react and whether it is in a safe condition.

You are required to complete the following tasks and submit evidence of your work.

Task (a) (i)

Measure and record the behaviour of a sample of a known metal by subjecting a standard sample to a destructive tensile test.

Produce a load/extension graph for the metal and record the dimensions of the sample.

State the type of metal you have tested.

(5)

Task (a) (ii)

Plot a graph of stress versus strain and from it determine:

- the ultimate tensile strength of the metal
- the modulus of elasticity of the metal

Compare these values with the published data for the metal. (Note that it is quite reasonable for your values to vary by 20% or more from the known values, owing to factors such as slight variations in the composition of the metal.)

(4)

The simple framework shown in Figure 1 is made from rods of circular cross section of the metal you have tested. It is fixed at D and F to a wall with simple pinned joints. A load (W) of 0.8 tonnes is supported at E.

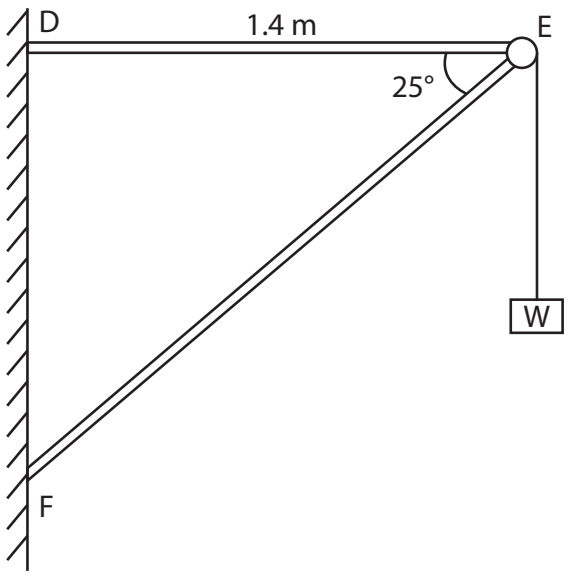

Figure 1

Task (a) (iii)

Determine the magnitudes and nature of the forces in all members of the structure.

(3)

Task (a) (iv)

Assuming a factor of safety of 8, calculate a suitable diameter for member EF.

(2)

Task (a) (v)

Determine the change in length of the member EF as a result of the load.

You may assume that the modulus of elasticity of the metal is the same in tension and compression.

(2)

(Total for Activity 1 = 16 marks)

Activity 2

Electro-mechanical systems are found in everyday life. They include industrial and domestic appliances, power tools and automated machinery. In this activity you will be asked to explain the function and investigate the design of an electro-mechanical system.

You are required to complete the following tasks and submit evidence of your work.

Figure 2

Figure 2 shows a car ramp. The ramp is operated by pressing separate buttons that send an electric signal to the motor, either raising or lowering the ramp. The ramp is attached to four legs which control its vertical movement.

Task (b)

Explain, with reference to the electrical and mechanical subsystems, the operation of the car ramp shown in Figure 2.

(6)

Task (c)

Investigate the construction and operation of the car ramp and explain, with the aid of a block diagram, how its subsystems and components are connected.

Your diagram should show clearly:

- the connecting pathways
- the input and output of each block
- any energy transfers and conversions that take place

(10)

Task (d)

Provide an alternative design solution that fulfils the basic function of the car ramp.

(6)

(Total for Activity 2 = 22 marks)

Activity 3

Process outputs such as materials handling, temperature, pressure, speed and measurement, etc. often need to be monitored and controlled.

In this activity you are asked to design a suitable delivery system which fulfils the requirements of the given design brief.

Design brief

A major car manufacturer assembles three different types of vehicle along the same assembly line. The assembly process is an automated system where vehicles are produced as customers confirm an order. This assembly process means that the vehicles are not transported along the assembly line in any logical order.

Vehicles have to be fitted with the correct wheel size as the vehicles move along the assembly line. Each vehicle has a manufacturer's 16 digit VIN (vehicle identification number) represented by a barcode attached to the vehicle chassis. As the partly assembled vehicle approaches individual workstations, a scanner identifies component parts to be fitted at that workstation.

The three vehicles assembled at this factory have different wheel sizes according to the vehicle's own individual specification as follows:

Car	Type	Wheel diameter (including tyre)
A	Small family size car	50cm
B	Medium family size car	55cm
C	Large family size car	60cm

The wheels are held overhead on a conveyor system in three separate cages, with a gate opening at the correct moment to deliver the wheels to the workstation by gravity. Each of the four operators takes the wheel presented by the system and fits it to the vehicle. The system must:

- allow for recognition as the partly assembled vehicle approaches the workstation
- ensure the correct wheels are presented to the operators when the vehicle reaches their workstation
- enable each individual operator to confirm that the correct wheel is in place by sending a signal to the mainframe computer
- stop the assembly line if the incorrect wheel size is fitted to a vehicle.

***Task (e)**

Produce a feasible design solution for the system which should include:

- a block diagram showing all system elements

(4)

- signal pathways, inputs and outputs

(3)

- a detailed explanation of how your system functions

(5)

- how it meets the requirement of the design brief and takes into account health and safety considerations

(2)

- details of the sensors, transducers and display equipment required for the system

(4)

Task (f)

Select suitable materials and components for your design which take into account:

- production constraints
- safety considerations

(4)

(Total for Activity 3 = 22 marks)

TOTAL FOR PAPER = 60 MARKS

Authentication Statement

Authentication Statement
GCE Engineering
External Test

The statement below **MUST** be completed for each candidate where a Unit Test specifies that a candidate's work must be handed in with the question paper. Failure to do so will result in the candidate receiving **zero marks** for the whole test.

Unit Number	6934
Unit Name	Applied Engineering Systems
Level	Advanced

Candidate's Declaration

I certify that the work submitted for this unit is my own.

Name of Candidate		Date	
Signature of Candidate			

Teacher's Declaration

I certify that the candidate named above has completed the work submitted.

Name of Teacher		Date	
Signature of Teacher			

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Appendix E: Pearson Edexcel GCE in Engineering – Unit 4 Mark Record Sheet

Centre no:	Centre name:	Internal moderator name:
Candidate no:	Candidate name:	
Series no:		

Unit 4: Applied Engineering Systems							
Assessment evidence	**Annotation and page number**	**Mark band**			**Centre mark**	**Pearson use only**
		1	**2**	**3**		
(a)		0-8	9-12	13-16		
(b)		0-2	3-4	5-6		
(c)		0-4	5-7	8-10		
(d)		0-2	3-4	5-6		
(e)		0-9	10-14	15-18		
(f)		0-2	3	4		
		Final total				

Pearson moderator use only		
AA number:	Name:	Signature: