

Edexcel GCE

Engineering

Unit 4: Applied Engineering Systems Candidate Brief

June 2013 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 Edexcel 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 Edexcel's external moderators. For this purpose, Edexcel 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 Edexcel 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 Edexcel for moderation. This form can be found on page 7 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 (e.g. stainless steel, aluminium alloy) 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 used.

(5)

Task (a) (ii)

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

- the ultimate tensile strength of the material
- the modulus of elasticity of the material.

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 A and C to a wall with simple pinned joints. A load (W) of 1.5 tonnes is supported at B.

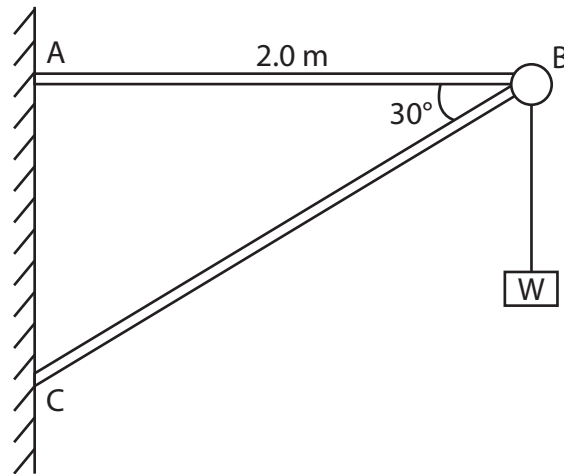


Figure 1

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 7.5, calculate a suitable diameter for member BC.

(2)

Task (a) (v)

Determine the change in length of the member BC 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 to be found in everyday life. They include industrial and domestic appliances, power tools and some items of laboratory, workshop and office equipment. 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 sliding gate. The gate is operated from a remote location using control technology. The frame of the gate sits on rollers that are rotated by a gear mechanism which is driven by a motor. Limit switches control the distance that the gate can travel. The automatic movement of the gate can be manually overridden.

Task (b)

Explain, with reference to the electrical and mechanical sub-systems, the function of the horizontal sliding gate.

(6)

Task (c)

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

Your diagram should clearly show:

- 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 functions of the automated electric gate.

(6)

(Total for Activity 2 = 22 marks)

Activity 3

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

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

Design brief

Design a monitoring and measuring system for a copper-wire drawing process. The process must be fully automated and reduce the copper wire from a diameter of 1.5 mm to a diameter of 1.2 mm in three reduction changes. The system must:

- monitor and measure the dimension of the copper wire after each reduction in diameter
- employ negative feedback to allow the system to automatically alter the inside diameter of each reduction die.

*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, including how the system copes with the increased length of copper wire as the diameter reduces after passing through each die (5)
- how it meets the requirements of the design brief and takes into account health and safety considerations (2)
- details of the sensors, transducers, display equipment and associated circuits. (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			

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

Centre no:

Centre name:

Internal moderator name:

Candidate no:

Candidate name:

Series number:

Unit 4: Applied Engineering Systems						
Assessment evidence	Annotation and page number	Mark band			Centre mark	Edexcel 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						

Edexcel moderator use only

AA number:

Name:

Signature:

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