Edexcel GCE

Engineering

Unit 4: Applied Engineering Systems
Candidate Brief

June 2010 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 practical 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 practical activities.
- You must enter your details and sign and date the candidate authentication document stating it is your own work.
- Task labelled with an asterisk (*) is 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, which is 15/05/10.
- **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 the 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 material (e.g. stainless steel, aluminium alloy) by subjecting a standard sample of the metal to a destructive tensile test.

Produce a load/extension graph for the material and record the dimensions of the sample.
State the type of metal you have used.

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 material. (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 material).

The members of the structure in Figure 1 are made from four solid rods (circular cross section) of the material that you have tested. They are fixed to a wall, to make a simple crane. You may assume that they are pin-jointed at their ends.

The load supported is to be 3 tonnes.

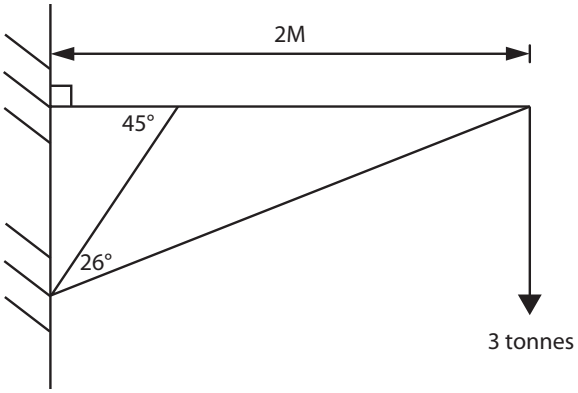

Figure 1

Task (a) (iii)
Determine the magnitude and nature of the forces present in the above structure.

Task (a) (iv)
Assuming a safety factor of 6 is required for the member under greatest strain, calculate a suitable diameter for that member.

Task (a) (v)
Determine the dimensional change that occurs in the member under greatest strain as a result of the loading.

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

(Total for Activity 1 = 16 marks)

Activity 2

Electro-mechanical systems are found in everyday life. They include domestic appliances, power tools and some items of laboratory and office equipment. In this activity you will be asked to explain the function and investigate the design of a given electro-mechanical system.

Thermistor controlled temperature alarm circuit

The circuit shown in Figure 2 uses a thermistor to monitor the temperature on a patio and, at a preset temperature turn on the motor of a fan heater.

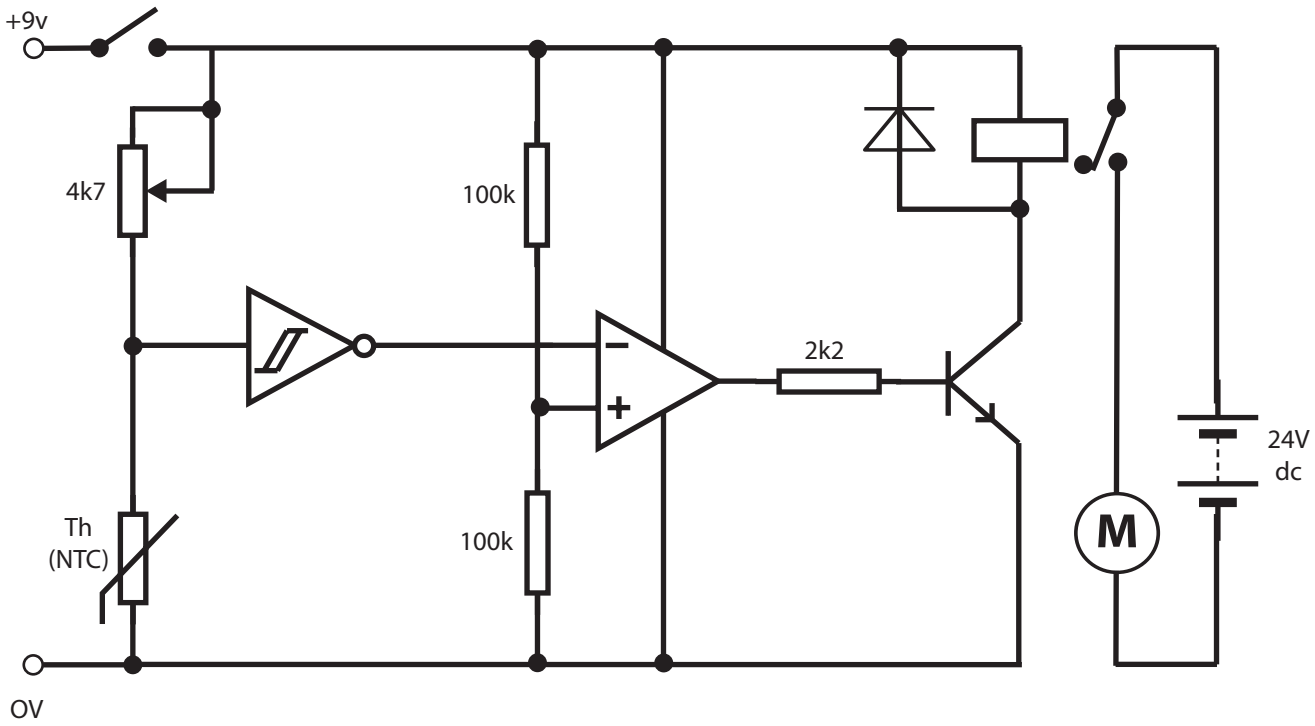

Figure 2

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

Task (b)
Explain how the circuit in Figure 2 operates.

(6)

Task (c)
Describe, using a block diagram, the energy transfers and conversions that occur in this system.

(10)

Task (d)
Design an alternative solution that provides the same basic function as the thermistor controlled temperature alarm circuit, comparing fitness for purpose of the two systems.

(6)

(Total for Activity 2 = 22 marks)

Activity 3

Process variables, such as temperature, pressure, speed, light intensity, etc., often need to be monitored and controlled.
In this activity you are asked to design a suitable monitoring or control system which fulfils the requirements of the given design brief.

Design brief

Design a microprocessor controlled monitoring and warning system to indicate when the temperature in a greenhouse exceeds pre-set levels that would be potentially damaging to plants, and to operate a ventilation system automatically.

Your engineering design for the system should include the following features:

- a method of monitoring the temperature using analogue circuitry
- a method of converting the output from analogue sensing into useful digital signals
- visual warnings in the greenhouse of increasing temperature levels in 3 steps
- a method of automatically operating motor driven ventilators when the final monitored temperature is reached

***Task (e)**

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

- block diagram(s) showing the system elements
- signal pathways, inputs and outputs
- a detailed explanation of how the system functions
- how it meets the requirements of the design brief and takes into account health and safety considerations
- details of the analogue circuit for the sensors and how they are linked to the microprocessor

(18)

Task (f)

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

- production constraints
- cost 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: 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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