EXTERNALLY SET AND MARKED ASSIGNMENT

AQA Level 3 Technical Level Engineering

Mechanical Systems (L/506/6524)

Sample Assessment Materials

EXTERNALLY SET AND MARKED ASSIGNMENT

Unit L/506/6524 (Mechanical Systems) is assessed via an externally set and marked AQA assignment.

External assignments are set by AQA (sometimes in collaboration with an employer or a professional body), they are sat by learners in a supervised environment, and marked by AQA.

Guidance notes for tutors

These notes must be read by tutors delivering this external assessment to learners. You must not begin delivering this external assignment before reading these notes.

You must explain the way in which the external assignment is conducted to your learners before commencing the assignment.

The external assessment will include three sections:

- understanding of mechanical systems
- design of a mechanical system
- assembly and testing of a mechanical system

The context for this assignment has been selected such that the designing and assembly could be carried out using only resources referred to in the specification, ie without the need to purchase additional specialist equipment or components. Typically, the product that learners are tasked with designing and assembling will:

- include pre-manufactured or bought-in components and an electrical drive
- provide an output in a different type of motion to the input
- change the magnitude of the input motion or force
- require at least five of the skills indicated under the unit content for methods of assembling mechanical systems.

Learners will not be expected to manufacture components within the assessment.

In the event that the learners design in section 2 is unsuitable for assembly, they can be provided with a feasible design to act as a starting point for section 3. Where this happens it must be noted on the candidate record form.

The evidence submitted for assessment could include the following:

- written response to the first section; this may include sketches if appropriate
- general arrangement drawing of the designed item
- materials list
- risk assessments for the manufacturing
- practical diary, including annotated pictures of the assembly operation and the final products
- quality test record sheet
- witness statement covering safe working
- preventative maintenance schedule for the finished product.

Assignment format and structure

There are two assignments for Unit L/506/6524 (Mechanical Systems) in each academic year. Learners can choose which of the assignments they wish to complete.

Materials for both assignments are released to centres on a specified date each year. This date can be obtained from the AQA website (www.aqa.org.uk)

In exceptional circumstances, centres may wish to modify the task sheet to take account of the conditions and equipment available in their centre or to reflect the specific employer/industrial focus they are using.

Any modification must be discussed and agreed, in writing, with AQA before learners undertake the task. Any requests should be sent to techlevels@aqa.org.uk. A copy of the correspondence giving authorisation for the change will then be sent to the AQA examiner.

There are two windows for assessment each year when centres must submit their learners' completed external assignments to AQA for marking. The dates of these windows can be obtained from the AQA website.

Learners must undertake their external assignment tasks individually and under supervised conditions.

Preparation

The assignment should only be undertaken after learners have acquired the necessary skills and after teaching for the appropriate sections of the specification has taken place. Learners should also be familiar with any apparatus, equipment or materials they will need to use.

Centres should organise an appropriate approach to the delivery of the assignment that takes into account when the assignment becomes available and when completed learner work is required by AQA for submission.

A centre may carry out the tasks, using similar apparatus, equipment and materials as the learner, in order to obtain centre results. This must not be done in the presence of the learners and the evidence produced must not be provided to the learners as an exemplar.

Risk assessment and risk management

Risk assessment and risk management are the responsibility of the centre.

Carrying out the assessment

Learners are expected to work individually

Unless specific guidance to the contrary is made in the assignment brief, centres should not give any advice to learners regarding completion of the assignment. The centre may only give advice or guidance to learners about the way they are conducting practical work if it is to prevent personal injury or damage to equipment or apparatus.

Where resources mean that equipment has to be shared, centres should ensure that the learners complete the task individually (eg by taking turns with the equipment to produce their evidence).

Details of any supporting documents, materials or electronic devices that can be used by learners during the assessment will be provided within the Guidance notes for tutors and the Assignment brief. The circumstances in which learners are permitted to undertake research will also be specified within the Guidance notes for tutors and the Assignment brief.

The ability to present evidence in an appropriate format will be an important part of the assessment. The centre must not provide learners with blank templates to complete or direct learners in designing and completing their own work.

Learners must work individually and under controlled conditions. Each task within the assignment should normally be completed in continual sessions. Centres can judge how many sessions are appropriate for their own learners.

As a guide, the assignment should be completed in approximately 20 hours. The brief indicates how much time should be allocated to each task however centres can adjust these as appropriate for their learners. Centres do not need to record the hours spent on the assignment however you should encourage learners not exceed the overall time or the time for each task.

At the start of each session, the centres should give each learner a copy of the assignment, together with the appropriate apparatus and materials to carry out the task.

Learner absence

If a learner is absent for a part of the assignment then they should be given the opportunity to undertake the part of the assignment missed before they move on to the next stage. This may be with another group or at a different time.

Storage of materials

Materials for each assignment must be kept unopened and in secure storage until the date upon which the centre wishes to commence work on the assignment with learners.

Secure storage is defined as a securely locked cabinet or cupboard.

Whilst undertaking assignment tasks, at the end of each session, the centre must collect the learners' work and keep it securely until the next session. Learners must not take any assessment materials away at the end of a session. Specific rules relating to the security of assessment can be found in the Guidance notes for tutors.

Further guidance on secure storage can be found in the JCQ Instructions for Conducting Examinations document at http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations.

Where learners' work is in an electronic format, centres must take steps to ensure that they meet the requirements for secure storage described above. This may involve collecting USB memory sticks for secure storage between sessions or restricting learners' access to specific areas of the centre's IT network.

As a general rule, learners should use the IT facilities provided by their centre. Where learners wish to/are required to use their own equipment, then the centre is responsible for establishing and implementing a procedure to ensure compliance with the requirements for secure storage described above.

Submission of learner work

Deadlines for submission of assignments are 10 January and 15 May.

The results of work submitted by 10 January will be sent to centres in March and work submitted by 15 May will be sent to centres in August.

Details of submission arrangements can be found in the Centre Administration Guide for Technical and Vocational Qualifications at aqa.org.uk.

To ensure that the external assignment has been completed appropriately, learners and tutors are required to confirm, before all learner work is sent to AQA for marking, that each of the learners has undertaken the assessment appropriately and in accordance with the rules.

Redrafting or resubmission of learner work

Learners may only make one attempt at each assignment and redrafting is not allowed at any stage. Learners who wish to re-sit a unit assessment must attempt a different assignment.

Suspected malpractice or maladministration

Where centres suspect that the work produced by the learner is not their own, then this could potentially be malpractice. Further guidance on dealing with malpractice can be found in the JCQ document Suspected Malpractice in Examinations and Assessments: Policies and Procedures - http://www.jcq.org.uk/exams-office/malpractice and in the Centre Administration Guide for Technical and Vocational Qualifications at aqa.org.uk.

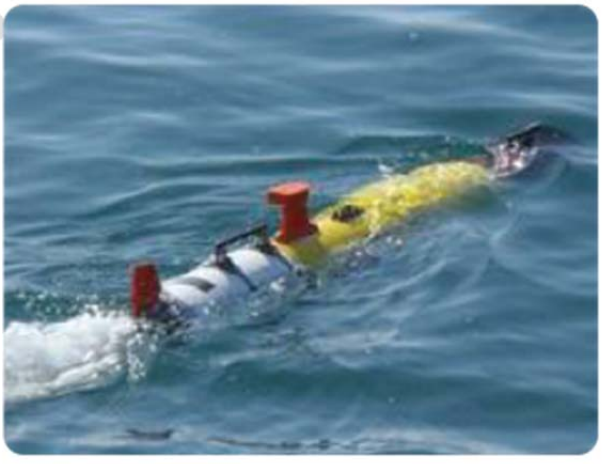
CONTEXT

Modus is a specialist provider of remote operating vehicles (ROVs) for use underwater or on the seabed (ROV). These unmanned vehicles are widely used in the oil industry and in offshore wind farms.

OFFSHORE WIND FARMS

Wind farms exist to generate electricity for use via the national grid. The power needs to get from the point of generation to the grid. This is achieved by using inter-array cables which link the different turbines on a wind farm together, and transmission cables to link the wind farm to the shore.

Sub-sea cables are at risk from fishing and trawling operations and from damage caused by anchors. Burying the cables in trenches on the sea bed offers some level of protection. This can be carried out by ROVs, which can also connect and repair the cables if damage occurs.



PRODUCT SPECIFICATION

Within this assignment you will design and build a robot arm for a ROV that will repair underwater cables in an offshore wind farm. This must meet the following specification:

1. The arm must be controlled remotely through a wired connection
2. The arm is to be powered by an electric motor, powered through the control cable
3. The jaws must rotate 360 degrees
4. The arm must be able to extend vertically at least 50 cm
5. The arm must be able to extend horizontally at least 50 cm
6. The arm must be able to hold a solid cube of material of dimensions 30 mm square
7. The arm must be able to move the cube of material from a stand and transfer it to another stand 20 cm higher and a horizontal distance of 20 cm from the first stand

Section 1: Understanding of Mechanical Systems (PO1 - Understand the types of mechanical systems and their purposes) [2 hours]

a) Name four mechanical systems that are used in a ROV. Each of the named systems should transmit motion or force between different forms of motion.

For each system describe how it transmits the motion or force from the input to the output. **(P1).**

b) Select two of the mechanical systems you have identified in point 1 a, above.

For each, explain how the system changes the magnitude of the force or movement. **(M1).**

c) Select one of the mechanical systems you have identified in point 1 a, above.

Explain why this mechanical system was used in the design rather than an alternative. **(D1).**

Section 2: Designing (PO2 - Design a mechanical system) [9 hours]

You have to design a robot arm that meets the requirements of the product specification. You should provide the following evidence for your design:

a) A sketch, drawing or model of a possible design **(P2)**. This could include an explanation of how the mechanical components in your design operate to provide the required outcome **(M2)**.

b) In addition to the design criteria in the product specification, provide a list of other design considerations for this application **(P3)**. This could also explain how each of these are relevant to the design **(M3)**.

c) A full list of parts and components to be used in the construction of the robot arm **(P4)**. This should include the electric motor **(P5)**. This could explain why the mechanical components **(M4)** and the motor **(M5)** are suitable for this application. It could also explain the reasons for selecting three of the parts and the possible alternative choices **(D2).**

d) A general assembly drawing of your design **(P6)**.

Section 3: Assembly (PO3 - Assemble and test a mechanical system) [9 hours]

You have to plan for and carry out the assembly of the robot arm designed in section 2.
As a record of your assembly you will need to produce the following:

a) A production plan for the assembly **(P7)**.

b) A risk assessment for the assembly process **(P8)**.

c) Evidence showing how you carried out the assembly process **(P9)**, whilst working safely at all times **(P10)**.

d) A picture of your finished robot arm. This could be annotated to identify further improvements or modifications that could be made **(M6)**.

e) Completed test record sheet(s) for the mechanical elements of the assembled system **(P11)**. These could justify the choice of measurement methods used **(P11)** and evaluate how well the system meets the needs of the specification, including how testing supported any improvements made to the product **(D3)**.

f) A preventative maintenance schedule to ensure that the robot arm is suitable for on-going use **(P12)**.

External Assignment Front Sheet (EAF)

AQA Level 3 Technical Level Engineering

Mechanical Systems

Learner name:	
Centre name:	
Tutor name:	

Learner Authentication
I confirm that the work and/or the evidence I have submitted for this assignment is all my own. I have complied with my tutor's instructions and the notes in the 'Information for candidates'. **Learner Signature:** **Date:** I confirm that the learner's work is all their own work. I have fully complied with the rules of the assessment contained in the 'Guidance notes for tutors' document. **Tutor Signature:** **Date:**

Note: you must attach this completed front sheet to the candidate's assignment before dispatch to AQA for assessment. Candidate's work will not be assessed without a fully completed front sheet accompanying each candidate assignment.