



## **General Certificate of Secondary Education**

# **Design and Technology (Systems and Control Technology) 3546/C**

**Coursework 3546/C**

## **Report on the Examination**

*2007 examination - June series*

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## **Coursework (3546/C)**

### **General Comments**

Once again the overall standard of outcomes continued to improve with centres in general encouraging candidates to produce work at an appropriate level of demand for this specification. The percentage of unfinished and inoperable outcomes previously seen by moderators has decreased, and many centres should be congratulated for an excellent display of Systems and Control work where their candidates had successfully linked Core and Focus technologies in their coursework. Moderators continued to report that they were made welcome by centres that had usually gone to some length to provide a suitable location with the work laid out well for inspection. Many centres had spent time and effort on the presentation of the coursework for moderation. It is very helpful when moderators are provided with screwdrivers, batteries or power packs and, when appropriate, a compressed air supply; this helps the moderation process enormously. Moderators were greatly helped when projects were left with screws removed from cases or loosened ready for examination.

### **General Administration**

The moderation time period is limited and, although the moderation process was relatively trouble free, there are a number of areas which need attention.

- Centres are reminded that Centre Mark Sheets need to be with AQA and the moderator no later than the 5th May.
- Centres with twenty or fewer candidates should include all coursework folders when sending the Centre Mark Sheets to the moderator
- Centres must complete and send to the moderator a Centre Declaration Sheet.
- Each candidate requires a completed Candidate Record Form attached to the design folder with grades for each assessment stage. Appropriate annotation is also helpful.
- Candidate design folders should be individually fastened together in a logical order to assist the moderation process.
- Bulky ring binders should not be sent to the moderator.
- Care needs to be taken by Centres when using the Assessment Matrix.
- Where two or more teachers are involved in teaching Systems and Control Technology, internal standardisation must take place.
- Centres are asked that they make a prompt response to moderators' requests.
- Centres should be reminded that the moderation procedure is completely confidential and the moderator is not permitted to offer verbal feedback during their visit. This is particularly important given that moderators are not in a position to if any adjustment will be made to centre marks at a later date. Written feedback will be available when results are formally announced.

### **Assessment**

The majority of schools were sufficiently accurate in their marking and the moderator was able to confirm the centre's assessments. Many centres referred to the autumn meeting photo sheets to aid the accuracy of their assessments. Where Assessments were inaccurate, they tended to be lenient rather than harsh. Photographic evidence of final outcomes is essential when design folders are sent to moderators.

### **Annotation**

The Candidate Record Forms provided essential information to moderators. Breaking down the overall designing and making grades allows moderators to see how centres had arrived at their assessment. Commentary to illuminate these grades is also very helpful. The provision of *photographs of outcomes* provided by most centres was a great help to the moderation process and should be positively encouraged.

### **Choice of Coursework Projects & Design briefs**

Projects are tending to become more realistic in terms of time as has been advised in recent years allowing candidates to achieve working outcomes in the time available. Use of CAD/CAM is on the increase, contributing to the quality of the systems manufactured, and where CAM is used this can release making time that can be used to produce slightly more complex systems or ensure completion and testing in the available time. Candidates are usually opting for a project brief that is within their capability.

There has been an increase in the number of centres only offering one design brief to the candidates. In some cases the brief is sufficiently open to give scope for a wide range of challenging outcomes to be designed and made, but in others there is a distinct lack of individual creativity because the teacher has led from start to finish.

### **Designing skills**

Candidates should ensure they cover the full design process and satisfy the AQA assessment criteria as stated in the specification. Candidates should evaluate their work at many stages throughout the project and not just at the conclusion of the project. Centres need to use the AQA Candidate Record Form to give feedback to the candidates on the progress of their designing and making skills.

### **Design Folders**

#### **Research**

It is clear that this is becoming much more focused and relevant to the task although a few centres still use the *more is best* approach, filling folders with copious amounts of irrelevant research material. Candidates should be encouraged to collect a range of relevant research material, make reference to books, data sheets, and component catalogues that they have used. Carry out practical research in the form of testing circuit ideas, using kits, breadboards and computer simulation.

#### **Analysis of task and research material**

The vast majority of candidates effectively analyse the task. Research material however is still often described rather than analysed. The simple question 'How is this relevant to my work and what can I learn from this?' applied to all research material would have aided many candidates. Candidates should be encouraged to break down the problem into a number of smaller problems or sub-systems: analyse the research material and the electronic and mechanical/pneumatic elements of the problem; use a systems approach and identify possible input, process and output devices; use a variety of diagrams and charts, possibly supported by experimentation and, if need be, market research. The experimentation can be carried out with the use of kits or with the help of computer aided design.

### **Specification**

The higher ability candidates discussed the function of the system, the constraints of cost, size and time, the working parameters of input, process and output devices, and made reference to power sources. It is pleasing to report that many centres had directed candidates to cover general areas such as:

- Target market
- Function
- Size
- Weight
- Durability
- Aesthetics
- Materials
- Safety
- Cost
- Green issues
- Manufacture

It is worth noting that a good specification is crucial to the success of any Systems and Control project and it will make it easier for the candidate to carry out the formative and summative evaluation. It may well be that the specification is re-written or added to later in the folder as the candidate proceeds with designing the system.

### **Generation of Ideas**

Moderators were looking for a variety of systems initially in the form of '*system diagrams*' that considered alternative forms of technology. AQA must stress that the design and development of the system is fundamental to Systems and Control Technology and should be simply and clearly evidenced within the folder.

Candidates should sketch or draw out by any means several designs e.g. three circuit ideas, alternative mechanical ideas or pneumatic ideas and show how the system may be assembled to its final outcome, these ideas may be relatively simple and appropriate to house the system at this stage. This type of activity may give the candidate the chance to carry out experiments using kits, software packages and breadboards to test their theories. The use of photography in a candidate's design folder enhances the folder and is an excellent record of experimental work carried out with kits and breadboards. At this stage in designing, candidates should be encouraged to apply mathematical calculations and record this evidence in their design folder. Centres need to ensure that candidates use and apply the given formulae in the specification wherever possible in their coursework.

### **Development of Solution**

Once again, far too few candidates are undertaking any real development of their ideas and simply redrawing one of their initial ideas as a design proposal. Moderators reported that many candidates simply moved from ideas into a making plan. Many candidates did not provide enough detail for third party manufacture to be attempted. Candidates should give reasons why they have selected a certain circuit or system from their generation of ideas and, equally, give reasons why they have rejected the other systems. Candidates intending to manufacture their own circuits should present an accurate final circuit drawing which satisfies the specification and clearly takes into account relevant research and analysis. The circuit diagram should contain sufficient information for the circuit to be made by a competent third person. Candidates who intend to use a printed circuit boards should show the developmental stages of their PCB layout or transparent overlay. This type of activity gives candidates of all abilities the opportunity to involve them in design and to show what they know and can do. This method of working contrasts greatly to the trend of many candidates who find a single circuit and use it without considering whether or not it can be improved upon. Again this year, development work on PIC programming, and mechanisms was missing from the folders of many candidates. However, some good combinations of control and mechanisms or pneumatics with resistant materials were seen in the work of higher level candidates.

### **Peripheral Interface Controllers (PICS)**

Many more candidates are using PICs in their coursework projects than in previous years. Centres need to remind candidates who are intending to use PICs, of the assessment stages contained within the Assessment Criteria and to ensure that candidates address them. The tendency with some candidates is to state right from the beginning of the design folder that they are planning to use a PIC and no further thought is given to alternative ways of solving the problem. Candidates preparing coursework should be using a systems approach and identifying the building blocks for the INPUT, PROCESS and OUTPUT sections of the system and, if a PIC is chosen as the most suitable building block for the process section, it should be arrived at by way of investigation.

### **Planning of Making**

Greater uses of flow charts were made by many candidates this year and this relates well to industrial practices. More able candidates were able to indicate the quality assurance/quality control checks that would take place at various points and the action that would be taken. The use of diaries to record the stages of the making was seen in an increasing number of centres this year. Candidates must be aware that in addition to the diary they must provide full evidence of planning to attain the higher marks. Full credit was given to planning as long as there was sufficient evidence to support the judgment that planning had taken place. Some of the more able candidates presented design proposals in sufficient detail that a separate planning document was not required. Credit was given when it was obvious that some planning had taken place. Candidates of all abilities are planning and making manufacturing decisions throughout their coursework, however very little of it is ever recorded. If candidates can record these decisions in a manufacturing diary then this should be encouraged. Decisions are made by candidates of all abilities but, unfortunately, records are often omitted by even the highest ability candidates.

### **Evaluation, Testing and Modification**

It was reported that many centres were not allowing sufficient time for evaluation, testing and modifications to be made and carried out. This part of the design process is poorly attempted by a significant number of candidates and is partly due to candidates completing their projects very close to the 5th May AQA deadline date. Centres must ensure that their candidates have sufficient time to complete this important section. They should encourage candidates to think up interesting ways of testing their projects and to record the results, using block diagrams, pie charts, pictograms, etc. The use of photography can be encouraged to record testing and to highlight any suggested modifications to the system. This section of the assessment criteria is possibly the only place in the design folder that a candidate can carry out an extended piece of writing and gives candidates the opportunity to reflect upon the whole process.

### **Use of Communication, graphical and ICT skills**

Throughout their design folders, candidates should be encouraged to show a wide range of communication skills and techniques. They should use information technology and appropriate software packages to generate circuit diagrams, printed circuit board overlays, the simulation of circuits on screen, and, if used, PIC programming.

### **Social Issues, Industrial Practices and Systems and Control (including the use of CAD)**

Many candidates had approached this as a bolt-on section at the end of the folder, and some copied material on general issues related to production was seen in the folders of candidates. This is unnecessary as there is plenty of opportunity throughout the various sections of the folder to demonstrate these issues effectively. Systems and Control of course should be evident throughout any folder in this specification. Many candidates achieving the higher grades had taken the opportunity to demonstrate how their system had been manufactured and which industrial practices had been utilised. Many candidates achieving the higher grades had also taken into account the impact their design might have on society. Where centres had addressed this aspect, candidates showed a good understanding throughout their work.

### **Realisations**

It should be noted that a number of candidates achieved low grades as a result of not completing a project which was too difficult for them to attempt or not fully suitable for a Systems and Control specification. Centres should endeavour to match the project specification to the ability/skills of the candidate and the Systems and Control specification.

If candidates choose to make and populate their own PCB boards, their circuit build quality can be improved by securing flying leads to the PCB with strain holes thus adding a mechanical joint to assist the soldered joint. Input and output devices such as Switches and Light Emitting Diodes should be well insulated with bare wires sleeved to reduce the possibility of short circuiting. The PCB and battery should be held securely within the system with easy access to allow changing the battery.

It is advantageous to the candidate to be able to complete a project and see it working. Many candidates do achieve success with PICs and evidence all assessment criteria but centres must ensure that candidates:

- provide evidence of PIC programming
- provide a range of design ideas
- evidence sufficient making skills in other areas of their realisation if using a commercially made bought-in PCB.

### **Correction of working errors**

As previously mentioned, the use of diaries to record the stages of making was seen in an increasing number of centres this year, and this proved to be useful when moderators were looking at work as the moderation of this process often relies on teacher annotation.

### **Use of appropriate equipment and processes (including the use of CAM)**

Once again production diaries are useful in the assessment of this area in pointing out what equipment and processes have been used. It should be stressed that where CAM is used candidates do need to record all aspects of this work with screen dumps and notes in their folders. Centres need to be clear that making grades can only be awarded to the candidate's own making. Whilst many candidates require considerable assistance centres do need to be vigilant about monitoring this work and recording assistance on the Candidate Record Form.

### **Production and effectiveness of outcome**

Electronic and/or mechanical or pneumatic products are expected to function to access the higher grades. However, when visiting, moderators will be sympathetic to a project with the capability of working that may not work effectively on the day of the visit.

### **Level of accuracy and finish**

Generally, this has continued a year on year improvement as fewer candidates take on inappropriate projects. However some centres do not allow sufficient time for final system assembly.

### **Use of Quality Assurance (QA) and Quality Control (QC)**

Once again production diaries are useful in the assessment of this area and it is also evidenced by candidates making their own functioning PCB boards and/or mechanical or pneumatic inputs or outputs. It is important to emphasise that this is part of the making assessment and is not regarded as a section within the design folder.

### **Advice to Centres**

Centres need to choose their design briefs carefully, and if they are unsure discuss them with their Coursework Advisor. If the centre is offering only one design brief to candidates make sure the brief is sufficiently open to give scope for a wide range of challenging outcomes to be designed and made. It is worth considering the following points when starting coursework projects.

- Ensure candidates start a suitable task. It should include scope for them to show their ability and use systems and control technology.
- Start projects early to allow candidates sufficient time for testing and evaluation.
- Match students to project titles that they can achieve within 40 hours.
- Encourage candidates to highlight where decisions are made in the folders and explain why they made them.
- Use the assessment criteria and marking scheme with candidates, to show how they can improve their grade.

- Encourage candidates to keep the research relevant to the project. It may include looking at how other products work and an interview with a potential user. This should also include an analysis, explaining their results.
- Encourage candidates to write a clear and concise brief. This can be two or three sentences. The specification should be as detailed as possible, including measurable statements (e.g. "the final product must be no larger than 100mm x 50mm x 15mm, so it will fit in the user's pocket")
- Ensure candidates record each stage of the project's development and modification. They should keep all their rough work and should not see the folder as an exercise in graphical presentation techniques.
- Set candidates intermediate deadlines for each stage of the project. The making section frequently takes longer than expected and has weighting of two thirds. For candidates to achieve high marks their project needs to be completed. This will also mean they will be able to carry out a detailed evaluation, which could include returning to the person they interviewed as part of their research.
- Introduce the concept of industrial practice as soon as possible in the course and discuss with candidates how this could form an integrated part of their coursework.
- Encourage candidates to use ICT which is relevant to Design and Technology. It is preferable for candidates to show in depth skills in a small range of software, rather than a shallow overview of a larger range of software. A good working drawing using CAD or circuit/system design and development are better examples of ICT skills.

### **Electronic portfolio submission**

There is now the facility for centres to submit portfolios to the moderator electronically. However, if centres wish to do this, they must follow these procedures.

- Contact AQA as early as possible to notify us that you wish to submit portfolios electronically
- The board can then allocate your centre to a moderator who has the facilities to view electronic portfolios
- Centres will be given specific instructions on what format the e-portfolio needs to be in, and how to submit to the moderator.

For more detailed information about using e-portfolios, please contact the AQA subject team.