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General Certificate of Secondary Education

Design and Technology: Systems and Control Technology

Specification 3546

Examiners' Report

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- 3546 Full Course

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General

Centres are to be congratulated on their thorough revision and preparation of candidates for both tiers of the examination. Candidates on both tiers of the paper performed well, showing sound knowledge of electronic components in control situations and, particularly, the application of mechanisms in design situations. The level of preparation of the candidates this year was generally very good. Many candidates demonstrated the ability to produce answers that showed a good understanding of the operation of mechanisms, pneumatics components, and the application of materials. Many of the questions were related to topics candidates should have met during their practical work. The knowledge and skills candidates had developed during their coursework was evident in the well answered questions.

Candidates also scored well on the design questions where they could relate them to coursework designing and making tasks. However, in the design questions the quality of drawing on sketched responses varied from excellent to poor on both tiers. The use of a sharp pencil and a ruler is a minimum requirement. Ink and biro responses gain little credit for drawing quality. Responses to CAD/CAM questions showed good understanding of the range and use of computer based designing and making equipment in schools, particularly in the Higher Tier. AQA was pleased to note high quality responses to the logic and the control sequence questions in the Higher Tier paper.

The health and safety questions were answered very well on both tiers, as were questions related to industrial processes. As in previous years many questions were common to both section A and section B with the questions requiring specialist knowledge of mechanisms and pneumatics being different. The vast majority of candidates in both tiers took the mechanisms option. AQA is pleased to note very few candidates attempted to answer both Section A and Section B. An erratum notice was issued for question A6 (b) on the higher tier. Unfortunately there was also an error on the erratum for which AQA apologises. This error did not place candidates at any disadvantage and due allowance was made in the marking of scripts. Centre administration was generally good. There were very few instances of centres failing to arrange their scripts into candidate order and all scripts were received promptly.

Foundation Tier (3546/F)

As in previous years, the vast majority of the candidates attempted the Mechanisms focus with the better candidates scoring very well. Many questions on the paper were developed to build upon the knowledge and skills developed by candidates during their coursework. Reports from examiners stated that these questions were generally well answered, particularly by the higher ability candidates.

However, some of the middle and lower ability candidates were giving incorrect responses to some of the questions. Most candidates scored well on the Health and Safety and industrial processes questions. Questions requiring the candidates to design met a mixed response, the earlier general comment regarding the use of simple graphics equipment needs to be noted by candidates and centres. At the lower ability range many questions were not attempted. Candidates need to be reminded that an attempt at a question, however limited, always has the chance of gaining marks.

Section A
Mechanisms Focus

Question A1

(a) Well answered, most candidates transferred the correct formula from the formula page, but often the calculation was incorrectly carried out particularly by the weaker candidates. Some credit was given for answers that were the 'wrong way around'.

(b) Most candidates understood the increased leverage created and were able to name a material and give a reason for their choice. However, generic terms are still being used e.g. 'metal' & 'hard' by some candidates. For the full mark a named material e.g. 'aluminium alloy' was required.

Question A2

(a) Well answered, the common components were well known and candidates of all levels of ability scored well. Thermistor and variable resistor were least well known and the battery was sometimes confused with 'capacitor'.

(b) Well answered, these common sensors were well known and candidates of all levels of ability scored well. The mercury tilt switch was the least well known. Marks were often lost for vague uses of the sensors. 'In a circuit' was not acceptable.

(c) The logic gate question was not well answered except by the higher ability candidates. 'Input' and 'output' were common errors and often a guessed series of numbers were entered in the truth table. Candidates who displayed clear understanding in this area scored well.

Question A3

(a) Poorly answered, considering the flow chart symbols were available on the next page. Process and decision symbols were the best known.

(b) Very well answered most candidates scored well. Wrong or missing feedback arrows were common errors.

Question A4

(a) Fairly well answered with candidates showing a good knowledge of a thermistor and its application.

(b) Usually well answered with a common error being 'resistor'.

(c) Attempted by the majority of candidates but only completed successfully by the higher ability candidates. Common errors included:

- Copying part (a) of the question.
- Modifying the two resistors on the circuit instead of adding a potential divider in the allocated space.
- Poorly drawn circuit symbols.

(d) (i) This is a basic circuit but a lot of candidates missed out the AND function. Some candidates tried to use more symbols than were required from the selection given. Some circuit symbols were poorly drawn.

(ii) Usually well answered with most candidates understanding the output requirement. 'Push to break' and 'flick switch' did not gain marks.

Question A5

This question was answered successfully by most candidates. Health and safety with risk assessment and methods of reducing hazards are topics that candidates appear to be comfortable with. Candidates of all levels of ability scored well on this question.

Question A6

(a) Well answered when candidates appreciated the need for safety related answers.

(b) Well answered when candidates appreciated the need to protect the circuit. Most candidates suggested enclosure of some sort.

Question A7

(a) Some candidates did not appear to fully comprehend the question and made generic CAD/CAM points rather than points related to quality.

(b) Some candidates did not appear to fully comprehend the question and made generic CAD points rather than points related to designing and modelling circuits. Candidates sometimes misinterpreted the word model to mean a miniature version.

(c) Usually very well answered but the need to use a test meter of some sort was a regular omission.

Question A8

(a) Usually well answered with successful cam solutions very common. Crank slider, gear, and rack and pinion were also seen, plus many other combinations, all of which gained some credit as long as they could be seen to be able to move the bollard. Notes gaining marks for components and operation were common but marks were often lost for construction and materials.

(b) Improving the system in part (a) was the key point and the more able candidates did attempt to pause the bollard at top and bottom often with a good attempt at the correct cam profile. However, many candidates in the middle and lower ability range either did not develop their previous design or started another, sometimes inappropriate solution, for example stating a 'time delay' with no clear triggering method. Some candidates did not attempt this part of the question and so failed to gain any marks for notes or drawing.

Question A9

(a) (b) & (c) Usually well answered candidates scored well.

(b) Most candidates understood the need to place the sensor after the bollard and could explain why. However, for the full description mark, candidates had to describe the operation of the complete system including sensor one.

Section B
Pneumatics Focus

Question B1

(a) Usually well answered, most candidates knew which input sent the cylinder positive and the correct formula was taken from the rubric. However, a minority had problems with the calculations and the units were often missed although candidates were not penalised for this.

(b) The main benefit of piston control in both directions as opposed to the automatic return of an S/A cylinder was often missed. Only a minority of candidates could name a specific plastic and explain its suitability for the task, many offered a range of metals.

Question B2

(a) Candidates scored well on these common symbols, however, the shuttle valve and spring return were often wrongly named. The shuttle valve was often confused with a flow control valve.

(b) Well answered, these common sensors were well known and candidates of all levels of ability scored well. The mercury tilt switch was the least well known. Marks were often lost for vague uses of the sensors. 'In a circuit' was not acceptable.

(c) This logic gate question was generally not well answered, except by the higher ability candidates. 'Input' and 'output' were common errors and often a guessed series of numbers entered in the truth table. Centres that had prepared their candidates in this area scored well.

Question B3

(a) This question was not well answered, taking into account that the flow chart symbols were on the next page. Process and decision symbols were the best known.

(b) Very well answered most candidates scored well. Wrong or missing feedback arrows were common errors.

Question B4

(a) Fairly well answered with candidates showing good knowledge of a thermistor and its application.

(b) Usually well answered with a common error being 'resistor'.

(c) Attempted by the majority but only successfully by the higher ability candidates. Common errors included:

- Copying part (a) of the question.
- Modifying the two resistors on the circuit instead of adding a potential divider in the allocated space.
- Poorly drawn simple circuit symbols.

(d) (i) This is a basic circuit but a lot of candidates missed out the AND function. Some tried to use more symbols than were required from the selection given.

(ii) Usually well answered with most candidates understanding the output requirement. 'Push to break' and 'flick switch' did not gain marks.

Question B5

This question was answered successfully by most candidates. Health and Safety with risk assessment and methods of reducing hazards are topics that candidates appear to be comfortable with. Candidates of all levels of ability scored well on this question.

Question B6

(a) Well answered, when candidates appreciated the need for safety related answers.

(b) Well answered when candidates appreciated the need to protect the circuit. Most candidates suggested enclosure of some sort.

Question B7

(a) Some candidates did not appear to fully understand the question and made generic CAD/CAM points rather than points related to quality.

(b) Some candidates did not appear to fully understand the question and made generic CAD points rather than points related to designing and modelling circuits. Candidates sometimes interpreted the word model to mean a miniature version.

(c) Usually very well answered but the need to use a test meter of some sort was a regular omission.

Question B8

(a) Usually well answered with single and double acting cylinder solutions very common. Both of which gained credit provided they could be seen to move the bollard. Notes gaining marks for components and operation were common but marks were often lost for construction and materials.

(b) Improving the system in part (a) was the key point and the more able candidates did attempt to pause the bollard at top and bottom sometimes with some attempt at time delay using flow control and reservoir solutions. However, many candidates in the middle and lower ability range either did not develop their previous design or started another, sometimes inappropriate, solution. For example saying a 'time delay' with no clear operating method. Some candidates did not attempt this part of the question and so failed to gather any marks for notes or drawing.

Question B9

(a) (b) & (c) Usually well answered, candidates scored well.

(d) Most candidates understood the need to place the sensor after the bollard and could explain why. However, for the full description mark, candidates had to describe the operation of the complete system including sensor one.

Higher Tier (3546/H)

As in previous years the vast majority of the candidates attempted the Mechanisms focus with the middle ability candidates scoring well and the higher ability candidates gaining very high marks. However, some of the weaker candidates were still giving incorrect responses to some of the questions. Many questions on the paper were developed to build upon the knowledge and skills developed by candidates during their coursework. Reports from examiners stated that these questions were very well answered.

Questions requiring the candidates to design generally met with a very good response. However, the earlier general comment regarding the use of simple graphics equipment needs to be noted by some candidates and centres. Health and safety questions were answered very well, as were questions related to industrial processes and most candidates gained good marks. The responses to CAD/CAM questions showed very good understanding of the range and use of computer based designing and making equipment in schools. AQA is pleased to note high quality responses to the logic and the control sequence questions.

At the lower ability range some questions were not attempted. Candidates need to be reminded that an attempt at a question always has the chance of gaining marks.

Section A
Mechanisms Focus

Question A1

(a) Very well answered, with candidates displaying a good knowledge of a thermistor and its application.

(b) Usually well answered, with common errors such as 'resistor' being given as a response.

(c) Very well answered, however some common errors included:

- Copying part (a) of the question.
- Modifying the two resistors on the circuit instead of adding a potential divider in the allocated space.
- Poorly drawn simple circuit symbols.

Question A2

(a) This question was very well answered with candidates showing a good knowledge of series switching shown. Some common errors included:

- Attempting to use all the circuit symbols.
- Using a push to break switch in the circuit.
- Adding additional symbols, e.g. a transistor.

(b) This question was very well answered, with candidates displaying a good knowledge of simple logic gates.

Question A3

(a) Most candidates saw the need for two cut-outs on the disc. However, some common errors seen by examiners included:

- One or more than two cut-outs indicating the questions key point of two exposures per revolution had been missed.
- Answer attempts made on the 2D view of the disc.

(b) This part produced some mixed answers. It was common to see the two Operational Amplifier inputs (pins 2 & 3) labelled the wrong way round.

(c) Injection moulding correctly answered by most candidates. 'Vacuum forming' was the most common error except when combined with 'extrusion'.

(d) Usually well answered but the key point 'easily made in school' was sometimes missed. Method and materials scored well but drawing ranged from excellent to poor.

Question A4

(a) Usually well answered with successful cam solutions being very common. Crank slider, gear, and rack and pinion were responses which were also seen, plus many combinations all of which gained some credit so long as they could be seen to be capable of moving the bollard. Notes gaining marks for components and operation were common but marks were often lost for construction and materials.

(b) Improving the system in part (a) was the key point and the more able candidates did attempt to pause the bollard at top and bottom often with a good attempt at the correct cam profile. However, many candidates in the middle and lower ability range either did not develop their previous design or started another, sometimes inappropriate, solution. For example by stating a 'time delay' with no clear triggering method. Some candidates did not attempt this part of the question and so failed to gather any marks for notes or drawing.

Question A5

(a) Usually well answered but candidates often lost marks by drawing the cam with an incorrect profile. Also, the need to modify the lever with an appropriate follower was often missed. The cam was sometimes drawn below the lever, which was incorrect as the movement this produced was at right angles to the correct direction.

(b) A wide variety of mechanism responses was seen. The key point of a 90 degree bend was regularly missed and often mechanisms that would only bend one way e.g. rack and pinion with no mention of reversal. Some of the lower ability candidates missed the point of completing their design around the drawing given in fig 16.

Question A6

(a) Mixed responses were seen from this question. The lower ability candidates often failed to score marks due to not selecting any 'moments' formula from the rubric.

(b) The candidates who scored well established the speed of the intermediate shaft at 120 rpm - this was the key calculation. The lower ability candidates often lost marks due to not selecting any gear ratio formula from the rubric.

(c) Generally, a well answered question with a wide range of common input switch sensors seen including photo switch (LDR) answers. However, these were sometimes poorly drawn on the tailgate diagram. 'Movement sensor' was not acceptable.

Question A7

(a) This question was answered successfully by most candidates. Health and safety with risk assessment and methods of reducing hazards are topics that candidates appeared to be comfortable with. Candidates of all abilities scored well on this question.

(b) The PCB etching process is well established in schools and the candidates' responses reflected this. However, a hand drill is unsuitable for drilling PCB and the continuity check needed a multimeter.

Question A8

(a) AQA was pleased to note the high quality responses to this control sequence question. Most candidates adopted a line oriented approach as the lead in to the question suggested. However, flow diagram approaches were also successful and candidates generally scored well. Common errors included:

- No 'END' command used.
- 'Turnon' used instead of the 'flash' command.

(b) The selection of two correct lines from part (a) with 'turnon J' and 'turnoff J' commands was done successfully by the higher ability candidates. However, in the middle and lower ability range, credit could often only be given for using the 'turnon J' and 'turnoff J' commands.

Question A9

Higher ability candidates showed good awareness of the issues and benefits of using CAM equipment. However, this question at times saw some vague and simplistic answers particularly from the lower ability candidates.

(a) There was some lack of understanding relating to the health and safety element. Well stated and relevant reasons for benefits to workers were required for maximum marks.

(b) There was some misinterpretation of safety systems. Well stated and relevant safety benefits for workers were required for maximum marks. 'Safety Notices' and 'instructions to stand clear' were too simplistic and workshop generic to gain credit.

(c) Some good descriptions of CAM processes were given in candidates responses reflecting the growing use of computer controlled making in schools.

Section B
Pneumatics Focus

Question B1

(a) A very well answered question with candidates showing good knowledge of a thermistor and its application.

(b) This was usually well answered, but a common response was 'resistor'.

(c) Again, this was very well answered, but common errors included:

- Copying part (a) of the question.
- Modifying the two resistors on the circuit instead of adding a potential divider in the allocated space.
- Poorly drawn simple circuit systems.

Question B2

(a) The majority of candidates responded very well to this question showing good knowledge of series switching. Common errors included:

- Attempting to use all the circuit symbols.
- Using a push to break switch in the circuit.
- Adding additional symbols e.g. a transistor.

(b) Very well answered with good knowledge of simple logic gates shown.

Question B3

(a) This was a very well answered question with most candidates seeing the need for two cut-outs on the disc. Common errors included:

- One or more than two cut outs, indicating the questions key point of two exposures per revolution had been missed.
- Answers attempted on the 2D view of the disc.

(b) There were mixed responses to this question. It was common to see the two Operational Amplifier inputs (pins 2 & 3) labelled the wrong way round.

Question B4

(a) This question was generally well answered with single and double acting cylinder solutions very common. Both of which gained credit as long as they could be seen to move the bollard. Notes gaining marks for components and operation were common but marks were often lost for construction and materials.

(b) Improving the system in part (a) was the key point to this question, and the more able candidates did attempt to pause the bollard at top and bottom often with a good attempt at time delay using flow control and reservoir solutions. However, many candidates in the middle and lower ability range either did not develop their previous design or started another, sometimes inappropriate, solution, for example saying a 'time delay' with no clear operating method. Some candidates did not attempt this part of the question and so failed to gather any marks for notes or drawing.

Question B5

(a) The calculation of the surface area of the piston was completed very well. Almost all candidates selected the correct formula from the rubric and the majority completed the calculation successfully.

(b) The calculation of the pressure required was well answered. The majority of candidates selected the correct formula from the rubric and most completed the calculation successfully.

(c) The higher ability candidates understood the answer required the difference in the surface area to be explained but the question was not generally answered well.

Question B6

(a) The flow control valve was often correctly positioned to control air out, however the symbol was badly drawn on a number of occasions. Candidates often simply drew a box, however, this still gained credit. A small number of candidates put the flow control valve in the wrong line to the cylinder, however this still gained a mark.

(b) Most candidates drew the piston and labelled its direction correctly.

(c) Most candidates were able to copy the five port valve correctly. However, only the higher ability candidates were fully familiar with the pilot air numbers and the correct valve window when valve B had been pressed.

Question B7

(a) This question was answered successfully by most candidates. Health and safety with risk assessment and methods of reducing hazards are topics that candidates appear to be comfortable with. All levels of ability scored well on this question.

(b) The PCB etching process is well established in schools and the candidates' responses reflected this. However, a hand drill is unsuitable for drilling PCB and the continuity check needed a multimeter.

Question B8

(a) AQA was pleased to note the high quality responses to this control sequence question. Most candidates adopted a line oriented approach as the lead in to the question suggested. However, flow diagram approaches were also successful and candidates generally scored well. Common errors included:

- No 'END' command used.
- 'Turnon' used instead of the 'flash' command

(b) The selection of two correct lines from part (a) with 'turnon J' and 'turnoff J' commands was often carried out successfully by the higher ability candidates. However, on occasion, in the middle and lower ability range credit could only be given for using the 'turnon J' and 'turnoff J' commands.

Question B9

Higher ability candidates showed good awareness of the issues and benefits of using CAM equipment. However, this question at times saw some vague and simplistic answers particularly in the lower ability range.

(a) There was some lack of understanding relating to the health and safety element. Well stated and relevant reasons for benefits to workers were required for maximum marks.

(b) There was some misinterpretation of safety systems. Well stated and relevant safety benefits for workers were required for maximum marks. 'Safety Notices' and 'instructions to stand clear' were too simplistic and workshop generic to gain credit.

(c) There were some good descriptions of CAM processes shown in candidates' responses reflecting the growing use of computer controlled making in schools.

Coursework (3546/C)

General Comments

The overall standard of outcomes continued to improve although centres need to be reminded that all projects, even those of the highest grade, should be achievable within 40 hours. It should be noted that there was a percentage of unfinished 'inoperable outcomes' seen by moderators. Centres should be reminded that it is imperative they make every effort to match the project outline to the ability of the candidates.

In this specification, in order to achieve the higher grades, students are encouraged to combine the core technology with their chosen focus technology. Most centres chose mechanisms as their focus technology, with few opting for pneumatics. AQA is pleased to note that PIC technology was evident in the work of many centres. It should be stressed however, that the use of PIC technology alone is not enough to guarantee a higher grade.

Coursework should be given marks for effective work in the field of Systems and Control. The systems and control element should be an integrated aspect of the project, and bought-in parts, such as motors with gear boxes/PIC boards etc, although useful in achieving projects in 40 hours, should not be used excessively as it becomes difficult for moderators to credit candidates' own work. Centres are reminded that no projects should have a direct mains connection.

The shop display project proved very popular with centres and produced many successful outcomes across the ability range,

Centres should be reminded that the moderation procedure is completely confidential and the moderator is <u>not</u> permitted to offer verbal feedback during their visit. This is particularly so given that moderators are not in a position to determine whether or not any adjustment will be made to centre marks at a later date. Written feedback will be available when results are formally announced.

Administration

This is the third year of this specification and centres are to be congratulated for their development of the subject.

Some centres included annotation of their work, and this was extremely useful for the moderators to help them understand where teachers had awarded marks.

Where more than one teacher is involved in delivering the specification, internal standardisation is essential. This procedure is essential in ensuring that standards of marking are maintained over the entire sample of work, and that the order of merit is a true representation.

This process was carried out well in the majority of centres, but in a small number of centres it was clear that internal standardisation had not always been carried out successfully. However, there are a number of areas which need attention. Centres are reminded that a copy of the Centre Mark Sheet needs to be with the moderator no later than 5th May. Centres with twenty or fewer candidates should also send the moderator all the design folders complete with a Candidate Record Forms and one Centre Declaration Sheet per centre.

AQA would like to request that centres respond promptly to moderators' sample requests, by sending coursework material immediately by first class post. **It was noted that a small number of centres did not structure the work correctly.** This made moderation difficult because of the often disorganised presentation of the material. It is the centre's responsibility to present candidates work in the best possible manner for moderation to ensure their potential is achieved.

Although the vast majority of centres sent well-presented work, carefully bound, and in order of merit to the moderator, some centres still sent loose sheets, or work in large, bulky binders, complete with theory notes.

Coursework Project

Moderators continue to look for well finished, working projects which clearly show how Systems and Control have been used. It is evident that the majority of centres are able to guide their candidates appropriately.

Design folders are expected to show evidence of how the candidates have researched and reached their design decisions. They should also include examples of industrial practice. Whilst most centres achieved this, some submitted folders containing large amounts of irrelevant research. This factor, coupled with poor task analysis, often led to vague design specifications.

In addition to this, although the established Systems approach of Input Process Output is evident in the work from most centres; in some folders final solutions still appear with limited evidence of system development. Centres have also not allowed their candidates' access to the higher grades because they only have one process block in their project, thus limiting them to a grade C. In order to achieve above grade C, projects must contain two process blocks.

Where PICs are used, it is important that candidates explain their programme/flow chart and note any changes and developments made. In many centres where candidates used PICs, very little development work on any aspects of their systems was evident.

AQA was pleased to note many fully functioning outcomes combining different "technologies". It is expected that simple systems will be complete and will work reliably. However, it is accepted that more complex ones may have problems and candidates will not be penalised provided they explain how they attempted to rectify any faults and modify their designs.

Research

Questionnaires and graphs were found in a large percentage of folders however this research rarely provided useful data to influence the candidates. A minority of candidates conducted this activity in a manner which would provide valid data and it is strongly recommended that this activity is discouraged in favour of more product analysis. A good range was seen in some folders, but the understanding of its relevance to the task varied from centre to centre. A lot of materials research was not necessary at the initial stages or irrelevant to the design specification.

Some of the better design folders had summarised research findings rather than including large amounts of copied material, which was more relevant to the design focus. Far too many candidates still had large collections of irrelevant research such as photocopied data on materials and components from textbooks, CD ROMs and the Internet.

Analysis

Moderators noted that research material was often described rather than analysed. AQA would like to stress that candidates should be advised to ask how it is relevant to their work, and what have they learnt that will help them with their system design in order to aid their analysis of the material.

Specification

A number of candidates were weak in this section, providing little or no measurable parameters. Points worthy of consideration are the function of the system, the constraints of cost, size and time, the working parameters of input, process and output devices, a reference to power sources.

AQA is happy 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

Generation of ideas

Although the established systems approach of Input Process Output is evident in the work from many centres, in some folders, final solutions still appeared with almost a complete lack of system development. 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. Moderators reported seeing some candidates expressing ideas in the form of quick, freehand sketches. AQA would like to encourage this as a way of showing candidates' thinking and exploring solutions. Higher level candidates summarised and evaluated their ideas giving clear information on why one or more might be developed further.

Development of a solution

A minority of candidates are undertaking full development of their ideas and instead, are tending to redraw one of their initial ideas as a design proposal. Development work on circuits, PIC programming, and mechanisms was missing from the folders of several candidates. However, some good combinations of control and mechanisms or pneumatics with resistant materials were seen in the work of higher level candidates.

Planning of making

Flow charts were often used 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 a small 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 judgement 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.

Evaluation, testing and modification

Centres need to ensure their candidates have sufficient time to complete this important section. They should encourage candidates to think up interesting ways of testing their projects and the record the results, using block diagrams, pie charts, pictograms, etc. Alarms are very popular projects and if, for example, a candidate designs an anti-theft alarm for a bicycle the scope for testing and evaluation are immense. 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 Use of I.C.T. 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 controls

It was noted that the many centres had not addressed this aspect of the coursework. Many candidates had approached this as a "bolt-on" at the end of the folder. Copied material on general issues related to production was the most common evidence seen. Few demonstrated any real understanding of how their system might be commercially manufactured. Fewer still had 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. Better candidates had noted, for example, that the casing for their product would be injection moulded from ABS.

Making Skills

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. It is advantageous to the candidate to be able to complete a project and see it working.

More candidates are using PICs in their coursework projects than in previous years. Centres must remind candidates who are intending to use PICs of the sections within the Assessment Criteria and ensure that candidates address them. There is a tendency with some candidates to state 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 for Systems and Control Technology should be using a systems approach and identifying the building blocks for the INPUT, PROCESS and OUTPUT sections of the system. If a PIC is chosen as the most suitable building block for the process section, it should be arrived at by way of investigation. 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.

Advice to Centres

- 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 *1OOmm* 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.

Mark Range and Award of Grades

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	69.8	23.9
Coursework	95	210	115.8	41.6
Foundation tier overall 3546/F	--	350	185.6	55.1

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	125	87	73	59	45	31
	scaled	140	97	82	66	50	35
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	210	133	106	80	53	27
Foundation tier scaled boundary mark		350	222	182	142	103	64

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	98.5	20.7
Coursework	95	210	166.6	34.2
Higher tier overall 3546/H	--	350	265.1	46.3

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	125	108	101	94	87	59	--
	scaled	140	121	113	105	97	66	--
Coursework boundary mark	raw	95	95	84	72	60	48	--
	scaled	210	210	186	159	133	106	--
Higher tier scaled boundary mark		350	327	292	261	230	172	143

Provisional statistics for the award

Foundation tier (2556 candidates)

	C	D	E	F	G
Cumulative %	27.4	55.2	74.4	86.9	95.2

Higher tier (3036 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	6.3	31.7	57.6	79.4	95.4	97.6

Overall (5592 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	3.4	17.2	31.3	55.7	77.0	87.0	92.7	96.5

Definitions

Boundary Mark: the minimum (scaled) mark required by a candidate to qualify for a given grade. Although component grade boundaries are provided, these are advisory. Candidates' final grades depend only on their total marks for the subject.

Mean Mark: is the sum of all candidates' marks divided by the number of candidates. In order to compare mean marks for different components, the mean mark (scaled) should be expressed as a percentage of the maximum mark (scaled).

Standard Deviation: a measure of the spread of candidates' marks. In most components, approximately two-thirds of all candidates lie in a range of plus or minus one standard deviation from the mean, and approximately 95% of all candidates lie in a range of plus or minus two standard deviations from the mean. In order to compare the standard deviations for different components, the standard deviation (scaled) should be expressed as a percentage of the maximum mark (scaled).