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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Design and Technology (Systems and Control Technology)

Specification 3546

Report on the Examination

2006 examination - June series

- Full Course

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Full Course

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Foundation Tier (3546/F)

As in previous years, the vast majority of the candidates attempted the Mechanisms focus paper with the higher ability candidates scoring very well. Many questions 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.

However, some of the middle and lower ability candidates gave incorrect responses to some of the questions. It was disappointing that simple circuit components were not recognised by some candidates. Most candidates scored well on the Health and Safety and industrial processes questions. Questions requiring the candidates to design met with a mixed response.

Candidates at the lower end ability range did not attempt many questions. Candidates need to be reminded by Centres, that an attempt at a question, however limited, always has the chance of gaining marks.

Section A
Mechanisms

Question A1

(a) Very well answered but occasionally poor quality drawing of simple circuit symbols and LED symbol poorly drawn or wrong / missing.

(b) Usually all correct demonstrating knowledge, or completely wrong.

Question A2

(a) Usually well done. Common errors included reciprocating and pulley system.

(b) (i) Most candidates scored well. It was rare to not see the correct direction for the cam.

(ii) Up and down was common for one mark, the more able were able to describe the slow rise and sudden drop. Most candidates scored at least one mark.

(iii) Well answered, most appreciated that the follower would jam on the snail cam.

(c) Some unusual cam designs were seen. Most candidates scored 2 marks, unusual not to score one mark (three marks was rare).

(d) Well answered, knowledge of bearings and common uses. “Ball washer” was a common error.

Question A3

(a) Most were able to label input for one mark.

(b) Simple gears were well known. 'Cogs' was a common misunderstanding.

(c) Only the most able gained full marks. Many did it the wrong way around and 2 on its own was a common response. It was disappointing that some candidates could not transfer the formula from the front of the exam paper.

Question A4

(a) A generally disappointing response, these common components and the potential divider, that is common in project work, should have been better answered. Credit was given for correct position with poorly drawn symbols.

(b) Candidates scored well, usually right or completely wrong.

(c) Very well answered question, the flow chart was regularly completed perfectly for 6 marks. It was rare for candidates not to score at least 4 marks.

Question A5

(a) Responses that move forward and return in proportion were rare. Single movement mechanisms for 2 marks were common. At the lower end many inappropriate mechanisms were seen, however most candidates were able to gain at least one mark.

(b) Most candidates scored 2 marks, although some gave an advantage of the product rather than the fact that it was available from a vending machine.

(c) Often well answered for 5 marks. Common errors included "stop" instead of "slip" and "electronic" instead of "gear".

Question A6

(a) Box 1. Two speed fully workable solutions were rare, most candidates failed to explain how to change the speed. More common responses at the top end gained 3 marks. One speed mechanisms for 2 marks were common and most candidates gained at least one mark for an attempt.

Box 2. It was very rare to see a 4 mark answer, bolt and screw were common responses with glue and weld producing low scoring responses.

(b) Most candidates scored by adding a second switch and connecting to the motor but the power supply was often missing.

(c) Most candidates appreciated the need for a safety type of response – the answer was in the previous part of the question.

Question A7

(a) Workshop safety is well known and most candidates scored well. A common reason for not scoring 6 marks was the duplication of rules.

(b) (i) Many "workshop vices" were seen and screw mechanisms scored well. Rack and pinions were common. Drawing quality was often poor, with little evidence of the use of rulers etc.

(ii) Not well answered, poor answers included quick, strong, easy whilst at the top end comments on leverage and mechanical advantage were seen.

(iii) Very rare to see a named soft metal or plastic. Common errors included iron or steel.

(iv) Poor technical responses with common responses including 'strong' and 'hard'.

Question A8

(a) Usually correct. Monostable is well known.

(b) Candidates scored well with most achieving at least one correct component.

(c) Switch 1 often given in error, disappointing as this is a common circuit used in project work.

(d) Candidates scored well on this. Common responses included the internet and parts catalogues.

(e) Very well answered and justified. Common responses included voltage, size, cost etc.

(f) Vacuum forming is well established and candidates scored well. Reasons for not scoring 8 marks included not giving 8 stages or describing vacuum cleaning.

Question A9

(a) Very well answered, CAD and CAM are widely understood concepts.

(b) A variety of responses from full marks to no marks was seen with a common response being 0 1 1 2.

(c) Poorly answered with few candidates being able to draw the correct logic gate symbol.

(d) Very well answered with full marks the most common response.

(e) Well answered, most candidates appreciated the qualities that the robots brought.

(f) Often misinterpreted and instead of "production workers" as asked in the question for gave other examples e.g. window cleaning, carrying shopping.

(g) (i) Again advantages for workers often missed and answers more suitable for consumers were given.

(ii) Advantages for consumers were understood e.g., quality and lower costs.

(iii) Candidates scored well here with common responses being unemployment and breakdown.

(h) Not well answered, the point of replacing logic gates was missed and simple one word answers were given e.g. ‘cheap’ or ‘quick’.

Section B
Pneumatics Focus

Question B1

(a) Very well answered but generally poor quality drawing of simple circuit symbols and LED symbol poorly drawn or wrong / missing.

(b) Usually correct or totally wrong.

Question B2

Candidates generally scored well on this question.

(a) These common components were both well known.

(b) Again both components well known.

(c) The correctly drawn S/A cylinder with spring correctly connected were common.

(d) There was often a need to carefully read candidate responses. The shuttle valve method of operation in OR operation was well known.

Question B3

(a) Almost always correct cylinder labelled.

(b) Most candidates understood the need to clamp first.

(c) Well answered. This is a common pneumatic term and answers reflected that.

(d) Guards and safety systems were common responses.

Question B4

Generally disappointing response, these common components and the potential divider, that is common in project work, should have been better answered. Credit was given for correct position with poorly drawn symbols.

(a) (i) Candidates scored well, usually right or completely wrong.

(ii) Very well answered question, the flow chart was regularly completed perfectly for 6 marks. It was rare for candidates not to score at least 4 marks.

Question B5

(a) Well answered. 3 port and S/A cylinder and 3 port + 5 port and D/A cylinder were common responses.

(b) Most candidates scored 2 marks, although some gave an advantage of the product rather than the fact that it was available from a vending machine.

(c) Candidates scored well, "machine" instead of "user" was a common error.

Question B6

(a) Very rare to see a good response, "bolt" was rare, often not answered.

(b) Often unsuitable ends on a 3 port valve.
Correctly completed cylinder, candidates scored well.
Connections to cylinder often correct. Connections to both windows was common, it was rare to see them correctly connected to the same window.

(c) Switch and solenoid often correct, the power source often missing.

(d) Safety response was common.

Question B7

This question was usually well answered by the pneumatics candidates.

(a) Workshop safety is well known and most candidates scored well. A common reason for not scoring 6 marks was the duplication of rules.

(b) (i) 2 x 3 port and 5 port + D/A cylinder common (often poorly drawn) scored well. Also 3 port and S/A cylinder seen but to grip the 3 port valve had to be held on.

(ii) Good justification seen for use of 5 port and D/A cylinder – it will close and grip.

(iii) Very rare to see a named soft metal or plastic. Common errors included iron or steel.

(iv) Again poor technical responses with common responses including 'strong' and 'hard'.

Question B8

(a) Usually correct. Monostable is well known.

(b) Candidates scored well with most achieving at least one correct component.

(c) Switch 1 often given in error, disappointing as this is a common circuit used in project work.

(d) Candidates scored well on this. Common responses included the internet and parts catalogues.

(e) Very well answered and justified. Common responses included voltage, size and cost.

(f) Vacuum forming is well established and candidates scored well. Reasons for not scoring 8 marks included not giving 8 stages or describing vacuum cleaning.

Question B9

(a) Very well answered, CAD and CAM are widely understood concepts.

(b) A variety of responses from full marks to no marks was seen with a common response being 0 1 1 2.

(c) Poorly answered with few candidates being able to draw the correct logic gate symbol.

(d) Very well answered with full marks the most common response.

(e) Well answered, most candidates appreciated the qualities that the robots brought.

(f) Often misinterpreted and instead of "production workers" as asked for in the question gave other examples e.g. window cleaning, carrying shopping.

(g) (i) Again advantages for workers often missed and answers more suitable for consumers were given.

(ii) Advantages for consumers were understood e.g. quality and lower costs.

(iii) Candidates scored well here with common responses being unemployment and breakdown.

(h) Not well answered, the point of replacing logic gates was missed and simple one word answers were given e.g. 'cheap' or 'quick'.

Higher Tier (3546)

As in previous years the vast majority of the candidates attempted the Mechanisms focus. 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 well answered.

Questions requiring the candidates to design generally met with a good response. 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.

Candidates at the lower end ability range did not attempt many questions. Candidates need to be reminded by Centres, that an attempt at a question, however limited, always has the chance of gaining marks. Centres must be take care to ensure they are entering candidates for the correct level, e.g. foundation or higher tier qualification for their ability.

Section A
Mechanisms

Question A1

(a) Well answered but some candidates made errors with the LDR symbol and transposed the symbols.

(b) Well answered with most candidates scoring 2 marks.

(c) Very well answered with few errors.

Question A2

(a) Well answered with most candidates scoring 9 out of 10, most failed to add a WAIT command between drill down and drill up. Those that chose to answer as a flowchart gained the marks for continuous operation as they usually drew a return loop, those that completed the written instructions sometimes often forgot to return the program to the start.

(b) Good well explained answers. Weaker candidates explained the principle without reference to an LDR or microswitch.

(c) The concept of non-erasable was well understood.

(d) Most candidates could give one advantage with the stronger candidates giving two.

Question A3

(a) (i) The Power Rails were well answered.

(ii) The Variable resistor was correctly answered by most candidates.

(iii) The Buzzer was poorly answered. Most candidates connected something to pin 3 but it was rarely the correct symbol or connected to only 0 volts.

(b) (i) Most candidates could identify the diode, a common error was LED.

(ii) It was an even split 50:50 of responses regarding the orientation.

(iii) Few could explain why the diode was required. Most explained its behaviour.

Question A4

(a) Well answered with most candidates scoring full marks. A common error was to repeat a safety rule.

(b) (i) Generally well answered with most candidates drawing a screw thread.

(ii) Most candidates gave one good reason and a weaker one e.g. strong

(iii) A poor response. Most candidates had failed to take into account that the jaw was to grip a polished brass bar.

(iv) As above, the common response was related to strength rather than to prevent damage.

(c) Inputs were usually correctly identified, process and output less so. Many candidates failed to understand that it was the process of the clamping mechanism and not the whole production process that was being asked for.

Question A5

(a) (i) Well answered with most candidates showing two sizes of pulley but few gained full marks as they did not explain how the operator could choose between the two speeds.

(ii) A wide range of answers from no response, through glue and weld to Grub screw or key. The quality of the sketches was better than the notes explaining the system.

(iii) Well understood and answered. Some of the more able candidates tried to complicate the answer with logic gates or 555 timers.

(b) Commonly well answered.

Question A6

(a) Few candidates managed to gain two marks with many unable to gain one mark. Common errors included "to save power", "to slow it down".

(b) Few candidates gained full marks but most copied the correct formula and used the correct units. A popular wrong answer was 100 rpm, where candidates had used the correct formula but failed to realise that it was a compound gear train.

(c) Few candidates managed to gain two marks with many unable to gain one mark.

(d) Generally well answered. Common answers included 'crane' and 'fan belt'. Incorrect answers included "Gearbox" and "Bike Chain".

Question A7

This question received a wide range of responses from perfect to random. Some candidates had the correct circuit but lost marks as they had failed to label the switches, drew bulbs instead of LEDs or forgot to add the resistor(s).

Question A8

The majority of candidates scored highly on this question.

(a) (i) Most candidates gained 2 marks for explaining how CAD works.

(ii) Well answered, responses included quicker to set up, no risk of damage to components.

(b) Some struggled on the use of symbol libraries.

(c) (i) A variety of responses but most understood the concept of auto-routing.

(ii) Most candidates could give an advantage.

(iii) Poor responses for the material for the PCB mask. 'copper' was a common wrong answer.

(d) A variety of responses with few that gave two ways in which CAM could improve quality.

Question A9

A wide range of responses from fully working designs for a gripper to cartoon sketches of a robot. The better responses sometimes lost marks for not following the marks awarded guidance i.e. not showing paths of travel of parts or mentioning the power source.

Better responses included grippers powered by motor driving a rack and pinion. Some candidates copied their screw thread (vice) response to question A4b.

Section B
Pneumatics Focus

Question B1

(a) Well answered but some candidates made errors with the LDR symbol and transposed the symbols.

(b) Well answered with most candidates scoring 2 marks.

(c) Very well answered with few errors.

Question B2

Well answered with most candidates scoring 9 out of 10, most failed to add a wait command between drill down and drill up. Those that chose to answer as a flowchart gained the marks for continuous operation as they draw a return loop. Those that completed the written instructions sometimes forgot to return the program to the start.

(a) Good well explained answers. Weaker candidates explained the principle without reference to an LDR or microswitch.

(b) The concept of non-erasable was well understood.

(c) Most candidates could give one advantage with the stronger candidates giving two.

Question B3

(a) (i) The Power Rails were well answered.

(ii) The variable resistor was correctly answered by most candidates.

(iii) The buzzer was poorly answered. Most candidates connected something to pin 3 but it was rarely the correct symbol or connected to 0 volts.

(b) (i) Most candidates could identify the diode.

(ii) It was an even split of responses regarding the orientation.

(iii) Few could explain why the diode was required. Most explained its behaviour.

Question B4

Well answered with most candidates scoring full marks. The common error was to repeat a safety rule.

(a) (i) Generally well answered with most candidates drawing a single acting cylinder.

(ii) Most candidates gave one good reason and a weaker one e.g. strong.

(ii) A poor response. Most candidates had failed to take into account that the jaw was to grip a polished brass bar.

(iv) As above, the common response was related to strength rather than to prevent damage.

(b) Inputs were usually correctly identified, process and output less so. Many candidates failed to understand that it was the process of the clamping mechanism and not the whole production process that was being asked for.

Question B5

(a) A variety of responses with few candidates gaining full marks by showing a fully workable solution.

(b) Well understood and answered. Some candidates did not show the correct ends on the valves. Another common error was connecting the air lines to different sides of the 5 port valve.

(c) Mostly well answered with candidates drawing the second push switch in series.

(d) Well answered.

Question B6

(a) Few candidates gained full marks but most copied the correct formula and used the correct units. A popular wrong answers were the correct figures but the wrong magnitude e.g. 1570 N.

(b) Well answered, some candidates could only give one advantage.

(c) Generally well answered.

(d) Generally well answered. Weaker responses included “to control flow”.

Question B7

This question received a wide range of responses from perfect to random. Some candidates had the correct circuit but failed to label the switches, drew bulbs instead of LEDs or forgot to add the resistor(s).

Question B8

The majority of candidates scored highly on this question.

(a) (i) Most candidates gained 2 marks for explaining how CAD works.

(ii) Well answered, responses included quicker to set up, no risk of damage to components.

(b) Some struggled on the use of symbol libraries.

(c) (i) A variety of responses but most understood the concept of auto-routing.

(ii) Most candidates could give an advantage.

(iii) Poor responses for the material for the PCB mask. 'Copper' was a common wrong answer.

(d) A variety of responses with few that gave 2 ways that CAM could improve quality.

Question B9

A wide range of responses from fully working designs for a gripper to cartoon sketches of a robot. The better responses sometimes lost marks for not following the marks awarded guidance, i.e. not showing paths of travel of parts or mentioning the power source.

Better solutions included double acting cylinders operating a grip with all controlling valves and pipe work shown (although this was not required). Some candidates copied their response to question B4b.

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. It should be noted that the percentage of unfinished and inoperable outcomes previously seen by moderators also decreased. Moderators continued to report that they were made welcome by centres which 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. It is pleasing to report that very few candidates used glue to seal their cases or hot glue guns to hold printed circuit boards or batteries in place. Centres need to make candidates aware of the moderation process and the need to design their systems to accommodate routine maintenance and changes of batteries.

The moderation time period is extremely tight 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 need to 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 standardization 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 know 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.

Assessment

Most 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.

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 ***photos 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 becoming more realistic in terms of the time spent by the candidates, following the advice given in recent years. This allowed candidates to achieve working outcomes in the time available. CAD/CAM is on the increase, contributing to the quality of the systems manufactured. 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 analysed 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 better 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 be involved 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 use of flow charts was 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 were planning and making manufacturing decisions throughout their coursework, yet very little of it is being recorded, candidates should be encouraged to record these decisions in a manufacturing diary. Decisions are made by candidates of all abilities but, records are often omitted by even the higher ability candidates.

Evaluation, Testing and Modification

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 the 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’ at the end of the folder, and some copied material on general issues related to production was again seen in the folders of some 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. 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.

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 *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

Full Course

Foundation tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	77.4	22.3
Coursework	95	210	117.1	42.0
Foundation tier overall 3546/F	--	350	194.6	53.8

		Max. mark	C	D	E	F	G
Paper boundary mark	raw	125	98	84	70	57	44
	scaled	140	110	94	78	64	49
Coursework boundary mark	raw	95	60	48	36	24	12
	scaled	210	133	106	80	53	27
Foundation tier scaled boundary mark		350	229	191	154	117	80

Higher tier

Component	Maximum Mark (Raw)	Maximum Mark (Scaled)	Mean Mark (Scaled)	Standard Deviation (Scaled)
Paper	125	140	85.2	18.6
Coursework	95	210	168.9	30.0
Higher tier overall 3546/H	--	350	254.1	40.2

		Max. mark	A*	A	B	C	D	allowed E
Paper boundary mark	raw	125	91	88	85	82	63	-
	scaled	140	102	99	95	92	71	-
Coursework boundary mark	raw	95	95	84	72	60	48	-
	scaled	210	210	186	159	133	106	-
Higher tier scaled boundary mark		350	311	277	250	224	177	153

Provisional statistics for the award

Foundation tier (2266 candidates)

	C	D	E	F	G
Cumulative %	28.5	56.7	74.6	87.0	94.6

Higher tier (2755 candidates)

	A*	A	B	C	D	allowed E
Cumulative %	6.6	31.3	57.7	79.5	96.0	98.3

Overall (5021 candidates)

	A*	A	B	C	D	E	F	G
Cumulative %	3.6	17.1	31.6	56.5	78.3	87.6	93.2	96.6

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).