Examiners' Report Summer 2008

GCE

GCE Engineering (8731/9731)

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Summer 2008

Publications Code UA019962

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Unit 1 – Paper 6931/01
Engineering Materials, Processes and Techniques

General Comments

Generally, the paper seems to have worked well, eliciting a good range of responses with no particular problems being found. The paper was broadly comparable in difficulty to the published exemplar and to previous papers.

Marking for this, the second year, was carried out online and went quite smoothly. Examiners are now familiar with the system.

Comments on Individual Questions:

Q1
A gentle lead in to the paper, and reasonably well answered. A common mistake was that candidates referred to problems of the bright/ultraviolet light from spot welding, rather than the more serious problem of sparks.

Q2
This question was comprised of a table asking for specific materials and significant properties and was quite well answered. However, candidates were penalised for use of non-technical terms such as "light", "strong" or "heavy". It was pleasing to note the increased use of technical terms such as "swarf", although still by a minority of candidates - phrases such as "excess material thrown off" were widely used (and allowed). A common, incorrect, ceramic material named by many candidates was "clay".

Q3
Most candidates knew the basic features of galvanizing, but the second part on electroplating was less well answered, with candidates mentioning an electric current through the sample, but omitting reference to an electrolyte or electrodes.

Q4
Most students chose suitable materials, for both parts of the question, but only a minority got full marks for comparisons of glass with acrylic.

Q5
Candidates were presented with a data table of different materials, and then asked to select a suitable material for a given function on the motorcycle, and to justify their choice. This was a large question, with 21 marks possible, and most were able to gain over half of these marks. The very last part, (c), involved two benefits of stainless steel, with four marks available. Only the most able candidates obtained full marks for this sub-question, so it appears to have acted as a good discriminator.

Q6
This question was about the carbon fibre reinforced plastic process. Surprisingly few candidates were able to accurately describe the process. It tended to be muddled up with injection molding, with mentions of "molten plastic".

Q7
Although parts a) and b) were generally answered well, a good number of candidates could not fully describe and compare the advantages of soldering with crimping. The last part of the question proved to be demanding as very few candidates achieved full marks.

Q8
This general question on hardness testing was well answered by only a small number of candidates. Some marks were given if a “scratch test” was described, but many candidates lost all marks by describing a tensile tester – presumably because this was the test they were most familiar with. A minority did offer correct tests, such as the Vickers test.

Q9
The final question was on tensile testing, and nearly all candidates managed to gain some of the marks, presumably for the reasons mentioned in Q8. Only a few, however could explain how stress and strain are calculated.

GCE Applied Engineering
Principal Examiner's Report June 2008
Unit 2 – Paper 6932/01
The Role of the Engineer

General Comments

Unfortunately, some centres (albeit a reducing number) still seem to encourage their candidates to start with a long introduction to the subject, the topic, the history of the company, multiple organisation charts, etc., and some are still including details of a range of different engineering roles and professions which occur in one company or the whole engineering world, taking as much as ten pages. None of this is relevant to the assessment criteria for this unit and attracts no marks across mark bands 1 to 3. Candidates may be including this in order to 'bulk out' their portfolio of work, but they run the risk of hiding their real work behind it all.

Before a candidate starts their research, centres should ensure their chosen engineer and product or service has the potential to evidence the whole assessment grid, across mark bands 1 to 3.

The good portfolios start with a short introduction, to set the scene, say who the engineer is, where they work, etc., and all this in less than half a page of A4. The fonts are a normal size (10 or 12 point) not massive and colourful, the paper is A4 and produced in portrait mode, not landscape, and any diagrams are relevant and well explained. Any extra material, such as leaflets, data sheets, etc. from industry should be kept to a minimum and if it is not specifically referred to, or it is not the candidate's own work – it should not be included at all.

The presentation of the portfolios still causes many headaches for moderators and the postal sampling methods. Each portfolio should be held together with one treasury tag through the top left hand corner, as with all examination papers. Folders, boxes, presentation wallets, even plastic sleeves tend to impede the moderation processes making the work difficult to get to, difficult to lie flat on a desk to read and if selected for use at an awarding meeting, difficult to photocopy.

Assessment criterion (A)

More centres than before are now making contact with the engineering industry in some way in order to attempt this unit. A few, nevertheless, still try to complete the work using internet searches about specific articles and seem to be reporting on what they would imagine an engineer would do. This just about addresses mark band 1 and gains very few of the available marks. The better centres and candidates provide real evidence that they have contacted an engineer and visited him or her at least once and even had email or telephone contact to ask further questions. To address the top of mark band 2 and mark band 3, the candidates need to be relating their engineer's activities which are relevant to the product or service they work with. Some centres tend to opt for a product, a service and/or an engineer and the evidence produced does not reach into the higher scores because they have not carried through the link between the person and their work, which really is the essence of this whole unit.

The majority of candidates achieved scores within mark band 2, stopping short of explaining and justifying the actions taken by their engineer.

Assessment of this section was generally accurate, with only a handful of centres being over generous.

Assessment criterion (B)

This is one of the high scoring sections of the unit, some candidates are achieving double figures, and a few scoring 11 and 12 marks for providing a range of technologies which their engineer uses, and then going on to justify the reasons for using these and the advantages for the product, the service, the company and, where relevant, the customer. Some moderation of marks was undertaken for this section, but generally the performance of candidates is improving and the assessment is becoming better evidenced. A handful of candidates still interpret this section on 'technology' to be about the machines used by the engineer, and others interpret it as the software which helps them do their job. Both of these are only part of the expected content and as the specification indicates, the communications systems and control systems in use by the engineer, relevant to the product or service, also need analysing, reporting on and, again, justification for the high mark band.

Some candidates (though a reducing number) are including comments like 'my engineer is too old fashioned and doesn't need any technology', when their assessor/teacher should have guided them to choose an engineer who carries out work which will allow them to generate evidence across the whole mark assessment grid, with extended opportunities to evidence mark bands 2 and 3.

Assessment criterion (C)

In section 'c', it now seems to be appreciated by most centres that the legislation and standards need to be relevant to the industry and most of all, relevant to the product or service undertaken by their engineer. The assessment of this section is also very reasonable, on the whole, and very few scores are expected to be reduced for section 'c' following moderation.

Looking at some of the weaker candidates' work, it seems that the candidate may not have planned his or her interview with the engineer terribly well. One good way of receiving better answers from their engineer would be to send them a list of questions which they will be asked. Some centres seem to encourage candidates to work with list of questions, the candidates then take the engineer's answer as the full answer without carrying out a bit more probing. A difficult task for a 16 year old, but a skill worth developing for many careers, particularly future engineers.

The standards and legislation tend to include British Standards, (BS and BSEN) or standards of other countries if they represent the customer, as well as quality standards, government and professional body inspections or standards of performance, etc. The part that is regularly overlooked, or not evidenced, is the explanation of how the engineer makes sure the standards are complied with. Responses, such as 'they do it or they get sacked' are not sufficient to earn any points, but a few candidates mentioned regular checks, included checklists and sampling techniques used by some engineers and this is one way of evidencing the high mark band.

Assessment criterion (D)

This section continues to be mixed up with section 'c' and assessors are again advised to count any marks or points which can be found anywhere in the portfolio, although it is better to be in the correct section. At AS level, in particular, we do not want this qualification to be seen as a ‘hurdled qualification’ where candidates have to provide particular answers in relevant sections only. Writing a report covering all the points required is difficult due to the open nature of this unit, so it is reasonable to expect only the highest ability candidates to get everything correct and in the right place.

This is one of the sections where candidates who did not make contact with an individual engineer gained few, if any marks, but this is not always the case. Some candidates, whether they talk to their engineer individually or not, will take the notes from their discussion and some research about legislation and health and safety, etc., and then sit alone trying to imagine how it all fits together, instead of discussing it with their tutor or preferably getting back in touch with their engineer.

Assessment criterion (E)

This is seen as the most difficult criterion to do and it is still the most difficult to get right. Some candidates came very close to full marks with this section for June 2008. Each of these high scoring candidates had investigated an engineer, and the choice of engineer was across a wide range of industries, and the thing that helped them achieve high marks was providing evidence which demonstrated that they understood what their engineer did, what the product was and how it should perform and had actually taken part in carrying out some real tests. Finally, they gave their own personal evaluation of the product and identified any weaknesses.

Where a group of students all looked at the same engineer, or the same product, and several of them gave the same evaluation, followed by an almost identical list of recommended modifications, it is almost impossible for them to score anything above halfway through mark band 1 which states that they need to demonstrate ‘objective, personal judgements’.

Overall, this section remains the section which costs candidates the most marks due to over generous assessments being reduced following moderation. This indicates that when each candidate is choosing their engineer and product or service it is essential that tutor guidance is given by asking the candidate ‘can your investigation address MB3 throughout this unit?’ If not, think again.

Assessment criterion (F)

In the first couple of years of this qualification, it was feared that candidates at 16/17 year old would not be able to make the type of suggestions and comments required for this section. Experience has proved this belief to be wrong and some candidates are performing very well with this section and many score between 6 and 8 points, just by following the assessment grid descriptors. If sections ‘a’ to ‘d’ have been thoroughly covered and reported on, using a real engineer and product or service, then section ‘e’ has been fuelled by some deep investigation and analysis of the product and the customer it is being produced for, the high scoring candidates then find that each of their criticisms from section ‘e’ can be expanded on through section ‘f’, producing some acceptable suggestions to improve the product or service.

GCE Applied Engineering
Principal Examiner's Report June 2008
Unit 3 – Paper 6933/01
Principles of Design, Planning and Prototyping

General Comments

Once again, as in 2007, a wide range of coursework projects was undertaken by students and Edexcel approved titles such as 'PCB holder' and 'television wall mount' featured strongly. Most students produced work that allowed them the opportunity to fully access the marks available and only a few chose coursework tasks that provided only limited levels of response and failed to reach AS expectations. Although tasks were potentially appropriate, many students failed to reach high levels of achievement, but this was generally recognised by teacher assessors and credited accordingly.

Once again, where electronic project work was submitted for moderation, students showed little real understanding of circuitry and most was of a low level that is generally surpassed by GCSE standards. In setting problems for students, some centres allowed an open choice of task, while others limited choice to one or two briefs and some set all students the same task. Where this occurred, the vast majority of students took ownership of the 'theme' and personalised and developed it appropriately.

The standard of student performance mirrored that of 2007 in most respects. Problem areas were once again in criterion 'C' the design and development of proposed solutions, where students failed to present a range of alternative solutions that were well annotated and thought through in engineering terms. The vast majority of students achieving marks in the middle to low ranges presented only one solution to the problem in hand, as they had already decided what their outcome would be. More able students produced better results here as expected, but it was rare to find high quality work in this criterion. The use of CAD continues to grow and most students have become expert users, allowing the vast majority to score significantly in criterion 'A'.

Most centres seem now to have grasped what is meant by the 'engineering approach' to their work, moving away from the Design and Technology approach of placing emphasis on form rather than function. As already alluded to, where electronic circuitry was included in project work, it was usually of very low level and was almost always based on a 'found' circuit that students had not developed at all.

More students scored higher marks this year in criterion 'D' and most project work was completed and functioning. Most students produced clear photographic evidence of what they had manufactured, but this requirement remains problematic for some centres. Some students submitted minimal photographic evidence such as a single image as part of a presentation in criterion 'E', and some only included photographs of their work in progress without a final separate image of the completed product to aid moderation. Some photographs were in black and white, which made it difficult to see detail and a few students submitted no photographic evidence of practical work at all, relying on witness statements to justify their marks.

Most centres submitted the sample of work on time, but many failed to include authentication sheets. Most centres submitted marks appropriately, but some used copies of the assessment criteria photocopied from the subject specification and wrote marks on these. Where this occurred, there was no accompanying annotation. Some centres used their own assessment grids to record marks, which was often difficult and awkward to follow. Some centres with larger cohorts sent more than ten samples of work. Moderators complained of poor packaging of samples from some centres. Loose, unidentified pages, several pages in one plastic sleeve, folders containing manufacturers brochures, worthless in terms of credit, were all avoidable issues that added to the burden of moderation.

Teacher assessment was generally inaccurate in criterion C, but broadly acceptable in A, B, D, E and F.

Assessment criterion (A)

The quality of engineering drawings has continued to improve as more students have become expert in the use of CAD drawing packages. Fewer hand drawn engineering drawings were seen, but where this technique was used, the quality of outcome was generally high. Some problems still remain, such as failure to complete title blocks, or include details of materials and parts, and the use of appropriate dimensioning that conformed to British Standards was not always in evidence.

All students who submitted work in this criterion were able to produce formal engineering drawings of some description, and these usually included some industry standard symbols and drawing conventions. However, some students failed to understand what is meant by a 'range' of engineering drawings. A range could include detailed pictorial views, assembly drawings and exploded views, as well as formal orthographic drawings. As with last year, some students produced drawings that lacked important dimensions, while others were not drawn to scale. Many students produced several high quality engineering drawings, but failed to include enough information to enable the design proposal to be manufactured.

Overall, this criterion was well tackled by students, the majority of whom were able to achieve good marks.

Assessment criterion (B)

When planning their project, almost all students were able to produce a plan that included a sequence of events, some realistic timings that focused on processes related to the design needs and some points of quality control and/or safety consideration. There was usually a chart or Gantt chart included in this assessment section, but some planning lacked the depth of understanding and detail of the sequence of events needed to achieve successful product manufacture within a realistic time span. Many students presented retrospective 'diaries' of events instead of forward looking 'plans', while others included the whole of the design process in their time charts instead of focusing only on the manufacturing of their product and where this occurred, plans lacked appropriate detail.

Written specifications presented by students varied from excellent to weak and superficial. More students this year were able to identify key points that were considered important, but many failed to justify specification statements with additional information. For example, the statement "the frame should be made from aluminium alloy tubing" is not justified until the additional information "so that it is light while being strong in compression" is added to qualify the first part of the statement.

Although in general most students scored quite well in this assessment section, a significant number of specification points presented were superficial and generic and lacked technical information that could have been used to evaluate the final outcome.

Where research was gathered, it often failed to be used to inform the specification and many students presented information that gained no credit because it was generic and did not focus closely enough on the problem in hand.

Assessment criterion (C)

This criterion was the least well done and was often over-marked by teacher assessors. Despite more students embracing the 'Engineering' approach to their work, where materials choices and selection of processes need to be scientifically or mathematically justified, many failed to offer this feature in their work. Where electronic circuitry was included in project work, students usually offered little detail of building blocks or sub-systems and the level of response was generally low. More credit could have been gained from illustrating the proposed circuit in circuit modelling software such as 'Crocodile Technology' or 'Livewire', then developing the circuit into a Printed Circuit Board using an appropriate software package such as 'PCB Wizard'.

Most students submitted a range of alternative design ideas relating to their chosen project, but these were often limited and some students presented no alternatives, relying on a single solution. Where this was the case, marks were immediately limited, as the assessment criteria demands a range of alternative ideas to be offered in order to score significantly. Many ideas were of a low level, lacking a true understanding of the problems involved and student annotation failed to convey technical information regarding design features, materials and processes that could have been used in constructing the ideas.

Although it is expected that students will produce a range of alternative ideas to solve the problem in hand that focus on its technological content, it is not always necessary to produce a complete solution in a proposed design idea; it is acceptable that students consider the sub-systems that make up the intended product and focus on these as alternative ideas too.

Formative evaluation of design ideas was not very well done and many students failed to review their design ideas against the measurable points in their product specification, or to use the specification as a basis for their alternative design ideas.

Students should explore a range of approaches to their work in this section, using their knowledge of technical detail, materials, techniques and processes to produce realistic design proposals that match the points of specification.

As work progresses, alternative designs and their details should become linked and strands of continuity should be seen in higher quality responses as one idea moves to the next to be improved upon.

Communication skills are important in conveying ideas and students are encouraged to use any appropriate means of illustrating their work that they are comfortable with, as long as the results are clear and easily understood.

Effective annotation is an important feature of this section to enable students to explain details of design thinking and to offer evaluative statements regarding their design proposals.

In evaluating each alternative idea, it is important that students refer to points of specification objectively and avoid using tick-boxes or marks out of ten as a deciding factor in which design to select for further development.

Health and safety issues were not well considered by most students and where this did take place, considerations were usually focused on the use of machinery and processes employed during manufacture of the product and did not consider the health and safety issues linked to product design proposals.

Assessment criterion (D)

In this criterion, most students presented evidence that was fairly rewarded by teacher assessors and for the majority, this section was their most lucrative in terms of marks gathering. A wide range of high quality skills was in evidence through the production of successful, functioning prototypes and most students were successful in manufacturing an outcome to their task that matched their final design proposal, but a significant number failed to reach the higher skill levels.

There was little evidence this year that some practical work had been carried out by technicians and teachers, for instance where welding or the use of machinery such as band saws was concerned and where this was the case, marks were awarded appropriately.

It is pleasing to report that, in comparison to previous years, many more products were complete and working as intended, due mainly to good planning, time management and the selection of projects that are achievable in the time allowed. Although the vast majority of students submitted photographic evidence of their practical work, a significant number lacked the detail necessary to illustrate the complexity of task and the higher-level skills necessary to gain higher marks.

Choice of project is crucial to the success of this course for students and centres must ensure through teacher intervention that individuals are working at a level of response appropriate to their abilities and that they are able to realise their potential within the demands of time and task set.
In this assessment criterion**,** students are asked to produce a high quality product that meets the requirements of the specification and fully matches the final design proposal in terms of function, sizes, finish etc.

During manufacture, students should demonstrate their understanding of a range of materials by selecting, justifying and using those that are appropriate to their needs in terms of properties and working characteristics that were detailed in the specification and work-plan.

Students must show demanding and high-level making skills in order to achieve the high category of marks in this section, so it is essential that the product under construction offers enough complexity to allow access to high marks. As evidence of the quality of manufacture, clear photographs must be submitted that show enough detail to support the credit awarded during centre assessment. As photographic evidence is the only proof of manufacturing quality, it is essential that images convey details of levels of difficulty and complexity of construction, so it is unlikely that a single image will achieve this. A series of photographs taken over a period of time during manufacture is the ideal way of highlighting processes used and providing examples of precision and attention to detail that may not be readily noticeable in an image of the finished product.

Photographic evidence can also be employed to support a student's awareness of health and safety issues when working.

Assessment criterion (E)

Most students provided appropriate evidence of oral presentations, which included hard copies of Powerpoint slides, CD Roms and teacher witness statements, which were generally informative and provided useful annotation regarding individual student performances. This assessment criterion was generally well marked by centre assessors.

GCE Applied Engineering
Principal Examiner's Report June 2008
Unit 4 – Paper 6934/01
Applied Engineering Systems

General Comments

Cohort numbers at each centre were not high, so sub-sampling was not needed.

Most centres appeared to have assessed reasonably accurately, within the tolerance margin of 4 marks. There was occasionally a tendency for centres to be a little too lenient. In a few cases this was excessive, i.e. over 10 marks (out of the 60 available). This does demonstrate the importance and necessity of the external moderation.

Suitability of approach

The activities set in the brief were generally well responded to. The early availability of the brief seems to be welcome and the 2009 brief will again be available in September.

Standard of student performance compared with previous years

In comparison with 2007 the performance of candidates appears to be broadly similar. Some improvement in activity 1 was noticeable, this is most likely to be because of more familiarity with the unit, now in its second year. The results were generally quite pleasing, with many candidates attaining the higher grades.

The first two activities were generally well executed, especially the tensile testing and calculations around the pin jointed structure. A common error that did occur was candidates failing to identify the UTS as simply the maximum load point of the curve; usually taking it instead as the fracture point, which is quite different.

The decision to allow centres to choose a steel other than the high-carbon one originally specified clearly allowed the vast majority of centres to carry out activity one satisfactorily.

Activity three involved some electronics knowledge and references to data logging procedures. This was the least well done part, particularly the electronics. Only a minority of the candidates gave a suitable interface circuit for the sensor (a microphone).

It does seem that candidates are not properly prepared for the electronics part of this unit. Many tried to devise digital sampling circuits from the basic components, which was usually incorrectly done and, in any case, not necessary – an off the shelf, low cost, data logger could have been considered.

Additionally, for activity three, many of the solutions had little detail and were very sketchy.

There was clear evidence of internet use (downloads, sometimes unattributed). This was in spite of the fact that candidates should **not** have access to the internet for their work over the ten hours allowed.

However, to summarise, the overall level of response was good.

Centre performance, including administration

In one case no work was provided for activity one. This was presumed to be due to lack of equipment, but represents a serious situation, with loss to the students' potential marks and grades.

Most centres provided their samples of work in time, with appropriate documentation. Almost all had correctly provided the signed certification of work.

A minority did not use the Mark Record sheet provided by Edexcel, using instead a centre devised system or just photocopies of the assessment criteria, with marks against each section.

Annotation of the learner work was patchy and sometimes non-existent, which made the moderation more difficult, as the evidence then has to be sought from within the work.

GCE Applied Engineering
Principal Examiner's Report June 2008
Unit 5 – Paper 6935/01
The Engineering Environment

The candidates who performed best in this unit were those who were encouraged to find another engineer and/or product or service to investigate following unit 2 the year before and demonstrated their research and reporting skills with great effect. It is usually clear which centres provided candidates with copies of the assessment grid and explained each section to them, probably providing examples of how each part could be covered. There is no specific subject skill required to teach this unit, but a willingness to research the topics with the candidates and learn with them, which we all do, tends to show benefits for candidate performance and the comprehensiveness of the portfolios.

A reduced number of poor portfolios were presented for moderation this year. However, there does still seem to be a small number of centres who let their candidates produce work which is not relevant to any of the criteria or outcomes and addresses few, if any, of the mark band descriptors.

Second year GCE students need guidance on what needs to be done and the best way is to help them understand the requirements of each box on the assessment grid. The highest scoring centres appear to have taken steps to ensure this is the case.

Most centre assessors are now using the Mark Record Sheets which are provided by Edexcel in the Teacher Guidance material, available from the website. Some assessors only indicate the page numbers where each section is addressed, but others write brief notes on the mark record sheets to indicate the content which can be found there. Very few assessors annotate the candidates' portfolio, but the few who do this, accurately, have to be congratulated by the moderation team for helping a remote moderator locate the evidence required to address each section across the mark bands. Some use guides, such as 'AO1, AO2,' etc – written in the margin. The most effective annotation comprises the assessment 'verbs' or 'key words' from the mark bands being written in the margin throughout the portfolios – e.g. 'explain', 'identify', 'justify' etc. This action is recommended for all assessors.

Assessment Criterion (A)

This section is intended to build on the introduction to standards and legislation provided in unit 2. Many candidates scored high marks on this section and this is probably due to the extra time they have had to identify the relevance of, and need for, engineers to work within specific guidelines in order to produce the desired product or service and to minimise the risks to the environment and all concerned. Some candidates' work contained some very superficial or generic comments and a few of them appear to have included anything they could think of, hoping that quantity would earn them a high mark. Where assessors gave high marks for work of this nature, they have been reduced following moderation. The majority of candidates produced work within mark bands 2 and 3 and the majority of assessors demonstrated reasonably accurate marking.

Assessment Criterion (B)

This section covered the full range of scores and was assessed very accurately. The lowest scoring candidates included several samples of documents in an appendix at the back of their work, without referring to them in the main body of their work – hence, no marks can be awarded because they have not addressed any of the outcomes for any mark band. It is recommended that appendices are avoided and the inclusion of extra material is kept to a minimum. Some high scoring candidates included a few scans or photographs of sample documents which they had reduced in size and written explanations around them.

Assessment Criterion (C)

A large number of candidates included many pages of very interesting 'save the planet' type material for this section and section 'd', but did not make sufficient use of it to gain many marks. Some higher scoring candidates made reference to information and included small sections, but the main reason why they scored high marks was because they had analysed the information from the point of view of being relevant to the engineer, the product or service being investigated. Very few scored above mark band 2 for this section because they had not found out about, or had not reported on, the impact they had on the engineered or manufactured product – and a few that did failed to understand how to justify the energy efficiency measured taken.

Assessment Criterion (D)

Again, as with section 'c', many candidates included lots of information about energy efficiency, domestic appliance ratings, machinery efficiency, etc, but only those who did anything with it, which was relevant to the engineer and the service or product, achieved anything more than mark band 1 scores.

Assessment Criterion (E)

Several candidates seemed to be doing the same work they had done the year before for unit 2, section 'b', and although there are similarities, it must be remembered that this is A2 and the expectations are higher. Many listed and described the 3D CAD and other software packages in use – and what they could do if they had a system, but this is only part of it. The specification indicates that modern technology and techniques could include 'smart' material, electronic components and techniques of manufacture, optical fibres, communications, etc., and it was disappointing to see the number of candidates who had merely downloaded information about the latest mobile phone. The expanding applications of nanotechnologies has not once been mentioned in a unit 5 portfolio, and it is topics like these that need to be included and used to fire the imaginations of our young engineers to support the ongoing research.

Assessment Criterion (F)

This is, again, a difficult section and the high achievers are the candidates who have obviously spent some time researching and investigating their engineer and the products or services they work with. Others tend to be happy to provide criticism of the 18 month old computer someone is using, or the lack of the latest most expensive software which does everything, etc – and recommending they buy it without consideration of cost, impact on the product or the engineer using it, etc.

GCE Applied Engineering
Principal Examiner's Report June 2008
Unit 6 – Paper 6936/01
Applied Design, Planning and Prototyping

General Comments

Moderators report that many more students this year had produced true 'engineering' work that reflected scientific and mathematic influence. Almost all coursework seen was appropriate to the requirements of this unit, allowing students access to the full range of marks. A broad approach to work was adopted by most centres, which produced a wide and diverse range of engineering outcomes, although a minority of products were no more than well-made metalwork tasks. Teacher guidance appears to have improved this year and most students seem to have had a better understanding of what evidence was required in each of the assessment criteria.

As might be expected, there was an improvement in approach and performance by most students as centres used last year's 'first time through' experience to assist them. Some outstanding coursework was seen, which was beyond the levels of response expected at A2 level and in these cases, students were expert in their fields of study, demonstrating true ownership of their work.

Most coursework was appropriate to A2 levels of response and moderators reported that there was in improvement in the 'engineering approach' where students showed evidence of the use of scientific and mathematical reasoning. However, despite a better approach, some students failed to reach the expected A2 level of response, but this was generally recognised by teacher assessors and marked appropriately. Almost all students approached their work through product design, with some excellent results. Fewer Design & Technology products were seen this year, and work often featured scientific and mathematically justified elements. Areas of difficulty for some students were criterion A, where research was often unfocused and general and there was too much padding. As with AS work, criterion B, design and development, was usually the weakest area of students' work and C 'discussion with peers or engineers' was often either not attempted or completely misunderstood. Testing was often weak, where students failed to justify tests, or carry them out under realistic conditions. Evaluation was often subjective and did not include the views of a client or user-group.

In the submission of work for moderation, most students were well organised and presented logically prepared coursework folders with appropriately titled sections that were easy to follow. Some students however were less well organised and work lacked page numbers and section titles which hindered moderation. Almost all students used specialist ICT to aid their work and this resulted in some very high quality presentation.

Most centres submitted the sample of work on time, but many failed to include authentication sheets. Most centres submitted marks appropriately, but some used copies of the assessment criteria photocopied from the subject specification and wrote marks on these. Where this occurred, there was no accompanying annotation. Some centres used their own assessment grids to record marks, which was often difficult and awkward to follow.

Moderators complained of poor packaging of samples from some centres. Loose, unidentified pages, several pages in one plastic sleeve, folders containing manufacturers brochures, worthless in terms of credit, were all avoidable issues that added to the burden of moderation.

Teacher assessment was generally slightly inaccurate but consistent, which is understandable where large numbers of marks are attached to some assessment criteria. Photographic evidence was usually good, but quite a few E6 requests were made to centres for missing or clearer images to aid moderation.

Assessment criterion (A)

All students were able to gather information from a range of sources that focused on the problem selected for investigation. The most successful students were selective in their research, using only information that was relevant and helpful to the development of designs and the formation of a comprehensive product specification. However, many students assembled vast amounts of research material that amounted to no more than padding. This kind of irrelevant and unfocused information carries little currency value and students would be much better advised to use their time and efforts in other areas that are likely to elicit more marks. Selectivity, focus and relevance are the key statements that should be borne in mind when gathering research material.

Many students undertook analysis of existing similar products to find out about materials, processes and construction methods used in producing similar commercially manufactured products and this practice is to be commended as it is useful in developing high-level technical understanding of products and their manufacture.

Appropriate research areas that could be useful to students include product analysis, market research, materials and component research etc, but all must relate closely to the needs of the identified problem under investigation and should contain technical information that can be used in the design and development of a design proposal.

Specification writing ranged from excellent to superficial. The best examples of technical specifications used gathered research as a basis for identifying key technical points that were based on scientific and/or mathematical justification which allowed testing and evaluation to be realistic. Some students consulted with their peer group or 'a client' to ensure that the specification points were appropriate to the problem in hand and that they met the identified needs. Many weaker specifications contained superficial and general points that could not be used as a guide to design and development.

Assessment criterion (B)

Moderators reported that the work in this section was generally weak and often failed to reflect the assessment criteria statements. In this section, teacher assessors often over-rewarded students by awarding marks for gathering research rather than using it to inform design ideas. Students showed little flair in their designs or willingness to explore a range of ideas. Many students settled on a single design solution, while others appeared to add 'extra' designs cosmetically, rather than for true technical development.

Many students did use their product specification to evaluate design proposals against, but this was often superficial or brief, especially where weak specifications were in existence.

There was evidence of some good modelling, but there was usually little design development beyond specifying materials and processes. Development should reflect and illustrate 'change' and a moving-on of a design proposal to a final refined state suitable for manufacture. Many students simply used an initial idea and repeated it instead of developing it further.

Students should explore a range of approaches to their work in this section, demonstrating their knowledge and understanding of their engineering studies, including consideration of technical detail, materials, techniques and processes when producing realistic design proposals. As work progresses, alternative designs and their details should become linked and strands of continuity should be seen in higher quality responses as one idea moves to the next to be improved upon, reflecting knowledge and understanding gained from the study of other units in the engineering course.

Communication skills are important in conveying ideas and should reflect the gains made since the AS project. Students are encouraged to use any appropriate means of illustrating their work that they are comfortable with, as long as the results are clear and easily understood.

Effective annotation is an important feature of this section to enable students to explain details of design thinking and to offer evaluative statements regarding their design proposals and the needs of the product.

In evaluating each alternative idea, it is important that students refer to points of specification objectively and consider any feedback from peers.

Assessment criterion (C)

Many students were able to organise and carry out discussions with other engineers/peers and record feedback from these meetings. However, in many instances they failed to use these meetings to gather useful, critical information that was used to modify their subsequent design decisions. This assessment criterion was often marked generously by teacher assessors who credited any meetings between students and peer group as appropriate.

Assessment criterion (D)

In this assessment section, most students were able to offer comprehensive planning for production, but only a minority achieved effective descriptions of relevant regulations and standards.

Plans for production were generally well done, outlining a sequence of events, use of processes and materials and referring to time and deadlines. The best examples of planning included quality control and health and safety issues.

In this assessment criterion, planning for manufacture should include reference to time management, consideration of commercial methods of production including sequencing for batch/mass production and quality control. Health and safety issues should also be considered. Planning must be based on forward thinking and not treat it as a retrospective exercise, as this reduces the information to a diary of events and takes it out of this assessment category.

An appreciation of the application of relevant standards and regulations to the production of students' work was not well done and many students offered no evidence in this assessment section. Examples of regulations and standards that could have been considered include ISO 9000/2000, which relates to quality management; ISO 9002, promoting quality standards such as RFT (right first time); OHSA 18001, which relates to health and safety at work; ISO 14000, which deals with environmental standards. There are also more specific standards to consider where appropriate, such as BABT – British Approvals Board for Telecommunications; BEAB – British Electrical Approvals Board and others.

Assessment criterion (E)

In this assessment section, students produced work that was outstanding in some instances and justifiably scored very high marks. Lower level, less demanding, work often demonstrated good quality skills, but could not meet the assessment criteria for higher marks because of the lack of challenge in the manufacturing task. Where this was the case, teacher assessors usually awarded marks appropriately. The use of CAM in the form of laser cutters and CNC machinery was evident, but used appropriately, so that products were not dominated by such technologies, allowing students to show a range of processes and competencies.

High quality photographic evidence is essential in conveying the quality and complexity of product manufacture, and most centres are adept at producing ranges of excellent images in support of the marks awarded. However, a number of centres failed to submit appropriate images and some submitted no photographic evidence of practical outcomes at all. Where this is the case, centres cannot expect to have their marks agreed.

In this assessment criterion**,** students are asked to produce a high quality product that meets the requirements of the specification and fully matches the final design proposal in terms of function, sizes, finish etc.

During manufacture, students should demonstrate their understanding of a range of materials by selecting, using and justifying those that are appropriate to their needs in terms of properties and working characteristics that were detailed in the specification and work-plan.

Assessment criterion (F)

All students presented evidence of some testing and evaluation, which ranged from thorough and well described field tests carried out under realistic conditions, to superficial, subjective statements. In the best examples of testing and evaluation, students evaluated their products against the specification and photographed evidence of their field trials. Client involvement and feedback were also in evidence, which led to realistic suggestions and designs for modifications. However, a significant number of students produced superficial evaluative comments, which did not involve third-party comment, or discussion with the client and were not set against points of specification.

When they have completed the manufacture of their product, students are asked to use specific tests to check its fitness for purpose. The finished product should be tested under realistic conditions to determine its success, and this can be done best by using the points of specification to check product performance and its quality. Field trials carried out by potential users is a reliable way of gathering objective feedback and students should use this tool whenever possible.

Results of testing should be used as a basis for summative evaluation so that students' comments are as objective and unbiased as possible.
Information from testing, evaluation and client feedback should be used by students when making suggestions for modifications and future improvements to the product. Suggestions for modifications should focus on improving the performance of the product, or its quality and should avoid superficial, cosmetic changes that are wholly subjective.

Statistics

6931 Engineering Materials, Processes and Techniques

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	90	71	63	55	47	40
Uniform Boundary Mark	100	80	70	60	50	40

6932 The Role of the Engineer

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	60	46	40	34	29	24
Uniform Boundary Mark	100	80	70	60	50	40

6933 Principles of Design, Planning and Prototyping

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	60	48	42	36	30	25
Uniform Boundary Mark	100	80	70	60	50	40

6934 Applied Engineering Systems

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	90	51	44	37	31	25
Uniform Boundary Mark	100	80	70	60	50	40

6935 The Engineering Environment

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	90	51	44	38	32	26
Uniform Boundary Mark	100	80	70	60	50	40

6936 Applied Design, Planning and Prototyping

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	60	52	46	40	34	28
Uniform Boundary Mark	100	80	70	60	50	40

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