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Examiners' Report Summer 2007

GCE

GCE Engineering (8731/9731)

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

General Comments

Overall the paper worked well and was fair test of the knowledge one would expect from an AS level candidate. It elicited a good range of responses with no general problems. The paper was broadly comparable in level of difficulty to the published exemplar.

Q1

A gentle lead in to the paper, and reasonably well answered.

Q2

This question, a table asking for specific materials and significant properties, was quite well answered, though occasionally candidates misread and gave a *use* for the material rather than a *property.* Candidates were penalised for use of non-technical terms such as "light", "strong" or "heavy".

Q4

In part (a) (ii) a lot of candidates chose a suitable material, but then suggested injection moulding even if they had used steel or aluminium alloy. No candidates mentioned 'clean or quality check'. For part (b) most candidates managed to describe some way of attaching the blade, although a good few chose to use bearings, which is incorrect.

Q5

Some candidates did not appear to read the question carefully enough, and spent a lot of time writing about the wrong materials. Most candidates chose appropriate materials, but it was surprising to see how many did not know the materials used in this everyday item (eg ABS or steel for the plug pins).

Q6

Almost all candidates could name a thermoplastic, but many could not identify a thermoset. Part (b) about structure was poorly answered, but part (c), about actual properties produced better responses.

Q7

Although parts (a) and (b) were generally answered correctly, some candidates did not know that the UTS was the point of maximum loading. In part (c)(i)-(ii) - many candidates included the right formula but the wrong calculations, or vice-versa and occasionally units were omitted in answers.

Q8

This question about joining the two halves of the case together and then discussing the relative merits of two materials was reasonably well answered.

Conclusion

As indicated questions 1, 2, 3, 4a and 8 produced good responses, but question 7 proved more problematic for candidates.

GCE Applied Engineering
Principal Examiner's Report June 2007
Unit 2 – Paper 6932/01
The Role of the Engineer

General Comments

The number of centres that submitted scripts this year increased since last June and the work submitted covered the full range of scores. Moderators were pleased to find that most centres had marked their candidates' work consistently and accurately which was an improvement since last year. Clearly more teachers/assessors had been to INSET events and been in contact with Edexcel, who pass on any queries to the senior moderators/examiners to generate as quick and effective a response as possible.

Moderators were advised to provide guidance in their reports to any centres where the teachers had been assessing inaccurately and to explain why scores were reduced. If the moderator report does not make this clear, or if teachers want further advice and explanation, they are advised to make contact with Edexcel who will put them in touch with the senior moderators to discuss the issues raised. It is also recommended that any teacher who wishes to obtain the views and guidance of the senior moderators should make every effort to attend the INSET events, starting in or around the October half term.

Internet Searches and Plagiarism

A few centres submitted work that candidates had downloaded from the internet. This year, the number of such instances approached double figures. The use of the Internet is to be encouraged if the research is in preparation for a visit or as a follow up exercise after making initial contact with an engineer. What is not acceptable is to carry out an Internet or text search and attempt to use this as the sole means of addressing the criteria. In the introduction to this unit on page 21 in the specification, paragraph 3 states 'you will investigate the role of a professional engineer'. Without actually meeting and talking to an engineer, it is very unlikely that a candidate will produce work which covers anything beyond mark band 1.

Preparation and Contact with Engineers

The benefits of carrying out a thorough study of the specification on-line Teacher Guides, as well as taking part in INSET event(s), cannot be over stressed. It was also evident that where centres had arranged effective and relevant contact between their learners and practising engineers, the portfolios tended to contain material which had the potential to address the assessment criteria across all three mark bands.

If this presents some difficulty due to location or geography, the Internet provides a means of finding the contacts, for example, the local Chamber of Trade or Commerce, the local or regional SETPOINT contact; Education Authority advisors, IIE and IEE (now combined to create the IET) websites all contain contact details. Many contain the personal contact details of local engineers. Engineers like to help recruit the next generation of engineers, so please be advised to make use of them. There is also a range of other sources of contacts, including regional employer federations and telephone directories.

Once contact has been established and possible visits arranged, a large amount of guidance and support must be provided by the teaching staff to help ensure that the engineers chosen are aware of the criteria and that they can provide opportunities for the learners to address the full spread of criteria across all the mark bands, allowing the learners to achieve their maximum potential. This year, all the criteria in each candidate's portfolio was about one engineer and product or service, as per the specification, and there were no incidents of trying to cover one or two sections from a different source, which was the case last year, especially for 'testing and evaluation'.

Presentation of a portfolio

A brief introduction to ‘set the scene’ often helps, but should be limited to a short paragraph. Anything more than half a page, such as the company history, the engineer’s 4 years at university, or pages of description about the different possible careers in engineering are all interesting, but not relevant. A few candidates produced portfolios as formal technical reports with decimal headings, sub-headings, sub-sub-headings, etc. This is not a requirement, but if it helps to keep a candidate focused on the topic, teachers may wish to encourage this approach.

The use of six sections with headings which directly reflect the six outcomes ‘a’ to ‘f’, is a perfect way of presenting the work. References were generally fair, but many portfolios contained large appendices. If an appendix is not referred to in the main body of the portfolio, it is ignored. Please encourage candidates to produce a portfolio with six sections as discussed above and include a small snippet from a company document, rather than the entire document, legislation or standard. Assessors can only mark the candidates' own work.

Coursework Authentication Sheets (CAS) and Mark Record Sheets were not included by all centres. Without the inclusion of these documents, particularly the CAS, the work may not be accepted.

Centres are reminded that candidates’ work should be submitted using either treasury tags, staples or paper clips rather than lever-arch files and/or plastic or card folders.

Assessment criterion (a)

Most candidates completed this section quite well. It was clear which candidates had spent time effectively with their chosen engineer, but a weakness in many portfolios was that very few of them had pushed their inquiries far enough to obtain evidence to cover mark band 3 in order to justify why their engineer undertook certain activities which were specific to the product or service under investigation. Some candidates said what their engineer might have done if the circumstances had been different, but the reason for this was not clear. The communication skills required to interrogate a professional engineer are challenging and may need teaching in the early stages of the program, or the linking with key skills communications could see some development of these skills. The regular use of the assessment criteria grid and the 'verbs' within each statement will also help candidates see what they need to cover.

Assessment criterion (b)

The ‘technology’ which needs to be investigated should be that which the engineer uses whilst carrying out her or his work on the product or service they are involved with. The specification indicates (on page 22) what this could include - CAD/CAM, software applications, control systems and communications – and some portfolios contained some very thorough detail which addressed this criterion well. A few candidates, as with last year, described the machines which were in the factory where their engineer worked, whether they were relevant to the product or service under investigation or not. Technology can include the machines and control systems in use, but it is not the only facet of 'technology' as outlined in the specification.

Some candidates seemed to find it easy to cover mark band 3 by giving detailed explanations about why email had advantages over letters and faxes, how mobile phones allowed immediate and international access to colleagues and clients, CAD produces clear, reproducible drawings which can be easily modified, and they can be emailed. or downloaded into CAM equipment to produce rapid prototypes.

Assessment criterion (c)

The difference between criterions (c) and (d) is still unclear to some candidates and teachers. Criterion 'c' requires details of legislation and standards which affect the product or service which the engineer is responsible for providin

g, whereas 'd' is about the health and safety standards which affects the way they carry out their work criterion.

Criterion (c) continues to be the most easily misinterpreted. Suggestions on how to address the legislation and standards which influenced the product or service is described in detail in the Teachers' Guide. Perhaps learners need more encouragement to question their engineers about the legislation which they are guided by and which they must adhere to. For instance, any British Standard (BS or BS-EN) which the engineer refers to, or works in accordance with, is the aim of this criterion. Do they use 'as fitted' drawings, or some other documentation system? Is there a final inspection report carried out before 'handing over' the work to the client?

One aspect which was covered quite well by a number of candidates is the 'cradle to grave' consideration of their product. Some good explanations and justifications were evident in portfolios which explained how the expired article was to be disposed of at the end of its life.

Assessment criterion (d)

Health and Safety standards are generally set by employers, using current relevant legislation as the minimum acceptable standard. All employees must abide by the Health & Safety at Work Act (1974), but not all candidates mentioned this. Some mentioned 'risk assessments', but failed to mention the Management of Health and Safety at Work Regulations (1999) which outlines the requirements for them. Asbestos Regulations and COSHH, etc, were referred to by some candidates, but in most cases, the candidates failed to fully address mark band 3 by reporting on how the engineer ensured that appropriate standards had been met. Some candidates appeared to have asked, but had been told 'I just know they do' which is unhelpful. There were also instances of pages and pages of legislation details which had been dumped from the Internet and used to bulk out the portfolio. Please advise candidates that we can only award marks for their own work.

Assessment criterion (e)

This continues to be the most challenging area of this qualification. Evaluation and testing of the product or service to ensure 'fitness for purpose' cause the most problems. Some evaluation was carried out by candidates, but many used reports from their engineer without doing any testing or evaluating themselves. The evidence generally lacked depth on the actual tests made because very few included details of how the product or service was checked to ensure fitness for purpose. One simple, but effective way in which this was addressed by at least one candidate last year, was to check the production rate of certain articles. They counted how many were produced in a few minutes, then converted this to articles per hour as a production rate. They checked this with the engineer's claimed production rate and discussed this and criterion (f) with the engineer, almost fully addressing all the mark bands. Teachers need to ensure that the engineers involved are aware of the assessment grid before and during the candidates' investigation and reporting. Evaluation is a difficult task, particularly for someone new to the world of engineering. Many candidates included test reports of cars which they had researched on the Internet, which is OK to an extent, provided they have met an engineer who works with the production of the car and is following up some query to take back and discuss.

Use of Internet or magazine-based research does not provide relevant opportunities for coverage of the assessment criteria.

Assessment criterion (f)

Although some candidates scored well on this criterion, it continues to be a problem if criterion (e) is not addressed properly. To achieve high marks, each point raised must follow a comment mentioned in criterion (e). Many did not. To suggest improvements to a product or service possibly needs the candidates to be given more background information and opportunities to practice such investigations throughout the year. As with criterion (e), expecting a candidate to have gained sufficient experience and knowledge to be able to suggest modifications, with justifications, is a real challenge for all but the most determined of candidates.

GCE Applied Engineering
Principal Examiner's Report June 2007
Unit 3 – Paper 6933/01
Principles of Design, Planning and Prototyping

General Comments

In this examination series, some excellent work was seen, some of which was beyond the expectation of the AS level of response.

Those centres who had prepared candidates for this course last year generally improved their performance where they had acted on advice offered through moderator feedback and the Principal Moderator's report.

There was an improvement too in the majority of candidates' approach to 'Engineering' coursework, where scientific and mathematical concepts were considered and there was less reliance on 'Design & Technology', an approach which focuses on form and function without justification.

A wide range of coursework projects was undertaken by candidates and titles such as 'PCB holder' and 'can shaker' proved popular choices. Most candidates embarked on appropriate tasks that provided opportunities to access the full range of marks, but a significant number failed to achieve the quality and skill levels necessary to gain high marks. Where electronic project work was submitted for moderation, there was little evidence of the quality of making linked to the electronic circuitry, which was usually hidden inside a case that had been photographed from the outside. When submitting electronic project work it is essential that clear photographic evidence of 'electronic-making' is shown.

Some centres appeared not to appreciate the greater level of demand in coursework projects one year on from GCSE and an accompanying rise in levels of response from candidates. A significant amount of the work seen by moderators was of a GCSE standard, but was credited highly by centres when applying the AS assessment criteria.

In setting problems for candidates, many centres limited the choice of tasks to one or two design briefs and a significant number of centres focused all candidates on the same initial task. This strategy enabled planning and resources to be centralised and teacher input to be effective and relevant to all candidates. However, this approach resulted in some instances in replication of evidence, especially research, which appeared in several candidates design folders. Where candidates were allowed to identify their own design brief, this frequently resulted in low levels of performance, particularly where electronic projects were pursued. Where teacher intervention was effective, candidates were much more focused and more likely to achieve success.

Most centres submitted samples 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, which hindered moderation. Some centres used their own assessment grids to record marks, which were often difficult and awkward to follow.

Centres are reminded that candidates' work should be submitted using either treasury tags, staples or paper clips rather than lever-arch files and/or plastic or card folders.

Teacher assessment was often inaccurate, particularly in criteria 'b' and 'd' where more marks are available and many centre assessors were optimistic when awarding marks, where the evidence identified did not match the credit given and could not be interpreted in terms of assessment criteria statements.

Assessment criterion (a)

The response to this assessment criterion improved in this examination series in comparison to last year. More candidates this year used CAD packages to produce engineering drawings and the overall standard was high, with many candidates displaying expertise in this area. However, a significant number of candidates failed to complete title blocks, include details of materials and parts, or use appropriate dimensioning that conformed to British Standards.

The vast majority of candidates were able to produce formal engineering drawings, and these usually included some industry standard symbols and drawing conventions. A significant number of drawings however were limited in quality and understanding and candidates failed to produce a range of engineering drawings eg detailed pictorial views, assembly drawings, exploded views etc. Some drawings lacked important dimensions, while others were not drawn to scale. Many candidates produced several high quality engineering drawings, but failed to include enough information to enable the successful manufacture of the designed prototype. The trend remains in some candidates' work, where engineering drawings are generated without input from candidates themselves, from 3D sketches created in CAD packages such as ProDesktop. Where such practices occur, candidates must adjust and modify drawings to bring them in line with British Standards requirements, so that their chances of achieving higher marks are maximised.

Assessment criterion (b)

As was the case last year, when planning projects, most candidates were able to produce some realistic timings with reference to processes and the established design brief. Planning usually included a time chart or Gantt chart, but some planning lacked detail and understanding of the necessary sequence of events required to achieve a successful outcome within a realistic time span. Many candidates 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.

The quality of specifications presented by candidates varied in content and detail. Most candidates were able to identify some key points, but not many attempted to justify specification statements with additional information. For example, the statement "aluminium alloy should be used to manufacture the body of the device" is not justified until the additional information "because this material will not corrode when used in outside weather conditions" is added to qualify the first part of the statement.

Often, specification points that were presented were superficial and generic and lacked technical information that could have been used to evaluate the final outcome.

Many candidates spent a great deal of time and effort collecting research, but much of this was unfocused and did not relate directly to the problem in hand and was hardly referred to when developing the product specification. Although there was better evidence of success this year, a significant number of candidates continued not to understand how to structure a technical specification. Candidates would benefit in future from using appropriate sub-headings to present linked information logically.

Assessment criterion (c)

As was the case last year, in this assessment criterion, the standard of performance was particularly disappointing and many candidates failed to reach the higher range of marks available, although many centres gave high levels of credit where there was not enough evidence to support the marks awarded. Although more candidates appreciated the necessary 'Engineering' approach to work, where material choices and selection of processes needs to be scientifically/mathematically justified, many missed opportunities to explore these justifications and a disappointing number of candidates once again adopted the 'Design and Technology' approach, placing emphasis on form rather than function. Few candidates used their research to inform their ideas and not many used formative evaluations to review their design ideas against their product specification. Where electronic circuitry was included in project work, it was usually at a low level and was often based on a 'found' circuit that candidates had not developed at all. 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'. Where electronic solutions to problems were proposed, there was generally much more emphasis placed upon the design and development of the case in which to place circuitry, rather than the technology and electronic engineering behind the proposed solution.

Most candidates presented a range of alternative design ideas relating to their chosen project using appropriate design strategies, but design ideas were often not well analysed in terms of possible materials and processes used for manufacture and there was little evidence of research information being used in the designs presented. Many ideas were at a low level, lacking a true understanding of the problems involved and in many cases candidates appeared to have already decided what their final solution was going to be and did not explore their problem fully. Although it is expected that candidates will produce a range of alternative ideas to solve the problem that focuses on its technological content, it is not always necessary to produce a complete solution in a proposed design idea; it is acceptable that candidates consider the sub-systems that make up the intended product and focus on these as alternative ideas too.

The review of alternative ideas was not done well and many candidates failed to evaluate their design ideas against points of specification, or use the specification as a basis for their alternative designs.

Candidates 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 and effective annotation are important in conveying ideas and candidates are encouraged to use any appropriate means of illustrating their work, as long as the results are clear and easily understood.

In evaluating each alternative idea, it is important that candidates 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 candidates 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)

Evidence was seen of high quality skills presented by a significant number of candidates who had obviously enjoyed their coursework experiences and had succeeded in producing successful, working prototypes. Most candidates succeeded in producing a practical outcome to their chosen problem that reflected their final design proposal, though many displayed limited making skills that were limited and modest.

There was evidence that some practical work was carried out by technicians and teachers, particularly where welding or the use of machinery such as band saws was concerned, and while this is acceptable if the outcome is marked appropriately, high marks cannot be awarded where candidates have had little input beyond assembly of parts. Many products were unfinished and did not work as intended, but were rewarded highly by centres, and a number of centres submitted no photographic evidence of practical work, relying on 'witness statements' to justify marks awarded. The practical outcome is worth one third of the marks available, so it is essential that clear photographic evidence of manufactured outcomes is supplied by centres, otherwise no marks can be awarded in this assessment section. Despite submitting photographic images of 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. 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 candidate's awareness of health and safety issues when working.

Not many candidates provided details of materials and their selection based on mathematical or scientific reasoning. Candidates would benefit in future from consulting materials data/performance information, or referring to the knowledge and understanding they have accumulated via their study of Unit 1 when specifying and justifying their choice of materials and processes to be used during product manufacture. Some candidates were aware of safe working practices during manufacture and recorded their assessments, while others gave little or no consideration to this feature.

Choice of project is crucial to the success of this course for candidates 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.

During manufacture, candidates 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.

Assessment criterion (e)

Most candidates 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 candidate performances. Where centre assessors award marks in the higher regions for criterion (e), it is essential that evidence is supplied in support of the credit given that goes beyond simple witness statements.

GCE Applied Engineering
Principal Examiner's Report June 2007
Unit 4 – Paper 6934/01
Applied Engineering Systems

General Comments

Overall, low entry numbers at each centre meant that sub-sampling was not needed. Most centres appeared to have assessed reasonably accurately. However, there was a general tendency for them to be a little too lenient. Very occasionally this was excessive, ie over 10 marks (out of the 60 available).

The activities set in the brief were generally well responded to.

No comparison with previous years is possible, as this was the first cohort to take this unit. However, the results were generally better than might have been expected, with many candidates attaining the higher marks.

The first two activities were generally well-executed, especially the tensile testing and calculations around the pin-jointed structure. In some instances candidates were unable identify the UTS as simply the maximum load point of the curve, taking it instead as the fracture point, which is quite different.

Activity three required electronics knowledge and references to data logging procedures. Of all the activities this was the least well done, particularly with regards to the electronics. Only a few candidates knew the correct use of a potentiometer.

Furthermore, many of the solutions showed little mechanical detail.

There was evidence of internet use including downloads, that were sometimes unattributed. Centres are strongly reminded that candidates should **not** have access to the internet during the ten hours allowed fir the timed examination .

In summary, the overall level of response was good.

Most centres provided samples of work on 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. Centres are reminded that they must use the Mark Record Sheet provided by Edexcel.

Annotation of learners' work was sometimes non-existent, which made the moderation more difficult, as the evidence then has to be sought from within the work. Again, centres must ensure they annotate candidates' work clearly and accurately.

GCE Applied Engineering
Principal Examiner's Report June 2007
Unit 5 – Paper 6935/01
The Engineering Environment

General Comments

The majority of centres, as expected worked with industry, as indicated within the specification, and some achieved exceptionally high scores. This is expected due to the increased awareness and maturity of A2 candidates but it also reflects the increased confidence of teachers as they guided their candidates and assessed the work which they had done in comparison to the January 2007 series. Assessment, in general, was accurate, with only a few centres needing adjustments of scores.

As with unit 2, teachers should ensure that candidates are effectively guided in the selection of their engineered product or service to ensure that opportunities will be available to allow them to address the full set of criteria across the three mark bands. Many did this, and subsequently there scored well.

The spirit of unit 5 is to encourage the candidates to take a closer look at the environment in which real engineers work. This includes a more in depth look at the standards and legislation which affect the role, product or service and the documentation which is used by engineers and, importantly, why they need to use it.

Energy efficiency and the effects on the Earth's physical environment are topics which are in the news almost constantly and the modern technologies which are applied by people working within the engineering environment are not used just because someone wants to use them.

In depth evaluation including suggestions for modifications to the product or service is expected of an A2 level candidate in this unit, more so than in unit 2. It is essential that links with industry are utilised and several meetings set up to allow each candidate to investigate the environment in which their chosen engineer works. Unfortunately, several centres appear to have allowed students to attempt this unit by carrying out internet searches. This only serves to disadvantage the candidates. Mark band 1 can be addressed, and parts of mark band 2, but mark band 3 requires some actual investigation of a product or service which is provided by an engineer.

Again, the understanding of the assessment criteria is essential for successful teaching and portfolio compilation, and all candidates need to refer to the criteria constantly. For anyone embarking on this qualification for the first time, the advice is to attend the INSET training and learn from this year's work as well as sharing ideas with others.

GCE Applied Engineering
Principal Examiner's Report June 2007
Unit 6 – Paper 6936/01
Applied Design, Planning and Prototyping

In this unit, candidates are provided with the opportunity to display the knowledge and understanding, manufacturing skills and engineering expertise accumulated over the course duration, bringing these attributes together in a full engineering design and make exercise.

Moderators reported that the work submitted by centres was a 'mixed bag'. Some outstanding coursework was seen, which was beyond the levels of response expected at A2 level and in these cases, candidates were expert in their fields of study, demonstrating true ownership of their work. However, many candidates failed to make the expected progression from AS levels of response, adopting a safe, formulaic approach to their work. In these cases outcomes were predictable with little risk involved and this led to little innovative work being produced.

Most coursework was potentially appropriate to A2 levels of response, but a significant number of candidates were unable to target high marks because of their lack of understanding of fundamental engineering/technological building blocks and this resulted in simplistic design and development work that led to similarly modest practical outcomes. This was particularly true of electronic projects, where standard, often low level, circuitry was 'lifted', without any modification, from well known, recognisable sources.

Almost all candidates approached their work through product design, and some interesting, useful and realistic products emerged as a result. Unfortunately, in some instances the focus shifted from the technological content of the designed product to that of resistant materials and left the realm of 'Engineering' for that of 'Design & Technology'. In these cases, the use of materials was not justified scientifically, calculations for determining limits and values were not considered, and products were justified in terms of aesthetics and form, rather than through technical and functional reasoning.

Most candidates were well organised and submitted well-prepared coursework folders with appropriately titled sections that were easy to follow. Some candidates, however, were less well organised and work lacked page numbers and section titles which hindered moderation. Almost all candidates used specialist ICT to aid their work and this resulted in some very high quality presentation.

Teacher assessment was often inaccurate, which is understandable in a new qualification where large numbers of marks are attached to some assessment criteria. It was disappointing, however, to see so many centres unable to match the performance of their candidates to performance descriptors in the assessment criteria. A minority of centre assessors awarded marks for product manufacture, but could provide no evidence that anything had been made.

Most centres submitted samples 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, which hindered moderation. Some centres used their own assessment grids to record marks, which were often difficult and awkward to follow.

Centres are reminded that they must use the Mark Record Sheet provided by Edexcel. Candidates' work should be submitted using either treasury tags, staples or paper clips rather than lever-arch files and/or plastic or card folders.

Assessment criterion (a)

The vast majority of candidates were able to gather some information from a range of sources that were specific to the problem selected for investigation. The most successful candidates 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. Unfortunately, many candidates were too general in their approach to research, often producing irrelevant and general information with no attempt at selection or analysis. It is important that candidates focus closely on being highly selective in their research to ensure that the gathered information is useful in informing subsequent stages of design development and is directly relevant to the needs of the problem under investigation.

Research should be focused and succinct. Copious amounts of information downloaded from the internet, or cut and pasted from catalogues and databases without accompanying annotation, justification or selectivity carry no value. Some candidates analysed existing 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.

Analysis of research is an important activity and should be carried out when all research and information collection has been completed, in order to inform the specification so that it is as relevant and meaningful as possible. This aspect of information gathering was not well done and many candidates failed to use research as effectively as they could have done. Appropriate research areas that could be useful to candidates include product analysis, market research, materials and component research, 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, where candidates used previous research as a basis for identifying key technical points, to very superficial, where simplistic and general statements were offered that could have been applied to almost any product.

It is essential that a strong specification is developed, as it is influential throughout the design process because ideas and their development will be referenced to it to check that the design requirements and client needs are being fulfilled. Similarly, testing, evaluation and suggested future modifications should be referenced to the points of specification to check the success of the final outcome.

The starting point for a strong specification for the most able candidates began with analysis of research, where essential requirements were identified and included after studying the information gathered. Some candidates presented evidence of having consulted with their peer group or 'a client' to ensure that the specification points were mutually agreeable and that they meet the needs identified earlier. Many weaker specifications were no more than a rambling collection of points, that lacked organisation, but this could have been overcome by using sub-headings such as 'purpose', 'user requirements', 'performance requirements', 'materials/components', 'size', 'safety and quality', 'scale of production' and 'cost'.

The best examples of specification writing seen included technical and measurable points based on scientific and/or mathematical justification which allowed testing and evaluation to be realistic.

Assessment criterion (b)

As with the work seen at AS level, moderators reported that the work in this section was disappointing and did not reflect the progression expected from candidates one year on from AS level. The few examples of successful A2 projects seen, reflected design work that was sophisticated, requiring high levels of understanding and application of skills that went beyond the requirements of the course, but these were in short supply. Candidates were reluctant to take risks in their designing and almost always settled for the safe, formulaic option that guaranteed success, albeit at a lower level than could perhaps have been achieved with more imagination.

In this assessment section candidates did not often demonstrate that they had used research or scientific/mathematical information in their designs. Many candidates did use their product specification to evaluate design proposals against, but this was often superficial or brief, especially with weak specifications. Many candidates produced few alternative ideas, but were rewarded highly, where centre assessors had annotated mark sheets to say that credit had been awarded for use of research, reference to the specification and application of scientific principles. Such annotation is relevant, but only where there exists a range of different, alternative ideas that are well thought through, workable and appropriate. Marks in this section are awarded for creative and realistic designing and development of proposed solutions. Although good modelling and testing by some candidates was seen, most failed to develop their designs as outlined in the assessment criteria, relying on a description of how their final design proposal would be made, without refining or changing an original idea. Many candidates used 3D CAD modelling as well as physical modelling in resistant materials, but not many explained the purpose of the models they had produced.

It is not necessary for candidates to always produce complete solutions in their alternative ideas and depending on the complexity of a design proposal, high marks can be achieved by focusing on sub-systems or parts of design proposals.

Candidates 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. Candidates 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 candidates 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 candidates refer to points of specification objectively and consider any feedback from peers.

Assessment criterion (c)

Most candidates were able to organise and carry out discussions with other engineers/peers and record feedback from these meetings. In the best examples of this candidates were well prepared, with questions and discussions focused on aspects of their design proposals that were designed to elicit useful feedback that could be used to modify designs and improve the final engineered outcome. However, many candidates produced general evidence of superficial discussions that were of little help in modifying or improving design proposals.

Assessment criterion (d)

The vast majority of candidates were able to produce some form of a plan of production for their product, outlining a sequence of events, use of processes and materials and making some reference to time and deadlines. The best examples of planning included quality control and health and safety issues. Unfortunately, many plans were superficial and lacked the detail necessary to score higher marks. Where candidates used Gantt charts, many included the whole design and make process in their planning instead of focusing only on product manufacture.

Planning for manufacture should include reference to time management and 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 treated as a retrospective exercise, as this reduces the information to a diary of events and takes it out of this assessment category.

The inclusion and consideration of relevant standards and regulations was not well done and the majority of candidates simply ignored this assessment requirement. Examples of regulations and standards that were presented by a minority of candidates included 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; and ISO 14000, which deals with environmental standards. There were also more specific standards considered, such as BABT – British Approvals Board for Telecommunications; BEAB – British Electrical Approvals Board and others.

Assessment criterion (e)

Moderators reported that the quality of practical work produced by some candidates was outstanding and justifiably scored very high marks in this section. Where work was weak, manufacturing standards were often still high. The use of CAM in the form of laser cutters and CNC machinery was evident, leading to ever increasing standards of accuracy in manufacturing. However, as with AS level work, candidates were seen to be increasingly designing for the CNC equipment and reducing their own involvement in manufacturing, which resulted in lost opportunities to score higher marks. Many products did not carry the challenge of advanced skills or complexity required to gain access to the higher marks, but these were often rewarded highly by centre assessors. 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. If centres do not submit photographic evidence with candidates' wok it **will** be requested. If the evidence is still not forthcoming, the work will be marked down. Centres are reminded of the importance of including photographic evidence with candidates' work when the work is first submitted.

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 may also support a candidate's awareness of health and safety issues when working.

Assessment criterion (f)

Some candidates showed excellent responses to this assessment section, which involved evaluating the product against the specification and photographic evidence of field trials, bench tests and user opinion. Client involvement and feedback were also in evidence, which led to realistic suggestions and designs for modifications focused on improving the performance of the product, which in turn reflected good commercial practice.

Unfortunately, a significant number of candidates produced superficial evaluative comments, which did not involve third-party comment or discussion with the client and many were unable to offer complete evaluations as their work was not finished or did not function as it was designed to.

On completion of the prototype product, candidates are asked to test and evaluate the outcome to check its fitness for purpose and this should be done with reference to commercial techniques where possible.

The finished product must 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. Candidates should describe in detail any testing they carry out and results should be objective and considered by the client for their effectiveness, which is why it is important to include measurable parameters in the specification that can be used as controls.

Field trials carried out by potential users over time is a reliable way of gathering objective feedback and candidates should use this tool whenever possible.

Results of testing should be used as a basis for summative evaluation so that candidates' comments are as objective and unbiased as possible. Reference to specification points should form a significant part of the evaluation and detailed client feedback should be used to determine the success of the final outcome.

Information from testing, evaluation and client feedback should be used by candidates 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.

Effective testing and evaluation can only be carried out if a product is complete, so it is essential that candidates refer and adhere to their work plan to achieve the planned time for this activity.

Statistics

6931 Engineering Materials, Processes and Techniques

Grade	Max. Mark	A	B	C	D	E
Raw Boundary Mark	90	67	60	53	46	39
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	47	41	35	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	24
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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