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Moderators' Report/ Principal Moderator Feedback

Summer 2014

Pearson Edexcel GCSE in Engineering

5EG01 Paper 01

Engineering Design and Graphical Communication

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Unit 5EG01
Engineering Design and Graphical Communication

Introduction

This report of the moderation of the fourth assessment of the 2EG02 GCSE Engineering specification and in particular, here, of its 5EG01 Unit 1 Design and Graphical Communication unit, confirms again that centre approaches to the assessment of the unit are generally well embedded and appropriate and lead to consistent centre outcomes. This report will comment on these general approaches for the benefit of centre staff generally, and particularly for those centre staff who are new to the delivery of the specification. It will also raise for the record those less positive issues that give rise to some shortfall in centre performance, most often seen as a leniency in centre marking. Centres will receive further specific comment on any such instances in their specific centre moderator report. In this context it is worth making reference again to the key support documentation for 2EG02 (and its 5EG01 and 5EG02 units) and worth reminding centres to keep focused on these during the delivery and assessment process:

- The 2EG02 Specification
- The Teacher Support Book for Controlled Assessment for 2EG02 (see website)
- Website exemplar portfolios and moderator comments
- The Controlled Assessment Task for criterion e) for 5EG01 (see website)

General Issues

The 5EG01 specification and assessment criteria require that students follow the journey through the relatively standard engineering design process. There is an emphasis throughout on the engineering design of the mechanical and electrical/electronic (or other) features inside any outer casing, those features that make the product work. These engineering features need design also, not just the design of the 'form' of the outer casing. This is well appreciated in centres but students can still be distracted by modern CAD techniques into presentations that focus on copious views of the outer form, to the detriment of internal engineering features.

The focus of the customer design brief is decided upon by the centre, to suit centre resources (physical and staffing, electronic, mechanical preferences, etc) and further guidance to centres is available in the 2EG02 Specification, the Teacher Support Book and via website exemplars. The unit is assessed as a 'controlled assessment' of up to 33 hours and this includes a specific Controlled Assessment (CA) Task for criterion e), a Pearson Edexcel devised task of given drawings, identification and interpretive questions. This CA task for e) is also undertaken under controlled assessment conditions and the outcomes of the task are assessed and included in the 5EG01 portfolio for moderation. The 2014 cohort reported upon here is the first (2012-14) of the linear assessment cohorts and centre students were expected to undertake the 2012-14 CA Task for e).

For the 5EG01 specification, students are required to analyse a given customer design brief and to develop an engineering specification from that analysis for the form and function of the product within the constraints arising from the requirements of the customer brief. The generation of alternative design ideas and solutions should follow, these being tested to select a final solution to take forward. Students should select and use a range of drawing techniques in the process of design sketching, design development and detailed engineering drawing of mechanical/electronic/etc drawings, indicating the purpose of, and audience for, each of their selections. They should include in this range of drawings the production at criterion g) of high quality engineering drawings, to sector standards, of the final design, that would allow the manufacture of the product and the presentation of the final solution, in all its details, in a form whereby client/designer discussions can lead to further modification as required.

The Controlled Assessment Task for criterion e) requires the interpretation of given (Pearson Edexcel-set) mechanical/electronic engineering drawings via standard set questions for identification and explanation, the written responses to be included in final portfolios for moderation after assessment. This Task for (e) is reviewed every two years (2009 -11, 2011–13) and the 2012-2014 version was the appropriate version for use during the present 2014 assessment and moderation. Centres will need to note that cohorts being assessed for 2015 will need to present the 2013-15 version of the CA Task for e) (see website).

The eight assessment criteria take students through the standard engineering design process from an analysis of the customer brief at criterion a) to the presentation of final design to client or proxy at criterion h), with a description/explanation of how the final solution meets the brief. The client/proxy is at this stage able to suggest modifications for further design work, modifications that are rewarded at criterion h); any earlier modifications, perhaps as a result of detailed drawing, may be highlighted here. A range of drawing techniques, including final engineering drawings suitable for production purposes, will be used across the design process and included in the student portfolio.

The quality of written communication (QWC) is a progressively rewarded component in five of the eight criteria – details are available in the specification. The Controlled Assessment Teacher Support Book on the website, Section 3, highlights the evidence expected at the criteria generally, to meet the criteria requirements at the mark ranges, including for this QWC. The eight-mark criterion is at (g) and rewards engineering drawing skills to sector standards.

A wide variety of projects has been developed for use in centres during the years of assessment of the specification. These include: bicycle lighting, external lighting, bench lighting, adjustable lamps, various alarms, can and polymer bottle crushers, wind turbine generator or wind speed devices, model cars/vehicles, portable water tanks for garden work, and various mounting/ docking stations for electronic devices.

Some of these are centre devised (and developed over time and experience), others can be off-the-shelf projects from proprietary providers. These latter are acceptable and provide good evidence frameworks for those students who welcome more prescription. These frameworks can be less challenging to the more able. The use of centre-prepared pro-formas generally does serve to maximise student focus on the detail of criteria but also can tend to reduce the differentiation in the evidence presented and possibly inhibits the strongest students from a full demonstration of their abilities, including their quality of written communication.

It remains pleasing to see that centres are not doing 'design and make' projects covering both units 5EG01 and 5EG02, with all the attendant problems such a strategy contains.

Assessment Criteria

The 5EG01 unit assessment criteria follow the standard engineering design process. It would help if students and centre assessors, look to the detail of the criteria at each stage, before moving on to the next stage.

Criterion a) - there is continuing good use of internet market research to get a feel for current expectations of products typical of the one being asked for in the customer brief. Good written analysis arising from this research, for the upper mark range, is still unusual eg better students might be expected to summarise the key points and features of current market-place offerings and use such summary to demonstrate their quality of written communication. There might be a limited case for 'classmate questionnaires' here to determine what product details might have appeal for taking forward, but such questionnaires do not really contribute beyond the market survey, the current products revealed there being the outcomes of much larger market research. Thus 'classmate questionnaires' rarely add to student marks.

Criterion b) - there appears to be little appreciation at centres that the design specification required at criterion b) is a description of the detail of the engineering problems arising from the analysis at a), to be solved by the design engineer in order to design the product's external form and inner workings, the key features that will satisfy the client's need for a functioning product. Lack of detail here does lead to leniency in centre marking.

Thus at criterion b), there are usually adequate middle mark range responses, but others do tend to be bland and general: 'will meet quality standards', 'will be made of quality materials', 'will meet the client needs by looking good', instead of stating which quality standards apply, and explaining these. Other particular examples of where insufficient detail of design issues was captured included not asking the questions: how will a portable water tank for gardening deliver a pressurised supply to a hose? What is needed? How? What kinds of pumps are available? How are they to be powered? Or, what are the parameters of the design task? What regulations apply to front and rear cycle lighting? How do LED power ratings

relate to battery/cell ratings? Are there portable lighting regulations and standards?

Centres will see that at criterion b) the specification refers to product criteria and production constraints, so that the focus here does need to be on the engineering features: the former on what the product needs to be able to do, the latter on the constraining issues that pertain. The Teacher Support Book at Section 3 provides essential guidance and listings here, and centres are advised to revisit these.

Criterion c) - the issue remains again of lack of engineering detail, following from the similar lack of engineering detail at criterion b). What voltage? Why? How to supply it? How to fit the batteries? LEDs? What about the switches? How do the parts fit together? What dimensions are needed? What fasteners are needed? What forces will crush a can or bottle? How can this be supplied? How are any water ingress issues to be dealt with? Then, too often, the electronic features proposed are unconnected in design and in practice to the rest of the product, seemingly a separate product with no design alternatives proposed and apparently just a classroom exercise. There is little conversion of a chosen circuit to a pcb for fitting into the product and no listing of chosen components. It is still the case that only a few students deploy science principles and use calculations in design, whether mechanical or electronic.

Criterion d) remains poorly attempted. Subjective tabulation, giving scores to each design but not on the basis of any testing, can only score at the lower mark range. Centres appear to still grapple with the notion of objective testing their initial designs, including with testing via models in paper or plasticine or polystyrene foam, and where this is done, draw no clear conclusions. Where still used, a classroom questionnaire approach done at this ‘selection between designs’ stage at d) only serves to promote an ‘aesthetics and form’ approach to design, not the engineering design required by the unit. Different electronics circuit or pneumatic circuit solutions or component solutions are hardly seen so that testing between them to determine a preferred solution is rare. However, modern simulation software provides good opportunities for testing such different arrangements and component values and this use is encouraged. Typically though at present, no conclusions are stated as the outcomes of testing. Having chosen a final solution, by whatever means, there should be a clear statement of what this solution is and how it meets the design requirements.

Criterion e) - The CA Task for e) continues to be a good source of marks for students, especially as there are no direct marks here for good presentation. Centres are directed to the 2013-15 version of this Task for assessment for the 2015 cohort.

Criterion f) progress continues to be made by centres in dealing with this criterion, with centres and students now giving a better ‘bespoke’ account of audience and purpose for their diagrams, across the range of the portfolio, rather than the presentation of generic class handouts for this purpose. Marks are awarded for the selection and use of the widest range of drawing

techniques across the portfolio, including for design sketching at criterion c), though students sometimes neglect to include freehand sketching in their listing, even though used effectively at criterion c).

Criterion g) - there still seems to be a lack of centre and student attention to 'drawing standards' as listed in the Assessment Information section of the Teacher Support Book for 2EG02 on the website, so that the upper mark range of marks (at this eight-mark criterion) is often not accessed. The growing use of CAD methods may be positive but it does not necessarily help fulfil top mark range requirements, where there is still a manual drawing requirement.

The often-cursory electronic design work undertaken often results only in some circuit diagram screen-shots. Electronic circuit diagrams are rarely drawn, manually or via CAD, so that upper mark range credit for showing 'standard symbols' is not totally appropriate. Any shortcomings in design work on fixings and fittings at c) also limits the drawing at g) of the like of threaded parts, springs and bearings. Sector standards for orthographic drawings are becoming more familiar but it is disappointing to see good title blocks, on otherwise good engineering drawings, with empty boxes or completed only with hand-scribbled title or name, or other entry.

At criterion g), the lack of engineering design at c) of components, and of their assembly, still limits the use of standard symbols eg threaded parts, springs, bearings, at all three mark ranges for (g). The lack of design choice between electronic components and circuit alternatives is also limiting for the presentation of these symbols in electronics drawings.

Criterion h) - the specification for 5EG01 gives criterion (h) the title 'presenting and modifying the final solution'. This criterion at the three mark ranges embraces the 'presenting' and modifying' of the title by calling for description/explanation of how the design solution meets the brief and specification. Centres should note that what is not required, therefore, is evidence in the form of a PowerPoint presentation of the whole 32 hour controlled assessment process. Neither is a student evaluation of the strengths and weaknesses of their performance expected. The focus at (h) needs to be on a description/explanation of how the final design solution meets the customer requirements. Any modifications that have emerged subsequent to criterion (d) by virtue of the detailed drawing process or via presentation to client or proxy client may be included here.

Thus at criterion h), there appear to be few serious attempts to mimic typical client/designer design review meetings that lead to modifications to the product design detail. These latter modifications, if there are any, still tend to be superficial. PowerPoint presentations are laudable, but they do need to have a rationalised focus on the 'final design solution', not be a mere 'replay on slides' of previous portfolio content.

Some centres can therefore be deemed at moderation to assess leniently, for these reasons, including for a limited approach to the assessment of the quality of written communication presented. Centres do, however, tend to show a consistent approach to assessment within any one sample.

Centre Assessment

Centre assessors have developed a consistent approach to their assessment of student work against the 5EG01 standard. As stated, there is still a general tendency towards leniency against this standard (as represented by the detail of the assessment criteria) largely due to a forgiving approach at centres to the lack of engineering content to the designs.

Neither is the quality of written communication (QWC) presented by students taken account of appropriately at the centre assessment stage and the detail of how these are woven into the criteria is indicated at the Expected Evidence boxes in Section 3 of the Teacher Support Book referenced previously. The Controlled Assessment Task for (e) does not reward QWC directly, and it is appreciated that the Task for (e) is performed as a one-off assessment, with no opportunity for re-write, and the quality of the (hand-written) presentations in most cases was an improvement on the presentations here in 2013.

Administrative Issues

Centres and students do gather their work into portfolios and deliver them for moderation in good time and in good order, for the most part, including the highest and lowest scores where these were not pre-selected for sampling. Centres again responded well, as usual, to moderator requests over detailed issues.

Centres will have been advised in their particular moderator report as to which of the following 'administrative issues' applied in their case:

- Inaccurate/missing totals of scores, and/or errors in transposition between Tracking Sheets/Record Sheets and OPTEMS record, in some cases.
- Also in some cases, lack of student Authentication evidence. The Controlled Assessment Record Sheet (see 2EG02 Specification document) will suffice for this purpose
- The lack of use of the Pearson Edexcel format Tracking Sheet/Record Sheet, in some cases. Centre should note that these have an 'Edexcel Use' column which is used by moderators and for moderation quality assurance processes. In a few cases, centres drew up their own Tracking Sheet, without such 'moderator use' columns.
- The other helpful use of the Tracking Sheet, for centre annotation and page numbering guidance, was then also absent.

Occasionally, the centre top-copy of the OPTEMS sheet was included with portfolios. It is possible that the centres concerned had already entered their centre marks electronically but this was not clear so that the top-copy was sent on to the intended Pearson Edexcel address.

A4/A3 formats with single treasury tag, or similar, connection remain the ideal format for portfolio presentation at assessment and moderation stages, with student-identification and assessment documentation attached, and CA Task for e) included, allowing for ease of handling and of photo-copying, where required for Awarding or other purposes. Where centres in 2014 submitted electronic versions of portfolios in disc format it was most helpful to the moderation process when the identification and assessment documentation was submitted by centres alongside in hard copy.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
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