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Moderators' Report/ Principal Moderator Feedback

Summer 2013

GCSE

Engineering
5EG01 Paper 01

Engineering Design and Graphical Communication

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Unit 5EG01
Engineering Design and Graphical Communication

2013 was the third assessment of the 5EG01 Design and Graphical Communication unit of the 2EG02 specification for the Edexcel GCSE Engineering qualification. This Principal Moderator's report provides comment on centre and student performance in the 2013 assessment, subsequent to moderation following centre submission of the student portfolios. It is pleasing to report that, by this third assessment, the standard of this sepcification is now well embedded and the transitional issues encountered previously are being addressed in centres.

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-determined) 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 Controlled Assessment Task for (e) is reviewed every two years (2009 -11, 2011–13), this latter version being appropriate for this current moderation. This present form of the Task was extended for the 2013 -14 period to align with the first 2012-2014 Linear Assessment arrangements for the qualification, and will again be the appropriate version for use for assessment and moderation in 2014. The Task will again be reviewed for the 2013-15 period for new 2013 registrations for 2EG02, and centres will be able to access the reviewed Task on the website in September 2013.

The eight assessment criteria take students through the standard engineering design process from customer brief to the presentation of final design to client or proxy, as 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 (not the CA Task, nor the explicit drawings criteria). The 2012 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 QWC. The eight-mark criterion is at (g) and rewards engineering drawing skills to sector standards.

A wide variety of projects have been developed for use in centres during the three years of assessment of the new specification. These include: bicycle lighting, mechanic's bench lighting, directional lamps, various alarms, can crushers, wind turbine generator or wind speed measure, model cars/vehicles, portable water tanks, various mounting/ docking stations for electronic devices.

Some of these are centre devised (and adapted after trialling), 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 tend to be less challenging to the more able, and the use of common pro-formas, often with constrained (non-expandable) space, does tend to limit student written work in response, and thereby limit their demonstration of quality of written communication (QWC). The use of centre-prepared pro-formas generally does serve to maximize 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.

Many of these design briefs can be made to work well, provided students are focussed on the engineering design aspects. Alarms, lamps, torches, all have good electronic/mechanical features and engineering design possibilities, including design for assembly. There is a growing appreciation of the new LED technologies and the opportunities these provide but centres can develop further the power/illumination issues here, relevant to design work. IPod/MP3 docking stations do tend to slip quickly into aesthetics-only design of 'form' with attendant focus on rendered-CAD and less on associated electronics and loudspeaker considerations. Novelty sweet dispensers do not work well when the dispensing mechanisms proves to be too challenging. Can crushers with a designed and located electronic 'Can Crushed OK' signal output will cover the required range very well. Portable water tanks for gardens/gardeners are becoming popular but the pressure pumping of the water and the power supply needed for this tend to be neglected engineering features. The opportunity to develop a design appreciation of wheel bearings, for example, is not usually taken up.

It is, however, 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 has.

Assessment Criteria

The 5EG01 unit assessment criteria follow a standard engineering design process approach. It is not expected that students understand this process explicitly but it does help if they, and centre assessors, look to the detail of the criteria at each stage, before moving on in too much haste to the next stage.

Criterion (a) - there is growing 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 summarize 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 contribute much beyond the market survey.

Criterion (b) - there are often adequate middle mark range responses, but even these tend to be bland and general for example, '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.

Criterion (c) - the issue remains one of lack of detail. Too often the electronics gadgetry proposed is unconnected in design and in practice to the rest of the product, seemingly a separate product (perhaps a case of separate teaching and little liaison between those involved). It is still the case that only a few better students quote science and use calculations in design, mechanical or electronic.

Criterion (d) - this remains somewhat 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 still grapple with this notion of testing their initial designs including with testing via models in paper or plasticine, and where this is done, to 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 and yet modern simulation software provides good opportunities for testing different arrangements and component values. Typically, 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 – a great many of the presentations of this Task being poor. There were no cases reported of centres that were not now aware of the presence of this Task in the scheme of assessment. There will be appropriate website signposting to centres about noting the reviewed Task for the 2013-15 cohort.

Criterion (f) - some progress is being made by centres in dealing with both halves of the criterion, with 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 some generic class handout for this purpose.

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. There is also still 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. 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 in the current specification.

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' aspects 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 30 hour Controlled Assessment process. Neither is a student evaluation of 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.

It remains the case, then, that some continuing issues are reported by moderators, including the 'product design' of 'form' with little work on the design solutions to the electronic or mechanism engineering problems posed by the brief has been referred to. The use of scientific principles in the development of engineering solutions is still not a strong feature of portfolios presented so that Upper Mark Range marks are not accessed at the moderation stage. Some centres appear to bolt-on some 'electronics' to a project to capture further marks but this leads to a lack of coherence between the mechanical or product design of the outer form of the product, and the electronics design of the inner lamp, alarm or indicator. How the latter are fixed into the former is usually an unattended issue, as are cell/battery compartment designs.

Centre Assessment

Centre assessors have developed a consistent approach to their assessment of student work against the 5EG01 assessment criteria. There is still some general tendency towards lenient assessment .

It is not clear that quality of written communication (QWC) issues are taken account of appropriately at the centre assessment stage and further leniency of centre assessment arises when assessors do not take account of the detail of criteria as indicated in the section above, particularly at criteria (b), (c), (d), (g), and (h). Although the Controlled Assessment Task for (e) does not reward QWC directly, and while it is appreciated that the Task for (e) is performed as a one-off assessment, with no opportunity for re-write, the quality of the (hand-written) presentations in most cases remains disappointing.

Administration

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 responded well, as usual, to moderator requests over detailed issues.

Small numbers of calculation errors do continue, as do some errors of transposition and entry. The Authentication Statement at the bottom of the unit Controlled Assessment Record Sheet is normally signed and included, and the Controlled Assessment Tracking Sheet is put to good use by centres.

Some centres included the top copy of the OPTEMS sheet with the portfolios. Centres should note that these top sheets should be sent to Pearson (see Pearson, Hellaby, Rotherham, address at the left-hand margin).

A range of portfolio formats continue to be used.

A4/A3 formats with single treasury tag connection remain the ideal format for portfolio presentation at assessment and moderation stages, with student-identification and assessment documentation attached, allowing ease of handling and of photo-copying, where required for training and awarding purposes.

Grade Boundaries

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