OCR
Oxford Cambridge and RSA

Cambridge Nationals

Engineering

Level 1/2 Cambridge National Awards in Engineering **J830-3, J840-3**

Level 1/2 Cambridge National Certificates in Engineering **J830-3, J840-3**

OCR Report to Centres June 2016

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

CONTENTS

Cambridge Nationals

Engineering J830-3 – J840-3

Level 1/2 Cambridge National Award in Principles in Engineering and Engineering Business J830
Level 1/2 Cambridge National Certificate in Principles in Engineering and Engineering Business J840

Level 1/2 Cambridge National Award in Engineering Design J831
Level 1/2 Cambridge National Certificate in Engineering Design J841

Level 1/2 Cambridge National Award in Engineering Manufacturing J832
Level 1/2 Cambridge National Certificate in Engineering Manufacturing J842

Level 1/2 Cambridge National Award in Systems Control in Engineering J833
Level 1/2 Cambridge National Certificate in Systems Control in Engineering J843

OCR REPORT TO CENTRES

R101 Engineering principles

General Comments

For the June 2016 series, candidate entry numbers are similar to June 2015 but the cohort is made up of predominately Year 11 candidates, compared to June 2015 when it was as expected for the first year of teaching, made up of mainly Year 10 candidates.

Most candidates attempted all of the questions on the paper but, there was some evidence that candidates had not read questions carefully enough before answering. It is most important that candidates take the time to read through the question paper before attempting to answer questions.

Knowledge of basic engineering principles appeared to have improved in some aspects. Candidates demonstrated understanding of electrical principles although confused AC with DC.

Knowledge and understanding of pneumatic systems, hydraulic systems and components forms a significant proportion of the specification for R101/01. Generally, candidates' knowledge of hydraulic systems and components was variable. Candidates demonstrated very little recognition and knowledge of pneumatic systems and components.

Comments on Individual Questions:

Question No.

1(a)(i)	Most candidates achieved full marks for this part, correctly matching the terms.
1(a)(ii) & (iii)	Many candidates correctly gave the class of lever required and were able to give a lever application in part (iii).
1(b)(i)	Some candidates were able to correctly identify the type of gear as a bevel gear, but the majority of candidates were not able to. Where candidates recognised the bevel gear, they were able to give an appropriate application in part (b) (ii). However there was not necessarily a dependency on this as many more candidates gained marks in part (b)(ii).
1(c)(i) &(ii)	Candidates performed well on these questions with most candidates achieving at least one mark, and many candidates were able to correctly identify alternative drives for part (c) (ii).
1(c)(iii)	Candidates across the ability ranges gave correct responses to this part demonstrating some practical knowledge and application of drive belts.
2(a)(i)	Very few candidates achieved any marks for this part although most candidates attempted this part.
2(b)	Most candidates achieved at least 2 of the available 3 marks for this part, correctly applying the acceleration calculation. The third mark was awarded for stating the units which many candidates correctly gave.
2(c)	Candidates performed well on this question with the majority of candidates achieving two out of the available three marks.

3(a)-3(b)(iii)	Part (a) was answered reasonably well, however, less so for the calculation in part (b)(iii). Candidates were required to recognise that they needed to add the wattage of both lamps to get the correct values for the calculation. Higher achieving candidates succeeded in doing this.
3(c)(i)	This question proved to be difficult for candidates as the majority either did not know that the ammeter needed to be placed in series with the motor, or found the circuit diagram difficult to interpret.. In contrast to this, many candidates achieved at least one mark for part 3(c)(ii) with the voltmeter.
3(c)(iii)	Similarly, this part proved challenging for candidates as most did not recognise the relay symbol and the application of the relay. Some candidates recognised, that in effect, there are two 'switches' in the circuit and credit was given where possible for this. Overall the marks were consistently low for this question.
4(a)(i)–(iii)	These questions were very poorly answered by all but a few candidates. Candidates were unable to demonstrate knowledge of the pneumatic components or their application, except for the filter in part (c) which was well answered. Overall, very few marks were awarded in these parts.
5(a)(ii)	Surprisingly, candidates appeared not to understand the application of the power source used in Fig. 8 to drive the hydraulic pump, and therefore most candidates did not achieve the mark available.
5(b)(i)	Many candidates deviated from the energy conversion examples within the specification, but markers gave credit where possible.
6(a)	Candidates demonstrated their knowledge of mechanical principles quite well in this part, suggesting feasible answers on how to drive the conveyor. Many candidates achieved two of the available three marks.
6(b)*	Almost all candidates attempted this question, but marks awarded were generally quite low, as responses demonstrated little knowledge of different power sources, their differences and advantages. Many candidates confused AC with DC supplies. Where this was the case, markers gave the benefit of doubt where successive examples were given but were factually the wrong way around. Candidates recognised that AC could be transmitted over long distances but many suggested that the mains supply is DC, and that DC is dangerous. Few candidates recognised the use of DC in portable applications that utilise recharging. The candidate's Quality of Written Communication (QWC) was assessed in this question, and marks were awarded for well written answers, despite where the technical content of the response was limited.

R102 The engineered business

General Comments

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation.

Most centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate is also required to have a Unit Recording Sheet (URS).

The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to the centre who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome, it cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Where photographs are presented as evidence, centres need to ensure that these are annotated with the candidate number.

There was also evidence across units of work, being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
This was on the whole well attempted. Most candidates identified two sectors, and a range of products and services from these sectors. Higher mark bands can be accessed by providing a comprehensive coverage of the sectors, and highlighting a wider range of products and services.

LO2
This was well attempted by most candidates. In most cases, two or sometimes more companies were identified and their structure analysed. Relationship to other companies – both suppliers and customers – was also evident in some but not all cases.

LO3
Candidates mostly provided a clear description of the Engineering Council. Job opportunities within engineering were also often well covered, as were sources of information. Most candidates failed to include entry routes e.g. qualifications and progression in their job

opportunities. Rights and responsibilities of employers and employees were generally well covered. Most candidates were able to access marks in high MB2 or low MB3.

LO4
This LO was well attempted with most candidates being able to identify two innovations. In some cases the innovation aspect of the item was sometimes a little difficult to see. Candidates could improve in the LO by providing a more detailed explanation of the impact the innovation has made.

Conclusion and Recommendations

The evel of detail on the URS (and on learners' work) might be improved which would assist with the moderation process. Where learners produce a synthesized report then it must be made clear where marks are being awarded against each LO.

Both LO1 and LO2 were well attempted, but the level of detail was sometimes a little weak in order to access the higher mark bands.

Learners might explore products, services and sectors in more depth.

LO3 requires consideration of qualifications to access job opportunities, and progression routes. The Engineering Council was often well covered using information from the website. Learners should be encouraged to present information that is referenced, or in their own words.

For LO4 the innovations need to be relevant, and learners need to identify the impact the innovation has made.

R105 Design briefs, design specifications and user requirements

General Comments

This was the fourth series of R105: *Assessing client briefs, specifications and user requirements* exam paper. Although the unit and qualification has only just completed its second year of existence, candidates have clearly been able to successfully access the paper. In addition, the paper was successful in discriminating across the ability ranges.

As in previous series', it is worth emphasising here that centres should cover the entirety of the content set out in the specification. Once the content has been covered it is advised that centres spend some time preparing students for the examination using the specimen papers and, with growing availability, the past papers for the examination. This should allow students to answer the whole paper with sufficient understanding and depth. There are key areas of the specification where candidates' understanding is not as fully developed as it needs to be to access the questions.

Centres must also ensure that they prepare candidates with an understanding of the command verbs that are used within questions. At times, it is clear that students are not always answering questions in the style expected of the command verb. For example; when a question command verb is 'Explain' or 'Describe' candidates are answering with one-word answers which limits their ability to access the full marks available for the question.

Comments on Individual Questions:

Question No. 1

Part 1ai of this question requires candidates to list the phases of the design cycle in the correct order. On the whole, the question was answered well with a large majority of candidates achieving full marks. Where candidates have not gained full marks the order was incorrect. In general however, the question was answered well and acted as an effective starter to the exam.

In part 1aii, candidates were required to complete a phrase related to the design cycle. This question was generally answered well but in some cases mistakes were made, due to a lack of understanding of the stages of the design cycle. The question focused on the 'identify' phase of the design cycle and some candidates related their answers to different stages of the cycle.

For part 1bi, candidates were required to state one activity carried out in the validate stage of the design cycle. On the whole the question was answered well but as per the other initial parts of question 1 candidates failed to achieve marks by listing activities from different stages of the cycle. Centres are encouraged to ensure candidates are taught the specification thoroughly.

Part 1bii was related to budget requirements for the development of new products. Many candidates gave valid factors that impact on the budget requirements. In some cases however, candidates gave answers that focused on factors that would influence the selling price or the manufacturing cost, not the factors that would define the allocation of an initial budget.

The responses to part 1c varied in quality. The question required candidates to explain why designers may use the design cycle when developing new products. Many candidates gave answers that listed the stages of the cycle but the question required responses that outlined the reasons why following a defined process helps the development of a product.

Question No. 2

In part 2a, candidates were required to state two requirements that must be included in a design specification in addition to product requirements and user needs. Most candidates were able to access marks here with many candidates giving valid responses to the question that were specific to the outline of a design specification detailed in the unit spec. Where candidates failed to achieve full marks, responses tended to be vague and could therefore not be awarded. A similar, pattern of responses occurred in part b of question 2. The question asked candidates to consider design specification points for a pair of household scissors. On the whole again, candidates were able to access marks here but in some cases vague or generic responses without exemplification were listed which failed to achieve marks.

Part 2c asked candidates to explain what the British Standard Kitemark means when displayed on a product. It is clear that almost all candidates had an understanding of British standards and the principles represented by the kitemark. Where marks were lost candidates gave answers related to the kitemark providing permissions for sale which is not always the case.

In question 2d candidates had to correctly identify copyright and trademark symbols. Overall, most candidates answered this question correctly. It was clear that where candidates did not achieve the marks they were simply unfamiliar with the symbols. Part 2e of question 2 then focused on patents. Most candidates were able to access some marks due to some understanding of the purpose of a patent and the protection of inventions. Maximum marks were not achieved by candidates who failed to make specific points about the reasons designers apply for patents.

Question No. 3

Question number 3a required candidates to extract and interpret data from a table of material properties. Some understanding of the requirements of materials for high-performance racing cars was required but this was secondary to the interpretation of the data in the table. In almost all case, candidates were able to interrogate the table and identify two key characteristics that were advantageous to the production of racing car body shells. In a few cases, candidates may have interpreted the scoring scale wrong and therefore made inappropriate judgements on properties.

Part 3b, required candidates to explain why the availability of a material might be an important consideration when manufacturing products in high volumes. Candidates were able to access the question and gave valid responses related to the disruption of production should material supply run low. In some cases, candidates referred to the increase in cost associated with the scarcity of a material. In some cases, the explanation provided reinforced this point but this was a secondary factor of material availability and not the primary response required in the question.

In question 3c, candidates were required to give four ways in which a cast iron frying pan had been influenced by manufacturing considerations. In previous series' of the paper, similar issues with candidate responses have been highlighted in the report to centres. This question focuses specifically on the manufacturing considerations that impact on the design, rather than aesthetics or ergonomic considerations. Some candidates were able to give responses that focused on the geometry of the frying pan related to the manufacturing process but others provided responses related to aesthetics, function or ergonomics and therefore failed to achieve all of the marks. Centres are reminded to ensure a focus on the engineering and manufacturing related elements of design within the delivery of the specification alongside more aesthetic design considerations.

In part 3d, students were required to join images of products or components to the appropriate scale of production. On the whole candidates were able to access the marks here and correctly

joined the components and scale together. Centres are reminded to encourage candidates to think about their responses to this style of question prior to drawing on the paper as multiple lines can be added and this causes confusion when marking.

Question No. 4

In question 4a, candidates were asked to state two factors related to the sustainable disposal of engineered products. In many cases answers related to the end of life processes that occur such as recycling or reuse of material or products. Although these points are relevant when exemplified, the question required responses linked to how these can be achieved more effectively though the careful consideration of the design of the product. Many responses failed to consider the design considerations and focused entirely on the end of life processes that could be implemented.

In part 4b, candidates were asked to explain the term 'resource depletion.' Most candidates were able to express some understanding of the 'over-use' of a resource or that a resource is running out. Candidates that achieved maximum marks were able to explore the term in more detail, illustrating that 'resource depletion' tends to be related to finite resources being used faster than they can be replenished.

Question 4c, generated a varied set of responses. Candidates tended to talk about recycling or reuse of material and components without focusing on, or considering, how renewable resources may be utilised to improve such things as energy efficiency during use or during manufacture. Centres are reminded to focus on all sections of the specification in detail to allow candidates to answers questions fully when a depth of understanding is required, particularly in the higher level questions of the paper.

Question 4 part d required candidates to answer questions related to product life cycle. Overall, answers to this question were well written showing a clear understanding of the stages of the product life cycle with large numbers of candidates being able to give multiple stages of the product life cycle within their answers. Candidates understood that the product lifecycle considered all phases of a product's life from sourcing material, through production, use and end of life. In some cases, candidates missed out on marks due to not 'explaining' the life cycle and instead listing key points. Also, some students gave responses related to a business or marketing product life cycle rather than one focused towards engineering and manufacturing.

Question No. 5

Part 5a required candidates to give an example of a standard component and its application other than nuts and bolts in engine assemblies. It is clear that in this series, candidates had a better understanding of standard parts with the vast majority of responses containing valid examples. However, some candidates gave a very simplistic application which meant that occasionally marks could not be awarded.

Question 5b extended the knowledge of standard parts required for part 5ai by asking candidates to give two advantages of using standard components in the maintenance of engineered products. Some valid answers were given by candidates that showed a good understanding. For example, answers related to ease of disassembly and reassembly, use of standard tools and availability.
Where answers were less successful, candidates gave responses stating that standard parts were cheap without quantifying how or why this might be advantageous to maintenance.

In question 5c, candidates were shown a dimension with a tolerance and asked to explain the meaning of the tolerance. It is clear in this series that candidates' knowledge of tolerances has greatly improved with many being able to define the upper and lower allowed limit of the dimension from the tolerance. There is still a perception by some candidates that tolerance

relates to strength or ability to withstand stress. This therefore led to misinterpretation of the dimension and symbols and no marks could be awarded.

In part d, candidates' understanding of tolerances was further developed by asking them to explain how tolerances can be used to control production costs. The quality of responses to this question varied. In some cases answers were given that justified the cost saving by reducing the amount of material. Some marks could be awarded here when candidates were able to describe how the addition of an acceptable tolerance can help to reduce the number of waste parts that may not have perfectly accurate dimensions. Those answers that achieved the maximum marks were able to explain how trying to manufacture things to perfect sizes is impossible and therefore tolerances illustrate the acceptable deviation from perfection that still allows the product to function.

Question No. 6

Question 6 consisted of three parts that focused on ergonomics and its consideration when designing new parts. Part 6a, asked candidates to define what is meant by the term ergonomics. It was clear throughout most of the answers that all candidates have some familiarity with the term and some understanding of its importance and application in design. However, this was not always supported by detailed and clear definitions of the term. On occasion some responses were vague and at times related to other areas of design rather than focusing on the use of ergonomics to ensure a product is suitable, comfortable and accessible for humans to use.

Part 6b, gave candidates an image of a remote control and asked them to give two ergonomic user needs that must be considered in its design. Almost all candidates were able to select two ergonomic considerations including such things as the position of the buttons, size of the buttons and shape of the controller.

Part 6c required candidates to show further understanding by assessing their quality of written communication in a discussion question that focused on the ways ergonomics have to be considered. The quality of answers provided varied dramatically. Where candidates failed to achieve high marks, responses lacked development following each point and some candidates confused ergonomics with accessibility. In some cases, points were repeated rather than developed and many candidates did not write in extended prose therefore failing to meet the requirement of the extended written response asked for in this type of question. Centres are reminded to ensure they cover the full scope of the specification in depth to ensure candidates can achieve maximum marks. As mentioned previously, centres are reminded to develop candidates' ability to write extended responses. Some responses were written in bullet point format which, although some excellent points were made, candidates could not achieve higher marks as they are being assessed on their ability to write extended prose and not just their knowledge of the topic in the question.

R106 Product analysis and research

General Comments

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation.

Most centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate is also required to have a Unit Recording Sheet (URS).

The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO3 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the learner, and should not be used as a sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
Candidates made a good attempt at this LO by identifying commercial production methods, end of life consideration and also legislative requirements such as CE marking. The function and operation of products are not explicitly required for this LO, which were sometimes covered by candidates.

LO2
On the whole this was well attempted with candidates demonstrating a good range of research skills. The strengths and weaknesses were sometimes a little weak (and sometimes not evident at all), with the quality of research methods used often compensating for this.

LO3a and b
Again this was very well attempted. Most candidates were able to provide a good analysis of a product through disassembly. Candidates are also required to make a clear link back to Unit R105.

Conclusion and Recommendations

Level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

For LO3 candidates could evidence disassembly through photographic evidence or similar. A witness statement, or similar, should be used to corroborate how safely and independently learners worked and if they used the appropriate tools. Centres might consider alternative means of providing evidence (e.g. videos of disassembly being performed) or can use the pro-forma witness statement provided with the Live Assessment.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R107 Developing and presenting engineering designs

General Comments

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation.

Most centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate is also required to have a Unit Recording Sheet (URS).

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Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
LO1 was often well attempted. Most candidates were able to produce good quality 2D and 3D sketches applying techniques including shading and rendering. Labelling was good, and in most cases there was evidence of annotations. CAD, in various forms, had been used to enrich and develop the design. It would be useful if centres could confirm the amount of assistance given to learners in the commentary on the URS in future submissions.

LO2
There was evidence that candidates had attempted isometric and oblique drawings i.e. using formal drawing techniques. More successful candidates were able to able to develop their drawings by adding detailed annotations and dimensioning. In many cases candidates were able to clearly evidence knowledge from other units e.g. R106

LO3
This LO was often well attempted. There was often good evidence of the use of CAD to present a final design. Final presentations, however, sometimes lacked detail to confidently secure marks in the higher bands.

Conclusion and Recommendations

The evel of detail on the URS (and on learners' work) might be improved which would assist with the moderation process. This is especially the case for LO1 where credit is given for amount of teacher assistance or otherwise, and LO3 where learners may give a presentation.

LO1 was often well attempted. There was good evidence of sketching, appropriate annotation and detailing, and the use of computers to produce augmentation.

LO2 requires candidates to present designs in 2D and 3D using formal drawing techniques. This was well attempted by many centres, although some centres may develop these skills further with learners.

For LO3 CAD was attempted with varying levels of success, but with some excellent examples. Often final presentations lacked sufficient detail however.

R108 3D design realisation

General Comments

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation.

Most centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate is also required to have a Unit Recording Sheet (URS).

The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the learner, and should not be used as a sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1a and b
Most candidates were able to provide an excellent interpretation of the product specification. Where candidates failed to access the higher mark bands the interpretation was weak or too generic.

For some candidates a detailed plan along with a Gantt chart was often produced for the making of the prototype. This was often relatively detailed. Some candidates produced a weak plan with little reference to tools, equipment and materials, and so failed to access the higher bands.
LO2
There was evidence for some candidates of them producing a risk assessment, identifying hazards and how they can be mitigated, using safety equipment and PPE. There was also good evidence of the safe use of tools and materials, which was backed up by a witness statement. Some candidates in some centres failed to address these crucial points relating to health and safety however.

LO.3
There was good evidence of a prototype being made both manually and sometimes using rapid prototyping. The inclusion of annotated photographs showing stages of production is extremely useful for the moderation process. There was also evidence of materials selection in many cases.

LO4
This was perhaps the weakest LO for some centres. It requires an evaluation of the production plan alongside the prototype, and suggesting improvements. It also requires an assessment of personal performance including strengths and weaknesses. Candidates might also consider here improvements both to the finished prototype and also to the process of prototype manufacture.

Conclusion and Recommendations

The level of detail on the URS (and possibly on learners' work) might be improved which would assist with the moderation process.

In LO1 interpretation of the specification was often good, but sometimes too generic and lacking in detail. Plans were often quite detailed, and a Gantt chart produced.

For LO2 there was good evidence of safe working practices, and often the witness statement was used successfully. Some candidates, however, failed to address this fully.

In LO3 there was evidence, in most cases, of a prototype being produced (as seen in photographs of the finished item), but not always of a step-by-step approach.

LO4 requires evaluation of the finished item against the plan, and also reflection on personal performance, strengths and weaknesses. In some cases this was well attempted, but in others not fully.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R109 Engineering materials, processes and production

General Comments

Candidates had been generally well prepared for the examination and, in most cases, had attempted all of the questions on the paper. In a number of cases however, candidates' knowledge of some sections of the specification appeared to be rather limited.

Responses to questions relating to engineering materials were generally rather varied, as were those dealing with modern manufacturing and digital communications. In questions where candidates are asked to describe or explain processes or procedures, it should be noted that simplistic answers are not suitable responses. This was often the reason for candidates failing to score the higher marks in questions relating to modern technologies.

In a number of cases it was apparent that candidates had not read questions carefully enough before giving their answers, resulting in a loss of marks. This was particularly the case where questions asked for an example to be given, with candidates often losing a mark by simply failing to do so. It is most important that candidates take the time to read through the question paper before attempting to answer questions.

Comments on Individual Questions:

Question No.

1(a) Most candidates scored well on this question, but overall the results were very varied, with marks from zero to full marks being awarded. There was some confusion between ferrous and non-ferrous metals, and in a number of cases candidates gave High Speed Steel as a composite, this being the only material type not used up to that point. Many candidates did demonstrate good knowledge of materials and scored full marks on the question.

1(b) In most cases candidates were able to name at least one of the categories of polymers and many scored full marks by naming both. A significant number of candidates, however, did not take account of the word 'categories' in the question, and gave examples of specific polymers, such as polystyrene and ABS.

1(c) A number of candidates did not attempt this question, and few scored well on it. Explanations often showed some confusion between alloys and composites, but the most frequent reason for loss of marks was the fact that the example asked for in the question was simply not provided.

2(a) Very few candidates scored well on this question, mainly due to the fact that unsuitable materials were suggested for one, or both, of the two products. Where a relevant reason for use was given, a mark was awarded despite an incorrect material being suggested.

2(b) Some candidates did not offer a response to this question, and others appeared to think that 'smart' meant 'clever', giving examples such as carbon fibre and polymorph. Correct responses normally made reference to shape memory alloy or thermochromic pigments, but again the lack of a specific example of use often resulted in the loss of a mark.

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2(c) Few candidates scored well on this question, largely because responses often did not address the focus of the question correctly. The question asked for three characteristics of materials but, in many cases, candidates gave three properties as their response. Where this was the case a single mark was awarded for the properties given.

3(a) Responses to this question were generally disappointing and very few candidates scored more than half marks on it. It was important that the completed table gave stages in a workable order using appropriate tools, and marks were frequently lost by the suggestion that tenon saws and coping saws could be used to cut the 10mm thick mild steel. Some candidates ignored the fact that the clamp body was already marked out and made this Stage 2, effectively giving away the two marks available for that stage.

3(b) Plastic coating, galvanising and electroplating were popular correct examples of appropriate surface finishes for the mild steel. In many cases, however, simplistic and inappropriate responses such as polishing and sanding were given, scoring no marks.

3(c)* Candidates' performance on this question was often limited by the fact that their responses were focused entirely on hand forging and did not take account of any of the issues that relate to the use of forging in volume production. Responses from the higher achieving candidates made reference to the reduction in material usage and machining time brought about by producing the item in one blow, and also mentioned the high initial cost of making the specially made dies required for use in the process.

4(a)(i) Less than half of the candidates gave a correct response to this question, many simply repeating the information in the question by giving 'one-off production'. Sand casting and rapid prototyping processes were acceptable responses here, and these were only seen infrequently.

4(a)(ii) Most candidates failed to score any marks on this question, largely as a result of missing the main focus of it. Some candidates focussed on the quantity production aspect and gave responses such as 'batch' and 'mass' production, while others missed the fact that the nameplate was to be made from aluminium alloy and suggested processes such as injection moulding and vacuum forming. Only the higher achieving candidates gained marks by giving at least one appropriate process, such as die casting or drop forging.

4(b)(i) Many candidates ignored the fact that a batch of nameplates was to be drilled and gave answers that related to one-off production. The use of scribers and centre punches was often seen, and only a limited number of candidates scored marks by describing the use of jigs or CNC machines.

4(b)(ii) Most candidates were able to give at least two relevant safety precautions to be taken when using a drilling machine. Marks were sometimes lost where simplistic references to goggles and aprons were made, these being examples of safety equipment rather than safety precautions.

5(a) This question was generally well answered, with most candidates being able to name two or more CNC machines, the most popular being laser cutters and 3D printers. Higher achieving candidates often also gave water jet cutters, plasma cutters and robots as examples, but where marks were lost, this was most frequently due to repetition of the lathes and milling machines mentioned in the question itself.

5(b) The majority of candidates scored only two of the four marks available for this question, this being as a result of giving responses that were statements rather than descriptions. Any response to this type of question needs to be well reasoned, and simplistic responses can only ever achieve a single mark each. An example of this would be 'CNC machines produce more consistently accurate results because human error is eliminated', rather than simply 'CNC machines are more consistently accurate'.

5(c) Marks gained on this question were quite disappointing, with most candidates scoring only one or two of the three marks available. This was largely due to the fact that many responses did not address the focus of the question, but gave more general effects of the introduction of CNC machines, such as increased production and more consistent accuracy. Where candidates had correctly related their responses to the effects on the workforce, loss of jobs and safer working conditions were often mentioned, and re-training was also seen.

6(a) As was the case with question 5(b), the majority of candidates scored only two of the four marks available for this question, again due to responses being too simplistic. Most responses referred to a reduction in the workforce, but only the higher achieving candidates made mention of the use of JIT, or the fact that consistent accuracy resulted in the minimising of waste.

6(b) Very few candidates scored well on this question, and a significant number did not even attempt to answer it. The use of CAD was covered in most responses seen, but this was often then related to CAM in manufacturing rather than the sharing and editing of designs using digital communications.

R110 Preparing and planning for manufacture

General Comments

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Most centres had included a signed copy of the Centre Authentication Form (CCS160) and the internal mark sheet (MS1). Each candidate is also required to have a Unit Recording Sheet (URS).

The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO1 and LO2 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the learner, and should not be used as a sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1a
This LO requires interpreting 2D and 3D drawings and identifying all relevant details required to make a pre-production product. Candidates might achieve this through a written interpretation of a supplied drawing. Where the centre has provided this drawing then including it would greatly assist the moderation process.

LO1b
For this LO candidates are required to produce a production plan. Where done, this was often quite detailed. In a few cases, only basic plans had been produced. The plan should identify sequence of operations, tools, equipment, manufacturing processes, health and safety requirements and quality control checks.

LO2a
This LO requires the safe use of hand and machining practices to make an item using the production plan. Annotated photographic evidence might be used to show each step of the process. In some cases, only finished items were shown.

LO2b
This LO requires candidates to review the quality of the made component using appropriate quality control checks. Again, documentary evidence supported by photos and a witness statement here are all reliable ways of demonstrating this.

LO3
This LO requires reflecting on the production plan and making suitable modification appropriate to an increased scale of production. It was evident that some candidates simply said the use of a CNC machine was sufficient, but attention should also be given to other implications such as batch operations, sequencing of operations, materials etc to give a more comprehensive answer.

Conclusion and Recommendations

The level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

LO1 and LO2 both have some element of independent working, and also working safely and competently. Learner-generated evident can be supported using a witness statement or other means for both of these LOs.

In LO3 candidates might give a fuller answer as to how increased-scale production can be achieved rather than a simple answer of using a CNC machine.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R111 Computer aided manufacturing

General Comments

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The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 and LO3 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

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Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
Candidates attempted this LO and were able to provide plans for the production of components using a CNC machine. The plans sometimes require more detail in order to access the higher mark bands.

LO2
This LO requires candidates to interpret a CNC program and to demonstrate program operations. There was often limited evidence of this interpretation thereby restricting access to the higher mark bands.

LO3a, b and c
This LO requires candidates to set up and use a CNC machine to manufacture components. There was often good evidence of this, but in some cases only the final item was shown. One way in which to demonstrate this is by annotated photographic evidence supported by a witness statement.

LO4
This LO requires candidates to explore the wider application of computer controlled processes. Most candidates were able to identify processes and access the full range of mark bands.

Conclusion and Recommendations

The level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

There was good evidence of candidates engaging with this unit.

In LO1 plans perhaps require greater detail, in LO2 the interpretations were sometimes a little weak. For LO3 further evidence of each stage of setting and operating the CNC machine should be provided and corroborated, for example, using a witness statement. In LO4 the exploration of computer controlled processes was well addressed by many candidates.

Centres are reminded that a witness statement or similar is required for LO2 and LO3 in addition to evidence provided by the learner. A pro-forma for the witness statement is included with the Live Assessment.

R112 Quality control of engineered products

General Comments

Samples from centres were generally received for moderation before the deadline date, although there were isolated cases where work was not received despite requesting this several times from centres. Centres are reminded to consult the deadline dates for the submission of entries, marks and for sending work in for moderation.

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The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the learner, and should not be used as a sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
This LO requires candidates to describe, with relevant examples, the reasons for implementing quality control in production. This was often well attempted.

LO2a, and b
This LO requires comprehensive quality control checks to be performed during stages of production. One way of demonstrating this is for candidates to perform practical quality control checks using relevant measuring equipment. Evidence could be in the form of annotated photographs supported by a witness statement.

LO3
This LO requires a description of the application of modern technologies used in quality control. While there was some good evidence of this, some candidates misinterpreted this and provided a description of the application of computers in manufacturing rather than in quality control.

LO4
For this LO candidates are required to produce a description of the categories of waste and methods used to reduce waste in lean manufacturing. Most candidates were able to identify each aspect of TIMWOOD and explore this in detail. Some were also able to explore Design for Manufacturing Assembly (DFMA).

Conclusion and Recommendations

Level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

LO1 was often well attempted. LO2 required further evidence of quality control checks being performed. LO3 was often well attempted, but was misinterpreted in some cases as highlighted. LO4 was generally well attempted with candidates identifying aspects of TIMWOOD.

Centres are reminded that a witness statement or similar is required for LO2 in addition to evidence provided by the learner. A pro-forma for the witness statement is included with the Live Assessment.

R113 Electronic principles

General comments

Most candidates attempted all six questions.

In some cases candidates had clearly failed to read the question fully and went on to provide a response that was not actually relevant to the question. Candidates should be advised to read the complete question before attempting a response.

In a number of cases candidates attempted a question and then crossed out the responses. Centres are urged to remind candidates that this is not good practice because under some circumstances a marker can award marks for such questions but sometimes find it difficult to interpret what the candidate has written down.

Centres are reminded to encourage candidates when answering questions that they limit their answers to the space provided on the answer sheet.

Specific Comments

Question One

(a) Generally well answered except the symbol for a generator/galvanometer was not well known by a majority of candidates.

(b) The Digit1 and Digit 2 of Red and Yellow were well known. The multiplier and tolerance colour code of Orange and Yellow was not well known.

(c) Generally well answered by a majority of candidates.

(d) The formula for calculating the voltage across one resistor in a potential divider was not well known resulting in many incorrect answers.

Question Two

(a) The majority of candidates completed the circuit diagram correctly. A few candidates had no ideas of the symbols for a Signal Lamp or a Light Dependent Resistor.

(b) The majority of candidates did not give the correct answer of 'two npn transistors'.

(c) A few candidates gave a reasonable explanation of how the circuit worked but many more did not know the basic fact that in the dark the resistance of an LDR is high.

(d) When in the circuit the value of resistor R_1 was increased. Very few candidates stated that it had to be darker before the signal lamp came on.

(e) When in the circuit, a 1000 µF capacitor was connected across the LDR. Very few candidates stated that the signal lamp comes on more slowly.

Question Three

(a) A badly answered question. A high proportion of candidates confused the non terminal(+) of the operational amplifier with the supply $+V_{cc..}$ More confusion occurred with the inverting terminal (-) and the supply terminal $– V_{cc.}$
A high proportion of candidates labelled the output terminal correctly.

(b) Generally well answered with the correct term 'not connected'. However, a number of candidates became very inventive when deciding what NC stood for.

(c) A badly answered question with a low level incorrect description.

Question four

(a) A high proportion of candidates correctly named Switch A as a Double Pole Double Throw Switch and Switch B as a Toggle.

(b) The graphical symbol of a reed switch was reasonably well known.

(c) Most candidates stated correctly the Buzzer and Solenoid as output devices.

(d) A badly answered question with low level incorrect descriptions being given of how an electromechanical relay worked.

Question five

(a) Generally well answered.

(b) A high proportion of candidates did not state the correct tests that are carried out on portable electrical appliances which should have been visual inspection, earth continuity test, insulation resistance test, polarity of live and neutral test and earth leakage test.

(c) Generally well answered but a few candidates had no idea that they were looking at a plug that did not have its earth wire connected.

(d) Generally well answered with candidates getting at least one piece of information correct as to what should be included on a test label after the test had taken place.

Question six

(a) A high proportion of candidates answered this question with many giving a reasonable description of the flow wave solder process. However, a few included the use of a soldering iron which confirmed that they had no idea what this process involved

(b) A high proportion of candidates answered this question with many giving a reasonable discussion of the advantages to a manufacturer of using pick and place robots for surface mount components rather than using manual components. In a number of cases there was an inaccurate use of spelling, punctuation and grammar.

R114 Simulate, construct and test electronic circuits

General Comments

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The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 and LO3 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

Centres are reminded that witness statements should be used to corroborate evidence generated by the learner, and should not be used as a sole source of evidence.

Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
Most candidates were able to produce a circuit schematic diagram, and there was some evidence of the circuit being simulated. In some cases there was no evidence of simulation, or of any circuit modification as a result of testing.

This LO also requires learners to demonstrate how they can use software to produce a PCB layout – to include both track and component views.
This was often well attempted, but marks seem to have been given for simulation in some cases where this was not clearly evident.
Some candidates used photographs and screenshots effectively to illustrate simulation and also PCB layout production.

LO2a, b and c
This LO requires learners to safely manufacture a PCB and to populate the PCB using components. While it was often clear that candidates had done this, their presentations did not clearly show some aspects such as health and safety, testing of the constructed PCB and the quality of construction. This might be achieved by learners including further annotated photos and commentary, and also by the inclusion of a witness statement or similar. A pro-forma witness statement is included with the Live Assessment which can be used to corroborate and support learner-generated evidence.

LO3
There was evidence of testing, but in many cases this was a set of measurements. Sometimes it was simply a generic photograph of a piece of test equipment (e.g. multimeter) and a statement that testing had been undertaken. Again, this LO can be supported with a witness statement. Learners should also provide evidence, such as annotated photos and records of tests and measurements performed.

Conclusion and Recommendations

The level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

LO1 requires learners to clearly demonstrate producing or reproducing a circuit diagram using schematic software, performing a simulation, modifying the circuit in some way and also producing a PCB layout. Annotated screenshots or photographs are ways in which this could be shown.

For LO2, learners are required to safely manufacture and populate their PCB. Again, annotated step-by-step photographic evidence supported by a witness statement is one way to achieve this.

In LO3 learners have to test their completed PCB/circuit. Again, photographic evidence of testing taking place, with an accurate record of measurements alongside a witness statement might be secure ways of demonstrating this.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R115 Engineering applications of computers

General Comments:

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The standard of assessment by centres was generally consistent but in some cases a little generous or variable. In most cases marks had been clearly entered on the URS and correctly totalled, although there was evidence of incorrect addition. In these cases work is referred back to centres who are required to make a correction. There were no major errors in transferring marks online. The correct candidates had also been included in the samples received in most cases.

Teacher commentary on the URS was generally useful in most cases, but would benefit from the inclusion of further commentary in order to assist with moderation. This should also include page numbers and annotation to identify clearly which pieces of each learner's work is being accepted against each learning outcome. Centres are reminded that work cannot be double counted, and if used as evidence for one leaning outcome cannot be used for others. There was often no further evidence of annotation on learners' work, or additional commentary on the URS which would also help with the moderation process.

Centres should use the witness statement included with the Live Assessment for LO2 to demonstrate how safely and competently candidates worked, and how much assistance was required i.e. level of independence. Centres might consider alternatives. Where witness statements had not been sent for moderation these were supplied following contact with the centre.

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Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
For this LO candidates are required to demonstrate some understanding of how computers are used within engineering design, manufacture and process control. They should also draw upon skills/knowledge/understanding from other units in the specification. This was often well attempted with examples including computer aided design (CAD), computer aided manufacturing (CAM) and computerised process control.

LO2
For this LO learners are required to demonstrate understanding of Human Machine Interface (HMI) and expert systems in maintenance. While these were often well described, candidates did not always access and interpret results from a system, and make recommendations for corrective actions. This requires access to maintenance data. Evidence for this LO can be provided in the form of annotated photographs supported by a witness statement.

LO3a and b
For this LO candidates are required to explain how computers exchange data during manufacturing operations, and also how they communicate and exchange data during maintenance operations. In some cases both of these were not apparent, only one. They are also required to explain how production data is used in maintenance operations, and how hand-held devices are used in both manufacturing and maintenance systems. Candidates should address all of these points to access marks in the high bands.

Conclusion and Recommendations

Level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

LO1 was generally well attempted. In LO2 further evidence was sometimes required of the interrogation of system data (to include interpretation and corrective actions). For LO3 it should be noted that both the use of data, and data interchange in both manufacturing and maintenance is required.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

R116 Process control systems

General Comments

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Where photographs are presented as evidence can centres please ensure that these are annotated with the candidate number.

There was also evidence across units of work being presented without acknowledgement to the source (i.e. plagiarism). Centres are reminded that candidates must acknowledge all sources of information from which they extract material, and that collusion between candidates is prohibited.

Comments on Individual Learning Outcomes:

LO1
For this LO candidates are required to demonstrate understanding of microprocessor/microcontroller layouts in products or systems. This should be done using a range of examples and include operation and input, output and control devices. This was on the whole well attempted however some elements were sometimes missing. This restricted access to marks.

LO2a and b
In this LO candidates are required to design, develop and simulate a control system. This was generally well attempted but evidence was often lacking. This can include programs, annotated screen shots and photographic evidence supported by a witness statement. While it was apparent that candidates were able to develop and program a control system, the evidence did not always do this justice.

LO3
For this LO candidates are required to develop a test plan and to test their system against this plan. They are then required to suggest system refinements based upon this testing. This was generally well attempted, however the evidence provided was often unclear as to how the system had been tested. One way of providing this would a tabulated grid showing the test to be undertaken and the results of testing. Again, this LO can be supported by a witness statement.

Conclusion and Recommendations

Level of detail on the URS (and on learners' work) might be improved which would assist with the moderation process.

LO1 was generally well attempted but sometimes parts were missing or basic. LO2 was often well attempted however the evidence provided by candidates was difficult to follow and did not do their work justice. In LO3 there was evidence of testing but the outcomes of this was sometimes unclear.

Centres are reminded that witness statements must only be used to corroborate and support learner-generated evidence, and are not acceptable as an alternative.

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