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Moderators' Report/ Principal Moderator Feedback

Summer 2013

Principal Learning

Engineering
Level 3 Controlled Assessments

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Level 3 Engineering

General Comments

As in previous series it is evident that a wide range of student ability has been demonstrated which reflects the nature of Principal Learning. The standard of work varied across the units with the majority of students constructing substantial portfolios. Where centres construct robust assessment instruments, that meet the requirements of the unit specifications, students often perform very well. This is contrasted with students who, occasionally, produce considerable volumes of evidence that is insufficiently directed and does not meet the specification requirements.

Centre administration for the internal units proved generally satisfactory. The correct samples were usually supplied however some centres did not provide the correct number of samples or failed to include an EDI print out or correctly completed Student Record Sheets (CRS). The majority of centres however included these documents and packaged student evidence in neat bundles with clear tracking of Learning Outcomes (LOs). Whilst more evidence is being seen of internal verification, in many cases assessment instruments are not included in student packs, meaning it is often difficult for remote moderators to judge the suitability of task being required of students.

As previously noted most student work was prepared in such a way that it was straightforward for the moderators to find the evidence for each Mark Band (MB) and LO. As in previous series there are still issues with the annotation of student work. Indications such as LO1 (MB2), LO3 (MB1) etc. are very helpful to moderators. Using this annotation along with subdividing units into separate LOs, and using the page references on the CRS, is helpful to the moderation process.

Whilst less reliance on published resources is evident, centres are reminded that each unit specification has a section entitled ‘guidance for allocating marks’, which should be referred to when designing/completing summative assessments. The ‘what you need to learn’ section is also helpful in determining the content and evidence requirements of assessments. These elements articulate with the marking grid, which is the key component that assessors and moderators refer to when allocating marks for each LO and MB.

Some very good centre devised activities were noted this series. Similarly centres are continuing to adapt the Tutor Support Materials for this qualification, making improvements and contextualising the evidence requirements. As previously stated, care should be taken when using any sample or exemplar material to ensure that it is fit for purpose and covers all of the requirements of the unit specification.

Marks are moderated for Marking Grid A however some Marking Grid B evidence was noted including use of observation records. One or two centres confused evidence for the two marking grids, leading to incorrect marks being submitted online, not matching those recorded on the CRS.

Moderators noted that most students did not sufficiently indicate references used. It is expected that students should acknowledge reference materials and websites, where used.

Unit EG302_01
Applications of Computer Aided Designing

Moderators report centres assessing more accurately than in previous series, with a greater understanding of how the marking grid informs marks awarded and how assessment links to the guidance provided within the unit specification. There are however several centres that are being overly lenient in awarding marks, with marks often in mark bands far above the standard of work presented. This is often due to the nature of the set assignments, which do not match the unit requirements or provide activities that do not allow all elements of the marking grid to be accessed by students.

Assessment of this unit usually consists of a series of assignments, which target specific learning outcomes; these are usually compiled into a portfolio.

Learning Outcome 1

Nearly all students were able to identify the component parts of a computer system (MB1) and describe their function/role. Making the connection with data storage continues to be a weakness, however some centres are picking up on this and more able students link this neatly to their descriptions. Similarly MB2 continues to be somewhat challenging with students unable to describe typical applications of data storage. A description of data storage devices is often used as evidence which links to a comparison in terms of storage capacity and data retrieval speed, required for MB3. Using a specific design software application (such as a CAD system) as a case study, particularly with reference to storage and transfer of data, could assist students in accessing marks across the three MBs and put the data storage element in context.

Learning Outcome 2

A description of CAD software is usually presented as evidence, sometimes with specific CAD/CAM packages being described. Where students subdivide their reports into a discussion of design, presentation, testing and analysis they are more likely to achieve full marks (MB1). Too often the link with engineering products and engineering design was missing from this element however. MB2 requires students to prepare a case study of how software can be used in the pre-production of a simple engineered product. Very few students were able to provide evidence of this with many discussing how CAD systems are used more generally; a detailed explanation of CAD/CAM or virtual testing would be a useful source of evidence here. Similarly the MB3 requirement to identify how software can be used for more complex products, which involve more than one engineering process, was also inadequately addressed by most students.

Learning Outcome 3

The requirement to construct 2D engineering drawings (MB1) resulted in some good and some poor examples of layout and presentation. Most students used appropriate templates, with title blocks and projection symbols. Moderators report the use of appropriate projection systems and suitable dimensioning style was often missing or not in adherence with BS conventions. As previously noted, centres are generally, only producing the required number of drawings, unlike in previous series where far too many drawings were often constructed.

Issues with the production of assembly drawings remain, these are often fully dimensioned and students should understand that balloon referencing and parts lists are normally required with dimensions only indicated if they relate to the fit of components. Similarly there is no requirement to include dimensions on isometric drawings, although these are often well constructed (MB2).

There is evidence that centres are continuing to require students to produce hydraulic/pneumatic system diagrams as well as electronic/electrical circuits (MB3) as required by the specification, although a few students still (incorrectly) produce block diagrams.

Learning Outcome 4

The use of 3D software is often demonstrated, with relatively straightforward components reproduced in different orientations and visual styles (MB1). Having produced a very straightforward 3D model students often failed to produce more complex models (MB2), similarly the 3D representation of an industrial component (MB3), was not evidenced.

Students could consider using 3D software to generate complex models for LO4 and represent these same models as 2D orthographic views, in order to satisfy the requirements of LO3, an acceptable and creative approach.

Learning Outcome 5

In the majority of samples moderated students attempted MB1 and generally performed a suitable analysis (such as stress analysis) of a given product. Evidence presented is often a series of screen shots with insufficient detail, colour or explanation of what the diagrams represent. Often the screenshots are so small as to be of little assistance to remote moderators.

The comparison with a specified standard is often missing or very brief (MB2). Evaluation and explanation of the approach taken in the case of non-compliance (MB3) is generally not discussed in sufficient detail, often a trial an error process is used which is a rather limited approach at this level.

Unit EG303_01
Selection and Application of Engineering Materials

The standard of assessment across centres is broadly in line with national standards, with only a very limited number of examples of overly lenient assessment being noted in this series.
Assessment of this unit usually consists of substantial portfolios, containing a series of assignments that target specific learning outcomes.

Learning Outcome 1

Most students are able to provide an overview of the structure of metals and polymers and consequently address MB1, although sometimes forgetting to consider their effect on mechanical properties. Some students started to consider the electrical properties, required to access marks in MB2, and the thermal properties required of MB3. It is still surprising however to see these elements not being considered. Centres might consider instructing students to produce a table in order to encourage them to consider the properties required for MB1, MB2 and MB3.

Learning Outcome 2.1

The majority of students described a form of supply of a metal, polymer and composite. This allowed marks from MB1 to be awarded. Students were also able to discuss the properties (MB2) of each material and suggest an application, however few students were able to provide the level of justification required to fully access marks in MB3, particularly the justification of the form of supply.

Learning Outcome 2.2

Although students were often able to use a given information source to select material it would be helpful if this source could be clearly identified, screen shots often being used and reproduced at too small a scale (MB1). The use of a source that students select (MB2) was similarly often poorly evidenced, although reasonable justifications were often given (MB3).

Learning Outcome 3.1

Students described work hardening, grain growth in metals and glass transition temperature in polymers with relative clarity. This allows considerable marks to be awarded from MB1. This should lead to a description of the change in properties (MB2) and a reference to the micro-structure of the materials (MB3). It is evident that students are being encouraged to consider these elements and evidence presented continues to show progress in addressing these elements, in comparison with previous series.

Learning Outcome 3.2

Students were able to provide descriptions of heat treatment techniques in a reasonable amount of detail (MB1), associated property changes is an element that is still poorly addressed by many (MB2) and the materials to which the heat treatment processes apply are still often being referred to as steel in all cases. Structural changes that occur during heat treatment (MB3) is an element that is now starting to be evidenced by students, unlike in previous series.

Learning Outcome 4.1

A series of calculations allows marks across all three MBs to be awarded. The majority of students addressed all of the MBs, by performing calculations for direct stress, factor of safety and shear stress (MB1), direct and shear strain (MB2), and modulus of elasticity and shear modulus (MB3). Many students made arithmetical errors or made mistakes with the use of SI units and standard form and this prevented them from achieving the higher marks available.

Learning Outcome 4.2

Students were able to provide concise descriptions of modes of failure. The service conditions under which this occurs (MB2) and the characteristic appearance of two failure modes (MB3) proved more challenging with the usual annotated diagrams not being used as often as would be expected for MB3. As previously noted few centres use industrial visits or artefacts in order to contextualise this LO.

Learning Outcome 4.3

Most students provided evidence of destructive testing although non-destructive testing was sometimes missing from portfolios, which is the key requirement of MB1. Evidence presented to verify material properties or verify the nature of faults was often poorly presented by students (MB2). The industrial settings, where such tests might be used (MB3), also proved beyond the majority of students.

Unit EG304_01
Instrumentation and Control Engineering

There was evidence of the full range of scores being achieved by students, and some centres are commended for the links they have established with industry, making both the delivery and assessment ‘applied’ and not just a theoretical exercise. Where this is the case, students in general, produce the most effective evidence and score the highest marks. It is clear that the centres which assess their work most accurately are those where the teaching staff have developed a thorough understanding of the assessment grids across all mark bands, and how these relate to the ‘what you need to learn’ section. There was little evidence of centres providing assignments which did not fully meet the requirements of the specification, although there continues to be some weaknesses evident where there is little evidence of the delivery of the unit, or guidance on real industrial instrumentation and control systems as are required.

It is expected that students will have opportunities to investigate instrumentation and control systems which are of different types and complexity, covering a range of sensors, transducers, actuators, displays and how these components work together in a practical control engineering system.

This can be assessed using up to five tasks, which directly address each of the learning outcomes;
LO1 - an investigation of signals and transmission media
LO2 – a study of a range of different types of sensor, transducers and display
LO3 - an investigation of open and closed loop control systems
LO4 - practical activities using PLC programming software
LO5 – a thorough investigation of a complete application of a control engineering system

Learning Outcome 1

Most students tend to produce reasonable descriptions of analogue and digital signals, even if many of them are limited to a sine-wave and a digital pattern, with similar diagrams being produced by students across a range of centres. Very few students actually mention that an analogue signal is one which directly reflects the quantity which is being measured. The majority of students presented descriptions using simple diagrams to describe signal format, etc, but only a limited number of students developed their work to produce sufficiently detailed explanations of the methods and processes involved with interfacing and signal conversion as is required to gain marks across MB2 and MB3. Some students produced low level work which did not fully meet the requirements of MB1. A significant number of students included imported images and diagrams from the internet and often included only a brief description, scoring only low marks.

Learning Outcome 2

There was evidence of centres using industry standard training boards to deliver this section, and the results are that work is in line with the expectations of the specification. There are a range of resources available to help students to understand and explain how the system operates, for MB2, and the part played by each component in systems. The evaluation of the complete system, for MB3, continues to be more difficult for students with many writing only brief reports, showing limited understanding. Where access to suitable resources was limited, students tended to provide evidence which was based on internet content and therefore limited the marks which students were able to achieve. There was evidence that the assessments provided by centres stretched the more able students, however it should be remembered that the assessment should be designed in such a way as to allow students to achieve, rather than limit them to MB1 or MB2 because the nature of system being investigated is too complex.

Learning Outcome 3

The majority of students provided basic details of an open and closed loop system, although some appeared not to fully understand even the basic concepts and only included very brief and simple diagrams. Beyond MB1, the evidence aimed at MB2 and MB3 which considers positive and negative feedback, was not attempted effectively by many students. The evidence tended to be brief in nature, with negative feedback and the formation of error signals being covered in greater detail than positive feedback or feed forward. PID control evidence is varied across the full mark spectrum, although these were not evaluative in most cases, with students providing insufficient focus on the accuracy, resolution, range, hysteresis, settling time and stability for systems. Some students really demonstrated that they understood the requirements of this LO. As previously, the evidence tended to be descriptive, with limited evaluation of complete control systems for MB3. Students mainly described what a system did rather than how it did it, or how well the system did what it was designed to do.

Learning Outcome 4

The majority of students provided a description of a PLC system for MB1, with some explaining the advantages and disadvantages of such systems. There was little evidence from some centres of students being given an opportunity to program a PLC, although suitable evidence included a logic ladder being produced for traffic lights. Some student work was not supported by appropriate evidence of understanding. Where used, links with industry proved extremely valuable and gave students a base to work from as their ‘typical application’ was a real application, not one which was referred to in a handout or a website. There was little in the way of evaluation of the associated control programs in terms of structure and control flow, optimisation and/or minimisation for systems.

Learning Outcome 5

Some very thorough portfolios were seen which addressed all of this LO in great detail and, needless to say, these students had been in to industry and investigated real control systems whilst others focussed on more domestic applications such as washing machines. Students often included a brief description of the sensors and included a simple block diagram showing input, output and various sensors. These diagrams would however be only partly able to meet the needs of the Mark Band due to the incomplete labelling. Students included brief descriptions of signal conditioning for partial marks in MB2 and a description of the program. Not all students discussed the use of actuators and/or the control program being used. Similarly the level of justification and evaluation required to evidence MB3 was missing from most student portfolios.

Unit EG305_1A
Maintaining Engineering Plant, Equipment and Systems

This unit continues to be one which polarises student responses and is either very effective and allows them to achieve high marks, or there is little evidence beyond mark band one for many students. It is clear that in some centres there is a lack of expertise in the field, and therefore it would benefit students if they could experience the type of work involved in an engineering maintenance environment either through the use of industrial visits or talks from maintenance engineers or technicians across a range of industries.

The majority of the tasks need to be set in the working environment or where access is provided to a workshop where maintenance activities take place or are managed. Otherwise, the terminology and expectations may be insufficiently explained and understood.

To fully address the unit, it is possible to use three or four tasks, as advised in the specification;
Task 1 - LO1.1, 1.2 and 2.1 – is likely to contain written questions relating to specific maintenance activities. The LO is written with a link to 'production' which immediately makes a 'service industry' link quite difficult to evidence. For example, an aircraft or a fairground ride – where 'the effects on production' can be interpreted as 'loss of business or revenue'.

Task 2 - LO2.2 and 4 – is likely to be of a practical nature, and involve the planning and carrying out of maintenance. Many interpret a 'maintenance plan' to be a very simple checklist for a brief activity. A real maintenance plan would be developed by a team of maintenance engineers in a large industry, and each item of plan would be considered. Maintenance would be planned to be carried out for all, to ensure the minimum effects on production. A service for a car is only a small part of the maintenance plan, and the comments seen in such portfolios tend to be rather trivial when considered on an industrial scale. Further guidance is provided in the 'guidance for assessment' section of the unit specification.

Tasks 3 and 4 - could be a mixture of written activities and a practical activity covering LO3.
Where centres did combine the LOs as indicated above, and in the specification, some gave a score for the task, not for each LO as is required, making it difficult to see where the assessor had allocated marks. Assessment should always be by LO, even if the LO has 2 or more sub-sections, such as LO1.1 and LO1.2. This is imperative for the accurate moderation of work from centres.

Learning Outcome 1.1

A range of evidence was provided and the standard varied across MB1, 2 and 3. Typically these would consider the causes of failure of aircraft, railway signalling equipment, or industrial plant. Where students had considered product failure as opposed to failure of production equipment, students struggled to produce the evidence required to describe the effects on production. Where industrial links were made use of, students showed a real appreciation of the consequences of something failing.

Most considered the effect on customer expectation and corporate image although this was not always done by linking the two (MB2). The MB3 requirement, of two consequences of the failure on corporate image, was not always adequately considered, where advantages and limitations would be anticipated. Evaluation lacked some technical content, the detail of how downtime could alter a company's image was highlighted in some pieces of work, but evidence towards MB3 lacked the depth required.

Learning Outcome 1.2

The costs of maintenance (MB1) was evidenced well by some students, although there was little discussion/justification of the benefit of keeping accurate records. Some students presented costing sheets to show the cost of maintenance, however it would have been advisable to also include an explanation to detail the types of costs incurred and why they were incurred. The effects on customer expectations, at MB2, and record keeping in a maintenance environment, for MB3, were, again, poorly evidenced. Many students made responses which were aimed at MB3, but there was a lack of real, relevant information to gain mark at the higher levels. A small proportion of students did provide well detailed good reasons for keeping records and offering good examples/advantages.

Learning Outcome 2.1

Some students described two given types of maintenance strategy, for MB1, in detail, but for the majority, depth and content were lacking, probably indicating that industrial links with real engineering maintenance was lacking. There was a mixed response to MB2, the application was not always clearly defined, particularly as the key to this is how the strategy is used, not simply stating the equipment the strategy is used for, and MB3, to justify why it would be used. Although a handful of students performed well, the majority of submissions included brief evidence of justification which was not to the extent expected of level 3 students.

Learning Outcome 2.2

All students produced some kind of maintenance plan for MB1, presented using two appropriate methods. The range of evidence produced by students tended to be basic maintenance plans, sometimes describing the maintenance process rather than producing a maintenance plan. These plans should feature the elements listed in the guidance to assessment, indicated on page 89 of the unit specification. Many elements of this list were not seen in student evidence (MB1). Some students were able to describe the methods used to present a plan, for MB2, but many lacked real content and detail. Some made superficial and brief comments which did not really consider the use of the plan. In general, students did not provide evidence of adjusting and improving their plans as is required for MB3.

Learning Outcome 3

Work varied across the full range on the collecting and interpreting of data for plant, equipment and systems, as required for MB1, as did the reviews of their performance for MB2. Justifying the use of the data collected, for MB3, proved to be a challenge for the majority of students, as the justification required for MB3 should be in the form of advantages and limitations and, although some students started to address this, few did so in any detail. There was evidence that some students used workshop machinery very effectively for their data collecting, such as a centre lathe in the workshop, but the best performers were always those who had worked closely with industry, making use of real data about real equipment in a manufacturing environment.

Unit EG306_1A
Investigating Modern Manufacturing Techniques used in Engineering

There continues to be evidence of gaps in student knowledge where this unit is concerned, mostly with regard to critical path analysis, whilst evidence of teamwork continues to be rather limited. There was some misinterpretation of the specification requirements from certain centres, although this was restricted to individual learning outcomes.

To fully address the unit, it is possible to use three or four tasks, as advised in the specification;

Task 1 which could be a written ‘report’ or ‘oral presentation’ covering assessment focus 1. This will explore the issues and explain the differences in traditional and modern manufacturing production systems in industries. This should cover at least two different manufacturing systems.

Task 2 could then be a further written ‘report’ or ‘oral presentation’ covering assessment focus 2. This may be done on placement or related to an industrial visit. Alternatively, the task may direct learners towards two completely different industries to those considered in Task 1 so that they get a broader knowledge and experience of engineering manufacturing.

Task 3 could be a written ‘report’ or ‘oral presentation’ covering assessment focus 3. Within the report or presentation will be the completed network, including the critical path and also a schedule and justification for mark bands 2 and 3 respectively.

Task 4 should be a ‘process portfolio’ covering assessment focus 4. An activity which enables learners to collect process control data from a local industry or other local source needs setting is ideal. This should be done as a team, and then production control charts produced from the recorded data.

Learning Outcome 1

It is the expectation of this LO that students explain jobbing, batch and mass manufacture including typical products manufactured using these techniques and numbers/volume of production, as required by the stated assessment with regard to both traditional and modern techniques. The majority of students did not differentiate clearly between traditional and modern methods e.g. you can make a batch in either; what are the differences? This has the effect of restricting the marks which can be awarded. The analysis of modern flow manufacture was more appropriate with students able to achieve marks from MB2 and also MB3 where lean manufacturing was discussed along with the use of manufacturing cells where these were appropriate. Students in general did not consider lean manufacturing thoroughly, with some only mentioning JIT in passing their reports. It is expected that there would be some discussion of JIT, Kanban and Kaizen to allow students to gain marks across the full range of MB3. It is important that discussions are contextualised to indicate how it overcomes issues with traditional manufacture.

Learning Outcome 2

Students in the main displayed some understanding of the level of automation in the manufacture of two different products, although these tended to be limited to the automotive and aerospace sectors – it is rare for students to consider others which would offer greater scope for comparisons. Students tended not to include detail of the applications of computer processes in manufacturing, therefore comparisons can be limited. It is expected that students will include comparisons along with justifications for the level of CAM used for specific processes in order to achieve the full range of marks across MB2 and MB3. In the majority of instances, this evidence was somewhat limited and restricted the levels of achievement.

Learning Outcome 3

This learning outcome was often assessed with leniency on the part of centres, as the majority of students did not submit a critical path analysis which conforms with the expected standard. In some cases, the use of network analysis was evident, although in many cases the presentation did not clearly show the key earliest and latest start/finish times and/or critical path as is required for MB1. In order to achieve all of this it might be beneficial if students were to use the node method for network diagram. Students cannot achieve full marks if there is only one path, nor if every path has the same duration. It is important that at least some of the activities in the network diagram have some element of float. For the production plan (MB2), students should include all of the elements outlined in the unit content (see p107 'guidance for allocating mark's). These production plans would normally be presented in tables rather than being a list with no clear quality control points, quality checks and lack of H&S although some students included risk assessments, these appeared separately (MB2). Some plans were analysed and adjusted, however the level of review was limited, only allowing a few MB3 marks to be awarded. The majority of students evaluated the process rather than the plan, with the consequence that suggestions for improvements were for the processes and skills rather than changes to the production plan itself. This is an aspect where the task needs to be communicated more clearly to students.

Learning Outcome 4

Student evidence tended to be variable for this LO with students scoring across the full mark range. Some students produced only a simple subjective checklist, with no dimensions or control data. This meant there was no statistical data to analyse and no objective measures of variation. It is worth centres considering an activity where learners have to make a number of examples of a simple product on a CNC machine, measuring a key dimension (e.g. length), tabulating the results, calculating the mean and variance, plotting values on charts, comparing the outcomes with a stated tolerance, comparing different batches etc. This gives the students the scope to investigate standards e.g. ISO9001 and to access higher mark bands. A similar approach could be taken to data collected from a visit to an industrial partners produced charts and tables (MB1) and demonstrating data analysis (MB2). Implementation of ISO 9000 procedures was only briefly mentioned by most (MB3).

Unit EG307_1A
Innovative Design and Enterprise

The standard of assessment across centres is broadly in line with national standards, with only a few examples of overly lenient assessment being noted in this series. Assessment of this unit usually consists of a portfolio, containing a series of assignments, which target specific learning outcomes.

Learning Outcome 1

As in previous series students were often able to identify two innovative products and consider the design/operation of these, often focussing on products from a consumer perspective however; consequently the method of manufacturing and marketing approach, required for MB1 were often missed. This is also true of the required comparison with traditional products. By contrast the innovative features of the chosen products were often discussed in some detail (MB2), but the factors that made these products a success (MB3) was, frequently, not clearly identified.

Learning Outcome 2

Certain favourite innovators, such as Steve Jobs and Sir James Dyson continue to be featured here. Although individuals have often been identified and their career histories described (MB1), the choice did not always feature entrepreneurs who have a significant engineering background. Key factors that led to the success of the selected entrepreneurs often focussed on the products they developed rather than the individuals concerned (MB2). In general students did not sufficiently analyse the reasons for success in their chosen entrepreneurs' careers resorting to internet research with limited analysis or evaluation (MB3).

Learning Outcome 3

The expected engineering activities, required for MB1 were often case studies of specific events or companies, not allowing the impact of engineering activity to be broadly addressed (MB1). Environmental issues were often discussed although many students failed to identify how these environmental issues are being addressed, by the use of innovative technology for example (MB2). The case studies required for MB3 were often missing or used as evidence for MB1.

Learning Outcome 4

This LO allows a creative approach to be taken by students, although much of the evidence presented by students displayed elements of innovation, this was often in only one key product feature (MB1). Where centres provided design sketches, CAD models or annotated diagrams a significant amount of creative and innovative design was demonstrated. Innovative features were often well described (MB2) and the research and thinking process adopted was often somewhat evidenced (MB3).

Learning Outcome 5

More students are addressing features outlined in the guidance for allocating marks which indicates the expected range of activities expected, unfortunately some are still going straight into giving examples of successful products and comparing them with unsuccessful ones (MB2). Product features are often discussed however the majority of students need to understand that the focus of this learning outcome is on how the products were brought to the market and the different approaches taken in marketing terms (MB3).

Unit EG309_01
Principles and Application of Engineering Science

From the centres which submitted portfolios for this unit the work was generally good, with a few achieving around full marks on most LOs, although LO5 continues to be the weakness. The other LOs allow straightforward short tests, individually or in groups of LOs as suggested in the specification.

This unit has a focus on applying scientific principles to solving practical engineering problems.

The assessment should involve a series of tasks/questions aimed at assessing the range of scientific principles and some of these tasks will need to be set in a laboratory or practical environment to perform actual engineering science investigations.

Most of the explanations should include sketches, diagrams, charts and tables, and where provided, some were clear and helpful, but others were not. Where problems have numerical solutions, it is expected that full working will be shown. The tasks could be:

Task 1 - LO 1 and 2 – set of questions to work through involving coplanar forces and an investigation of Newton's laws of motion, or they could be based on a scenario involving linear and angular motion. Some centres are starting to develop interesting and effective assessment tasks. Most centres now include a task requiring the determination of 'beam reactions' as required for LO1, MB3.

Task 2 - LO 3 – should involve an investigation of series/parallel combination circuits and applications of electromagnetism. A close look at LO3, MB1, reveals a requirement to solve circuit problems involving single load, single source circuits. The weaker students who struggle with series/parallel circuits may have been deprived of marks if a centre assessment did not fully address this requirement.

Task 3 – LO4 and 6 - expect practical activities and problems based on energy transfer in a thermodynamic system and an investigation of the forces acting in hydrostatic systems. Many centres provide students with a range of tasks, generally derived from the sample assessment material or from other sources. All tended to be adequate.

Task 4 – LO5 - is based on an investigation of a petrochemical process. A handful of centres just left this LO out, possibly due to the lack of specialist knowledge.

Several centres assessed using fractional marks, when the assessment grids clearly show the scores to be whole numbers. For example, if a response is not worth 7 marks, the score is 6 – not 6.5, as seen on a small number of portfolios. Using such fractional marks on all LOs, then rounding up the final score can make the score 3 or more marks higher than it actually deserves.

Learning Outcome 1

The majority of students calculated the effects of forces in engineering systems at MB 1, 2 & 3, although some presentation and work was very untidy making the moderation process difficult. It must be noted that beam reactions are not included in the sample material, however some centres have appropriately modified these materials to include such a task, whilst also manipulating values to change questions as appropriate. Some centres provided differentiated tasks based on student ability which is good practice. Many students and assessors still do not seem to appreciate that forces are represented as vectors and should have magnitude and direction for full marks to be awarded.

Learning Outcome 2

Most of the students adequately carried out calculations to determine the effects of motion, work, and energy transfer in engineering systems at MB1, 2 & 3. The same comments apply to neatness and presentation of results as were made for LO1. Where centres included the question sheets/tasks and mark schemes being used, this was much appreciated by a remote moderator and also allowed feedback opportunities which may lead to further improvement of the assessment tasks. The principle of conservation of momentum, required for MB3, continues to be a challenging area for many students.

Learning Outcome 3

All students applied electrical principles to engineering for MB1, although not all students were able to complete MB2 by being unable to apply basic principles of magnetism. For MB3, most students did solve the required practical problems involving AC circuits. The comment made earlier about the requirements of LO1 (single source, single load circuits) is being addressed by some centres – providing access to the full range of marks.

Learning Outcome 4

Students generally did the calculations to apply the principles of heat and thermodynamics, particularly at MB1. Some were not able, at MB2, to apply thermodynamics to the expansion and compression of gases, and similar problems existed for MB3, where few could successfully apply the first law of thermodynamics.

Learning Outcome 5

The work required for this LO is quite specialised to the carbon chemistry requirements of the petro-chemical industries, where knowledge of the principles of chemistry and the effects of chemical processes and reactions is required. The standard of work seen at moderation was rather mixed and the impression appears to be that some students did not get on well with the theory that was presented. Some centres submitted portfolios which had this LO completely blank, whilst others submitted work which had been assessed very leniently.

Learning Outcome 6

Many students were able to demonstrate their understanding of the principles of fluid dynamics to achieve MB1 and carry out the associated calculations, but some struggled with MB2 which required knowledge of fluids in motion. Similarly, for MB3, the ability to apply Bernoulli's and D'Arcy's equations appeared to be limited.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwant to/Pages/grade-boundaries.aspx

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