Moderators' Report/
Principal Moderator Feedback

Summer 2012

Principal Learning

Engineering
Level 3 Controlled Assessments

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Chief Examiner's Report

Level 3 Engineering - June 2012

Introduction

Many candidates submitted comprehensive portfolios, containing their own work, while a minority still continue to include rough notes, research material and a large amount of documentation, most of which is not relevant to the marking grids, so should be retained at the centre.

The majority of centres demonstrate an ongoing commitment to the development of their employer and industry links, providing some excellent examples of applied learning, in the workplace and relevant to modern engineering industries.

The standard of work varied across the units with the majority of candidates constructing substantial portfolios. Where centres construct robust assessment instruments which meet the requirements of the unit specifications, candidates often perform very well. This is contrasted with candidates who produce considerable volumes of evidence that is not clearly directed and does not meet the specification requirements.

The assessment instruments are also starting to reflect employer links, making use of actual, or modified, scenarios around which to develop their applied assessments. Where assessment is based purely on theory or 'what ifs', research, internet searches, etc, marks from mark band 1 are all that can be attained due to the lack of real depth of learning.

A small number of centres continue to use the samples which were initially provided by the awarding body, without making attempts to tailor them to their own experiences and resources, or demonstrate any internal quality control by making them more fit for their own purpose.

Administration

Most portfolios were submitted in a timely fashion, some being a few weeks before the deadline, but most of them arriving for moderation on, or close to, the deadline.

Centre administration, inclusion of the correct sample, including the highest and lowest non-zero score, a signed EDI printout showing the scores submitted to Edexcel, authentication signatures of candidates and assessors on completed Candidate Record Sheets (CRS), etc was generally good, with a small number of centres needing reminders for an omission or two.
Centres are reminded that each unit specification has a section entitled 'guidance for allocating marks', which should be referred to when designing, completing and assessing 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 learning outcome (LO) and mark band (MB).

Some centres now include a complements slip or piece of paper with the name and contact email and direct phone number for the examinations officer, which saves a few days of return of post when anything is missing and has to be requested by a moderator.
Centres are also reminded to ensure their centre name and number are currently recorded on the Edexcel Gateway to allow contact and recording of results against the correct centre. Centres merge and change their name quite regularly, and keeping the records at Edexcel up to date can reduce the risk of delay for reporting the results and return of work.
The CRS is designed and provided by Edexcel to be completed and placed at the front of each portfolio. It is in Word format to allow the addition of more rows to allow the correct number of learning outcomes (LOs) to be entered, but some centres are using it to provide feedback to the candidates or expanding it to include the assessment criteria, etc. All this is fine, for centre use, but please place another one in front of these, in the original format, containing the information required for moderation.
A recording error which occurs quite regularly is the combination of LOs, such as LO1.1 and LO1.2, as appropriate, into a single LO1, which does not provide adequate information for the moderator to work with. Some centres have designed their own mark record sheets for marking/feedback. Whilst this is often useful for candidates the CRS provided by Edexcel should still be completed and included at the front of each portfolio or assignment. This is used to guide the moderator in selecting the initial sample of work to moderate.

Assessment

The presentation of portfolios improves year on year and the majority of centres are now presenting work as if it is going for moderation and not for a presentation or open evening. Folders, plastic sleeves, fancy coloured front sheets, etc, are not required, and in fact, they impede the processes of moderation and awarding, as well as bulking up the packaging, causing storage problems in many moderators' homes. A4 paper, in portrait mode, each portfolio being held together using a single treasury tag through the top left hand corner is all that is required. Staples should never be included. Page numbers should be considered essential.

For most units, a dozen to twenty pages of A4 proves adequate to achieve scores into the 50s, but despite this, some portfolios still contain copious amounts of unnecessary teaching material, research printouts, website and employer printouts, etc. The only material that can be awarded any marks is the work of the candidates, and that is generally all that should be assessed and sent for moderation.

The inclusion of a set of the assessment tasks is always helpful when evaluating a candidate's performance against the assessment decisions made by the assessor, but a few centres submit none of these. Some appear not to have had tasks set, but instead, they appear to come from candidates who have been told to go and find everything they can about a particular subject, then submit it. If the responses do not directly evidence the assessment grids, then marks are difficult to award and agree. If the moderator is not directed to the evidence, by CRS annotation, or annotation on the work, then the marks are generally reduced to match the evidence which the moderator can reasonably find.

A growing number of centre assessors now annotate effectively by adding comments in the margin, such as ‘MB2 explain’ top indicate exactly where the paragraph is that does this. Some, though, tend to be a little over enthusiastic, hence the need for internal moderation processes at centres as part of their internal quality assurance procedures. It is difficult not to award a candidate a score which represents their efforts over the whole course, so having a colleague to check a few samples is a good first step towards quality control.

The number of plagiarism incidents was much lower than in previous series and it is good to see that some centre assessors are detecting this early and allocating the marks which the work truly deserves.

Internally Assessed units

Unit EG302/01

Applications of Computer Aided Designing

Standard of Assessment

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 generous when 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 candidates. It is also accepted that assessors are also teachers and separating themselves from the assessment of a candidate's performance over two years and focusing on the assessment of the portfolio itself can be challenging, but must be done. Hence the advantage of having effective internal moderation, lead assessor and domain assessor roles in place.

Assessment of this unit usually consists of a portfolio, containing a series of assignments that target specific learning outcomes.

Learning Outcome 1

Nearly all candidates 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 candidates link this neatly to their descriptions. Similarly MB2 continue to be somewhat challenging with candidates 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 CAD system as a case study, particularly with reference to storage and transfer of data, could assist candidates 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 candidates 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 candidates to prepare a case study of how software can be used in the pre-production of a simple engineered product. Very few candidates 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 poorly addressed by most candidates.

Learning Outcome 3

The requirement to construct 2D engineering drawings (MB1) resulted in some good and some poor examples of layout and presentation. Most candidates 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. 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 candidates 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 beginning to require candidates to produce hydraulic/pneumatic system diagrams as well as electronic/electrical circuits (MB3) as required by the specification, although a few candidates 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 candidates often failed to produce more complex models (MB2) similarly the 3D representation of an industrial component (MB3), was not evidenced. Some candidates are 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 candidates 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. 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 and error process is used which is a rather limited approach at this level.

Unit EG303/01

Selection and Application of Engineering Materials

Standard of Assessment

The standard of assessment across centres is broadly in line with national standards, with only a few examples of over generous 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 candidates 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 candidates 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 candidates 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 candidates described a form of supply of a metal, polymer and composite. This allowed marks from MB1 to be awarded. Candidates were also able to discuss the properties (MB2) of each material and suggest an application however few candidates were able to provide the level of justification required to access marks in MB3, particularly the justification of the form of supply.

Learning Outcome 2.2

Although candidates 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 candidates select (MB2) was similarly often poorly evidenced, although reasonable justifications were often given (MB3).

Learning Outcome 3.1

Candidates 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 candidates are being encouraged to consider these elements and evidence presented is generally starting to address these elements, in comparison with previous series.

Learning Outcome 3.2

Candidates are 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 often referred to as steel in all cases. The

structural changes that occur during heat treatment (MB3) is an element that is now starting to be evidenced by candidates, unlike in previous series.

Learning Outcome 4.1

A series of calculations allows marks across all three MBs to be awarded. The majority of candidates 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 candidates made arithmetical errors or made mistakes with the use of SI units and standard form and this prevented them from achieving the number of marks expected.

Learning Outcome 4.2

Candidates 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. Few centres use industrial visits or artefacts in order to contextualise this LO.

Learning Outcome 4.3

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

Unit EG304/01

Instrumentation and Control Engineering

Standard of Assessment

Performance in this unit remains constant across the range of centres, with some portfolios reflecting good industry links with real applications of instrumentation and control. Where this occurs, the marking grids can be evidenced in their entirety and maximum marks are possible. Where the unit is taught and assessed as a classroom subject, with access to very limited resources, the potential to achieve any score beyond mark band 1 is almost impossible.

Candidates should be presented with opportunities to investigate real industrial applications of instrumentation and control systems of different types and complexity, covering the sensors, transducers, actuators, displays and how these components work together in a practical control engineering system. Where the teaching is limited to classroom and internet, much of the intention of the unit is missed.

This unit is generally assessed using up to five tasks, which directly address the learning outcomes, as follows:

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

Almost all candidates produce a basic overview/description of analogue and digital signals, although many seem to believe that an analogue signal must be a sine wave, when it can be any shape, or even flat, since its main characteristic is that the voltage/current represents a direct analogy of the system it is representing.
Very few candidates actually mention that an analogue signal is one which exactly replicates (or is analogous of) the characteristics of the quantity being measured. Many provide the descriptions using simple diagrams, describing signal format, etc, but few then go on to produce sufficiently detailed explanations of methods and processes involved in interfacing and conversion, across MB2 and MB3. Some portfolios contained work which hardly addressed MB1. Many imported images and diagrams from the internet (which is not their work, hence they receive no marks) and others who used imported images, but produced a few words of description, scoring perhaps half marks.

Learning Outcome 2

The range of sensor tends to be limited, unless a real industrial system is worked with or visited. Where linked training providers or industrial links are being used to deliver this the results are generally good, in that they effectively evidence the marking grids. Access to resources can help candidates to understand and explain how the system operates, for MB2, and the part played by each component. The evaluation of the complete system, for MB3, continues to present a challenge, causing many candidates to produce brief reports, showing limited understanding. Where access to suitable resources was limited, the responses tended to be internet based, scoring rather low marks.

Learning Outcome 3

Open and closed loops can be explained quite simply, or they can be made very complex. Repeating material which has been found on the internet does not attract any marks, and the benefits of working with a real applied system, in industry, cannot be over stressed. The majority of candidates provided basic details of an open and closed loop system, although some appeared not to understand the basic concepts. Beyond MB1, the evidence aimed at MB2 and MB3, regarding positive and negative feedback, was not attempted effectively by many candidates, whilst the PID control details continued to vary across the full mark range. Some candidates appeared to do very little, but a handful really demonstrated that they understood the requirements of this LO. As previously, the evidence tended to be descriptive, but limited on the evaluation of a complete control system for MB3 – saying what it did, not how it did it, or how well the system did what it was designed to do.

Learning Outcome 4

Without access to a PLC, marks will be very limited, here. Almost all candidates provided a description of a PLC system for MB1, but many centres appear not to have given candidates an opportunity to program a PLC as little evidence was found in many portfolios. Where used, links with industry proved extremely valuable and gave candidates a base to work from as their ‘typical application’ was a real application, instead of one which was referred to in a handout or a website. Unfortunately, real applications were few and far between.

Learning Outcome 5

Although simulations can be used for this outcome, it does tend to limit the score which candidates can achieve. Some very thorough portfolios were seen which thoroughly addressed all this LO in great detail and, needless to say, these candidates had been in to industry and investigated real control systems. Many contained few real details which addressed the assessment criterion, and some provided a collection of downloads from a range of websites, scoring zero, or not far from it. Some centres now realise that this is not the work of the candidate, so award zero marks, and others award a range of marks, resulting in a moderator passing the work to the Compliance Department at Edexcel, where a full plagiarism check can be carried out, leading to a full range of outcomes.

Unit EG305/1A

Maintaining Engineering Plant, Equipment and Systems

Standard of Assessment

To deliver and assess this unit, access to maintenance engineers and/or experience of working in a maintenance team in industry is essential. The samples submitted for moderation contained portfolios which indicated that it had either been delivered and assessed effectively, or not very much at all. The staff delivering this unit really need to have experience of working in an engineering maintenance environment, and/or use industrial visits to (or from) maintenance engineers or technicians across a range of industries.
To allow full coverage, access to a well equipped workshop can be used, where engineering or industrial machinery can be maintained. The types of maintenance need to be introduced, partly in class, but ideally with industrial visits, to show the candidates exactly what is involved. Without this, the terminology can be difficult to understand.

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

Task 1 – can include LO1.1, 1.2 and 2.1 and include 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; considering an aircraft or a car, where 'the effects on production' can be interpreted as 'loss of business or revenue', but it remains difficult to fully address the unit.

Task 2 - LO2.2 and 4 – is likely to be of a practical nature, planning and carrying out 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 plant would be considered, and maintenance 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. This year, one centre had devised the maintenance assessment around a range of items, including a car or fleet of cars, and the results were quite rewarding. Considering a car as a medium to long term investment, over 5 to 8 years, an effective maintenance plan can be created, but this should only be seen as second best, with the best approach being one of an industrial and manufacturing nature. 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. Centres should be careful to provide a score for each learning outcome, even when they do combine more than one LO together within a task or set of tasks.

Assessment should always be by LO, even if the LO has 2 or more sub-sections, such as LO1.1 and LO1.2.

Learning Outcome 1.1

The standard of work submitted for moderation varied across the full range of available marks. Where the candidates had experienced some industrial links, allowing real appreciation of the consequences of failure, a deeper applied interest became apparent in many candidates. A reducing number of portfolios contained poor detail and seemed to lack inspiration, with some containing evidence of ineffective use of the internet. The score for this unit continues to reflect the involvement of real industry.

Learning Outcome 1.2

The costs of maintenance (for MB1) was evidenced quite thoroughly by many candidates, but the effects on customer expectations, for MB2, and record keeping in a maintenance environment, for MB3, were evidenced quite inadequately by many candidates. Many responses showed a lack of real, relevant information which could have gained them marks at higher levels. Many outlined a broad range of maintenance strategies, for no extra marks, which can be awarded for depth, but not increasing breadth.

Learning Outcome 2.1

Some candidates described two given types of maintenance strategy, for MB1, in detail, and an increasing number provided more depth and content, which may reflect an increasing development of industrial links. There was a mixed response to MB2, describe how a strategy would be used, and MB3, to justify why it would be used, although some candidates performed well. The portfolios seen ranged from zero marks to almost full marks.

Learning Outcome 2.2

All except a handful of candidates produced some kind of maintenance plan for MB1, using two, or more, methods of appropriate presentation. Despite producing detailed documents, most candidates still appear to need informing that marks can only be awarded for their own efforts. Some candidates were able to describe the methods used to present a plan, for MB2, but many of them lacked real content and detail. This year, there were none of the trivial comments, such as ‘on paper and on a poster’, showing that moderator feedback is having some effect and reference to the ‘what you need to learn’ section of the unit specification is now being looked at more closely. Many did not justify the reasons for producing their plan, thus limiting marks 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 great challenge for the majority of candidates, although some candidates are now using 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

Standard of Assessment

The assessment of this unit continues to reflect a mix of centre resources and experiences and candidate abilities, both with setting the tasks and answering them. A reducing number of portfolios contained direct copies of website contents, and although some assessors did not award marks for imported work, a small number of them did. Where candidates carry out research, they are expected to find details from a range of sources, then use that detail to write their own response to the tasks. Referencing was quite vague, if it existed at all.

Learning Outcome 1

Portfolios usually contain details of a range of manufacturing systems and techniques, such as jobbing, mass, batch, etc, but they still tend to stop short of including more from the range of material which is suggested in the 'what you need to cover' section – ie – the number of products, production volume, layout, etc.
Most candidates covered a range of products, evidencing the lower mark bands, but few provided the analytical approach required to gain marks from mark band 3.
As before, only a small number of portfolios showed real links with real products associated with the manufacturing systems and techniques they described.

Learning Outcome 2

Although the use of computer aided manufacture (CAM) were evidenced quite thoroughly, the reference to real products was quite limited. When undertaking industrial visits, candidates should develop their note taking skills to provide themselves with sufficient material to address the learning outcome, well in advance of the controlled assessment sessions.
A reducing number of centres continued to allow candidates to include large amounts of internet downloads, allocating undue marks for the copying of the work of others. The analysis and comparison required for mark band 3 seems to have been beyond the reach of most candidates.

Learning Outcome 3

Most centres/candidates now appear to have grasped the requirements of critical path analysis. A detailed production plan should be developed for mark band 2, as well as a realistic schedule for manufacture, and a good way to evaluate the effectiveness of these is to ask whether they could be given to a stranger and the correct product be made. Justification and suggestions for possible improvements are required to fully address MB3, but some still stopped short of this.

Learning Outcome 4

The ‘what you need to cover’ section indicates that for this LO, candidates need to include detail of the relevant sections of standards and specifications, process planning, statistical process control to achieve quality, corrective actions, ISO9001 techniques and processes, etc. Some portfolios contained some small part of some of these, without presenting the whole picture.
A few centres continue to mix up the evidence for this part of LO4 and the marking grid B element of LO4, and some added the scores together, awarding higher scores than were actually intended.

Unit EG307/1A

Innovative Design and Enterprise

Standard of assessment

The standard of assessment across centres is broadly in line with national standards, with only a few examples of over generous assessment being noted in this series.

Assessment of this unit usually consists of a portfolio, containing a series of assignments that target specific learning outcomes.

Learning Outcome 1

As in earlier series candidates 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

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 candidates 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 are often discussed although many candidates 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 candidates, although much of the evidence presented by candidates 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) however the research and thinking process adopted was often poorly evidenced (MB3).

Learning Outcome 5

This LO, and MB1 in particular, continues to prove challenging. The guidance for allocating marks indicates the expected range of activities expected however few candidates are able to provide significant evidence of these and often go straight into giving examples of successful products and comparing them with unsuccessful ones (MB2). Product features are often discussed, however the majority of candidates 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

This unit provides for the application of a range of scientific principles to practical engineering problems.
Assessment generally involves a series of tasks which assess the range of scientific principles, with some being set in a laboratory or practical environment, allowing actual engineering science investigations to be carried out.
The explanations provided in the portfolios sampled included a range of sketches, or imported images, diagrams, charts and tables. Where problems have numerical solutions, it is expected that full working will be shown. This allows partial credit to be awarded, as relevant.

The tasks could be:

Task 1 - LO1 and 2 – a 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 continue to develop interesting and effective assessment tasks. Most centres now include a task requiring the determination of 'beam reactions' as required for LO1, MB3, which was not included in the original sample assessment material.

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

Task 3 – LO4 and 6 – usually combined together in one 'assignment' of phase test, but not always. A range of practical activities and problems were seen, based on energy transfer in a thermodynamic system and an investigation of the forces acting in hydrostatic systems. Many centres provide candidates with a range of tasks, generally derived from the sample assessment material or from other sources. All tend to be adequate. Some centres spend time developing effective tasks, and their candidates appear to benefit from their applied nature.

Task 4 – LO5 - is based on an investigation of petrochemical processes. A handful of centres tend to omit this section altogether, due to the lack of specialist knowledge. Many attempts contain much detail from websites and very few provide individual work, but those who do perform well.

Despite instructions to the contrary, a few centres continue to assess using fractional marks, when the assessment grids clearly show the scores as whole numbers. For example, if a response is not worth 7 marks, the score is 6, not 6.5, as seen on a few 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 candidates calculated the effects of forces in engineering systems at MB1, 2 & 3, although some work was very untidy and almost impossible to follow. Many candidates and assessors 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 candidates provided reasonable solutions to determine the effects of motion, work, and energy transfer in engineering systems at MB1, 2 & 3. Where centres include the question sheets/tasks and mark schemes being used, this is much appreciated by a remote moderator and also allows 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 some candidates.

Learning Outcome 3

Most candidates applied electrical principles to engineering for MB1, although not all candidates were able to complete MB2 by being unable to apply basic principles of magnetism. For MB3, most candidates 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 the majority of centres, providing access to the full range of marks. All candidates from at least one centre submitted no work for this LO.

Learning Outcome 4

Candidates generally did the calculations to apply the principles of heat and thermodynamics, particularly at MB1, but a few were not able, at MB2, to apply thermodynamics to the expansion and compression of gases. Many did not attempt the problems which could have gained them scores from MB3, as 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 is always rather mixed and the impression still appears to be that some candidates did not get on at all well with the theory that was presented, if indeed it was presented to them effectively, or at all. Some centres, again, submitted portfolios which had this LO completely blank.

Learning Outcome 6

Many candidates 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.

Some centres continue to ask if a text book will be produced for the level 3 Diploma or indeed for this unit, but following the closure of the Diplomas, as complete qualifications, it is now unlikely. Each unit, in the specifications, indicates suggested textbooks which should contain suitable material, and any textbook which contains a similar named unit to this, say for the BTEC Nationals, should provide the minimum requirements, even if it doesn't specifically address the entire unit. The use of a mix of teachers to deliver this unit is being applied by several centres, and at most centres, care is obviously being taken to avoid a 'pure A level' theoretical approach, where an applied engineering approach is required for success. Many centres are building up good links with local employers to recruit 'trainee engineers' who are at work during their 3 or 4 year bachelor's or master's sandwich degree, and are willing to come along and help deliver this unit. Local universities are also proving very helpful with the delivery of many units, including this one.

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