edexcel
advancing learning, changing lives

Examiners' Report

January 2010

Principal Learning

Engineering Level 3 Controlled Assessments

Edexcel Limited. Registered in England and Wales No. 4496750
Registered Office: One90 High Holborn, London WC1V 7BH

A PEARSON COMPANY

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our Diploma Line on 0844 576 0028, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

Ask The Expert can be accessed online at the following link:

http://www.edexcel.com/Aboutus/contact-us/

January 2010

Publications Code DP022747

Contents

Principal Learning Engineering

Level 3 Introduction

Although the number of candidates and centres has increased since last year, the numbers remain lower than expected, and this may be because most centres had difficulty due to inclement weather and closures around Christmas and early January. An extension to the submission deadline was made, but some centres still needed chasing to obtain their work for moderation.

Centres are reminded that marks can only be awarded for a candidate's own work. Any items taken from other sources should be sufficiently referenced to respect the original author's copyright and to indicate to their assessors that they have taken this work, then used it to help them develop their understanding of the topic without just cut and pasting it. When such work arrives for moderation, it is despatched to Edexcel's compliance department for a thorough check on all potential sources following the moderator's identification. If none of the work is that of the candidate, the final score can only be zero.

That said, it is also very encouraging to see that most centres are taking hold of the Principal Learning qualification and making excellent progress in its delivery and assessment. Some good examples of scenarios and work related assessments were seen and it is expected that these will develop over the next year or two as the centre staff expand their industrial links through consortia and networking at training events.

Attendance at National training events and requests for centre visits have continued to increase this academic year, and a continued increase in candidate and assessor performance and understanding is becoming apparent. Knowing what any new specifications require of teachers, candidates and assessors generally takes a year or two as the qualification becomes embedded within the curriculum and the overall observation appears to suggest that level 3 Engineering PL contains many and varied aspects of undergraduate topics and realistic Engineering activities which really do help learners prepare for a future in the industry. Knowing the level and complexity of what they need to understand from this is starting to find a level which is being shared at training events across the country.
Moving from coursework to Controlled Assessment appears to have been less arduous than many centres believed it would be, but the repetition of a few basic points may be of benefit to some consortia.

The Principal Learning contains two distinctly separate elements – Teaching/Learning and Assessment. The processes should separate, and assessment should follow teaching and learning. This makes it very different to conventional coursework where assessment is on-going as teaching takes place. The assessment should take place under controlled conditions, the details of which are provided in Annex E of the specification, which is also available separately on the website.

The Controlled Assessment (CA) activities should, as far as is practicable, be applied to Engineering. Regurgitation of facts and details is not a good learning experience and should be avoided as far as possible. CA should be used to allow learners to apply what they have learnt to a range of Engineering problems and tasks, and the centre can decide on how much research material, text books, internet, etc, each unit can make use of – in accordance with the advice provided in each unit.

Some appear to have been undertaken as closed book, examination conditions, which is not necessary, unless there is good reason for the centre to require this. INSET programmes on Domain Assessor Training and Assessing Learners are designed to provide guidance, with examples on overcoming a range of perceived obstacles to ensure that CA is carried out and managed with minimal discomfort and inconvenience for all parties.

Internal moderation or 2nd marking needs undertaking at consortium/centre level. As part of the overall quality assurance of the assessment processes and outcomes, it is essential that each consortium has such processes in place. In the vast majority of centres which sent samples for moderation, no evidence of internal moderation was included, and the assessment decisions in some cases made it quite obvious that the assessor had been the only person to have looked at the work. Without sharing the responsibility for assessment and collaborating with other teachers/lecturers, improving the quality of work and assessment methods will be extremely unlikely.

One important aspect of assessment is to note that each unit is split up into learning outcomes and each learning outcome can be assessed across 3 mark bands. If, for example a candidate's work contains sufficient material for a learning outcome to be awarded, say, 7 marks, but does not enough to achieve 8 marks, then it should be awarded 7 – not 7.5, 7.3, etc. Such fractions, when used, will run the risk of adding up to 2 or 3 points above the actual marks, and the assessment could rapidly become 'inaccurate – which it is. More than one centre used fractional marks, which must be ignored at moderation and should not be entered on line.

EG302 – Applications of Computer Aided Designing

Half a dozen centres submitted work for this unit, and only one of these was assessed with suitable levels of accuracy, even though the scores were mostly around the E grade boundary. The other centres were recommended for adjustment by the moderators and this suggested adjustment was as high as 15 marks. Some of the topics covered in the candidates' work appeared to have little resemblance of, or connection with, Engineering. The best performing candidates had produced work which did reflect the world of Engineering in the tasks which they had been set.

None of the work which was moderated contained accurate interpretations of the requirements of LO1, MB2 and MB3. The LO requires the following:
For MB2 – '... describes two typical applications of a method of data storage.'
For MB3 – '...describes two typical applications of a method of data storage and compares them in terms of retrieval speed and storage size.'
All candidates appear to have been asked to compare two different types of memory storage, which tended to generate descriptions of floppy disks, RAM, memory sticks, etc, and a table was used to unsuccessfully 'compare' them for MB3. It is assumed that this happens because centres are teaching LO1, then assessing it.
If an holistic assessment were to be used for this unit, as expected, then it would become obvious that the answer to this LO, and the content, is almost given in the remainder of the LOs.
LO1 can be addressed by discussing two applications, from 2D or 3D CAD, rotating images, software simulation and virtual testing of materials. Each of these requires different operating speeds and memory size for effective use. At its most basic level, a comparison of the processor/memory requirements when word processing or using 2D CAD, to that required for full 3D rendering, colour and rotation, etc, would make a good start point for this LO.

Where candidates' work was limited to MB1/2 it appears that a textbook approach may have been taken for the teaching of this subject. The higher achievers were demonstrating industrial applications and links, as required for successful completion of the Diplomas. Where real, complex Engineering case studies and components were used, the potential for fully addressing the unit was obvious, but missed by many candidates.

Although candidates are not expected to be working to full BS8888 standards after such a short time, title blocks and dimensioning were generally weak and the use of correct projections appear to have been poorly understood.

EG303 – Selection and Application of Engineering Materials

Five centres submitted work for this complex unit, which also contains a range of complexities across the mark bands, which not all centres and candidates evidenced. The first learning outcome was generally well addressed by most, particularly at MB1 and for some, across MB2. Some learners obviously attempted parts of MB3, but did not include the complex range of effects on the different properties of metals and plastics. Many tasks seem to be 'research and write' with little evidence of applied tasks being set to allow application of material learned, or researched.

Learning Outcome 2.
LO2.1 was generally well addressed, but some relied on a table of data without providing descriptions as required for MB1 and 2. There was very little evidence found to address the justifications required at MB3. LO2.2 requires an information source to be given to the learners to allow them to make use of it. Some seemed to refer to a text book, which appears to be out of print, or not used for some other reason. Many provided reasonable evidence up to and including MB2, but occasionally a table was used to try to provide the description required, but did little more than identify or select, with little attempt made to justify its use.

Learning Outcome 3.
LO3.1 provided problems for most as little evidence was found about the micro structure of materials, limiting the scores to MB1 and 2. Glass transition appears to be a weakness for most candidates and may be an area for development in many centres. Similarly, the properties of polymers was rather weak in coverage, with a few attempts which seemed to suggest they may have been copied from notes, websites or textbooks. LO3.2 follows the same sort of pattern, with MB1 being generally well evidenced, but simple statements in MB2 hardly addressed the requirements. MB3 was attempted by some, but details of the structural changes which occur were only covered using simple statements, which would not attract many of the MB3 marks.

Learning Outcome 4.
LO4.1 was done well by some candidates, although some appear to have been misled by the tasks because they did not provide the necessary calculations, but instead they gave descriptive evidence. Those that did attempt the calculations did quite well, although several of them made errors with SI Units and calculations. Some missed out the factor of safety, and for centres which do not include the briefs or tasks, it is difficult to identify the issue and provide guidance and feedback on how to improve. LO4.2 was answered well by many candidates, although some lost marks by not including all three modes of failure, or gave poor descriptions. A few candidates seemed to have misunderstood what was meant by service conditions. For LO4.3 many candidates generated some good test results, but failed to produce any reasonable level of analysis of them. This misunderstanding may have been due to the tasks which were set or by the candidates not understanding what was required. Without centres including the tasks with the samples, it is not possible to help with a solution to this problem. Non-destructive testing appeared to have been ignored by several candidates.

EG304 – Instrumentation and Control Engineering

The samples received for this unit were the first which had been submitted, as none had been completed in time for the earlier series. The work from five centres contained a full range of scores, and for a range of reasons, they received quite a range of recommended adjustment from moderators. Perhaps with it being the first time that this unit had been attempted, little of it had been understood and this led to a large amount of lifting of work from websites, which resulted in several samples being referred to Edexcel for a compliance check.

Learning Outcome 1
LO.1 contained explanations of analogue and digital signals were explained in some detail, with all learners illustrating their answers well. Transmission media were covered and some images included, however learners did not explain why there was a need for these different types, as required for MB1, 2 and 3 – in increasing depth.

Learning Outcome 2
LO.2 was suitably evidenced in many portfolios, and most learners were able to describe the use of instrumentation and control systems and components as well as explaining the role and operation of digital and analogue sensors, in some cases. Images were used to help with their explanations, but many lacked a detail description of a complete instrumentation system. The evaluation of a complete system was not effectively addressed by any candidate.

Learning Outcome3
LO.3 was well addressed by a series of illustrations in many portfolios, for open and closed loop systems, and positive and negative feedback. Most candidates failed to gain marks in MB3 because their understanding and explanation of a complete system was, at best, limited. Most did not include anything on proportional, integral and derivative control, apart from internet web page printouts. .

Learning Outcome 4
LO.4 requires detail of PLC systems and for MB1 and 2, some portfolios were well presented and contained relevant material. One idea which some candidates used was a carwash, and this worked well to outline the processes involved, and gave the learners the opportunity to gain marks up to and including MB3. Programming (MB2) was not always evident. Candidates should be considering how well an industrial application of a PLC system responds to inputs and how effectively the device is at controlling the desired outputs.

Learning Outcome 5
LO.5 was covered using a range of evidence from each centre. Candidates of one centre used a washing machine to aid this learning outcome, which is a good choice of product and seemed to relate to a simulator which was available to allow candidates to program it and draw block diagrams of the stages. A good understanding of flow diagrams was also evident. Where industrial systems had been chosen, some were far too complex for the candidates, and care must be taken to ensure that all work related activities are not beyond the capabilities of the candidates, and not too easy either. There was little evidence of justification of the control elements required for MB3.

EG305 – Maintaining Engineering Plant, Equipment and Systems

Another unit which was making its first appearance at moderation, the work from 3 centres only achieved about half marks at best. Some had been assessed higher than this by the consortia, but moderators recommended some reduction for the reasons given below. At least one centre had made errors with entering scores on line and appeared to have become confused by the marking grids 'A' and 'B'.

All centres included the assessment tasks, and this made it clear why there was some discrepancy in at least one assessor's scores and those of the moderators. The tasks had not been written to directly address the requirements of the assessment outcomes, across the 2 mark bands. It is recommended that for anyone new to the Diploma, training is essential. This can be arranged or supported through the consortium and the domain and/or lead assessors should be in a position to help with explanations of the requirements. Alternatively, Edexcel provide INSET training at National events and bespoke training for individual consortia, centres or staff.

It is a pity that none of the centres which were moderated had used this unit as an opportunity to deliver and assess by practical activities which would have supported the learning experience of students, and been more in line with the expectations of the Diplomas.

Learning Outcome 1
For LO.1.1, mark band 1 was evidenced by all candidates sampled, but many lost marks by not clearly explaining the effect on customer expectation and corporate image. Consequences of plant failure and the effect on corporate image was a weakness across many portfolios.

The evidence for LO.1.2 was generally adequate for most candidates, although some included more of the LO1.1 material. Some went on to achieve mark band 2, but many gave poor descriptions of the benefits of keeping accurate records of maintenance. No candidates appear to have tried to justify the use of records in a maintenance environment, making mark band 3 unattainable. Links with industry could address this quite easily. The costs and accurate cost records of maintenance were hardly evidenced and many portfolios seemed to be continuing with the theme of plant/machinery failure.

Learning Outcome 2
LO.2.1 was evidenced well for mark band 1 and 2, although maintenance strategies appeared not to be understood by the majority of candidates. Of those sampled, only a couple of candidates had been able to justify the maintenance strategy given in mark band 2 to achieve a mark band 3 result.

LO.2.2 showed that maintenance plans were not understood by many candidates. Some submitted a 'checklist' and some included a 'parts list'. It seemed obvious to the moderators that the 'what you need to cover' for this unit had not been covered, or had not been learnt, so it wasn't applied. Some used PowerPoint slides to illustrate a step by step process of maintenance, which is not a plan. Despite this, most candidates did produce at least one acceptable maintenance plan achieving mark band 1. Most candidates only just achieved mark band 2 because their explanations of how the methods used to present a maintenance plan can help deploy a maintenance strategy were poor.

No candidate achieved mark band 3 because no justification was evident of the use of a chosen maintenance plan and no alternative approach was included.

Learning Outcome 3

There was little evidence of the knowledge of how data is gathered and monitored for maintenance purposes, as required for LO.3, beyond MB1. This LO presents an opportunity for candidates to enhance their learning through work experience tasks or through visits to and from engineers. As a result, very few candidates had evidence which took them far beyond MB1. Although a small number of learners provided some details about monitoring techniques and data collection in general terms, very little interpretation was evident and no use of data was provided – which kept them all out of upper mark bands.

EG306 – Investigating Modern Manufacturing Techniques used in Engineering

The submissions for this unit were very low and the best score seen was just over half marks. The samples that were submitted were not complete units, suggesting that time had run out. It is worthwhile pointing out that where this happens, the registration is terminated for that unit and re-registration would be required if the unit were to be resubmitted later, having been set against a different scenario and set of tasks. It is not possible to submit a few LOs to complete a previously submitted partially completed unit.

Learning Outcome 1
LO.1 was not addressed in a manner that fully addressed the learning outcome and the contents of the assessment grids. Most candidates did, however, gain some points from mark band 1. Descriptions, in most cases, were very brief and the comparisons between traditional and modern manufacturing systems were either missing or the candidates had not answered the tasks appropriately. Mark band 2 was not evidenced as all candidates omitted the comparison of layout and arrangements of the processes and equipment for a traditional and a modern manufacturing production system.

Learning Outcome 2
Very few of the candidates attempted LO.2, and those that did addressed mark band 1 with a basic description of Computer Aided Manufacture. A small number of candidates provided good descriptions for selected products from two different engineering manufacturing industries, achieving mark band 2, but stopped short of analysing and comparing the processes and level of automation.

Learning Outcome 3
LO.3 was answered quite well, and some candidates produced good quality critical path charts and production charts. MB3 was not addressed by any of the candidates sampled, possibly because their production plan and schedule were not reviewed or justified.

Learning Outcome 4
There was no evidence submitted which addressed LO.4.

EG307 – Innovative Design and Enterprise

Very few centres submitted samples of this unit for moderation in this series. The assessment was deemed to range from generous to very generous and evidence of obvious plagiarism resulted in the work being subjected to scrutiny by Edexcel's compliance unit. Use of other people's work is fine, as long as it is referenced and the candidate then uses this material to inform their own writing. Where this does not take place, the work is investigated for actual source and feedback provided to the centres independent of the moderators due to the confidential nature of such actions and ultimate findings and decisions. It is also surprising how some candidates see all entrepreneurs as being suitable for investigation. Perhaps they need reminding that this Diploma is in Engineering, and their research should steer them towards engineering entrepreneurs.

Learning Outcome 1
LO.1 In general the candidates did provide details to show any in depth understanding of how their chosen products had evolved. A number of them had selected similar products to look at, and their evaluations were rather weak. The comparison to a traditional product was limited, and in most portfolios there were just a few simple statements. In general, the moderators' recommendations were to reduce the marks, generally to MB1

Learning Outcome 2
The work submitted for LO.2 was good and relevant and the entrepreneurial individuals were well researched allowing marks being awarded across from all mark bands, but they were not all engineering entrepreneurs, as expected. Centres are reminded that marks can only be awarded for a candidate's own work. Any items taken from other sources should be sufficiently referenced to respect the original author's copyright and to indicate to their assessors that they have taken this work, then used it to help them develop their understanding of the topic without just cut and pasting it.

Learning Outcome3
All the candidates who submitted work for LO3 provided some good case studies and some contained good explanations. The candidates had selected relevant engineering activities which have impacted society. In the main, marks up to MB3 were achieved and deserved.

Learning Outcome 4
LO.4 had encouraged candidates to spend some time using 3D software, although a number of the designs were similar. The portfolios tended to lack hand drawn sketches or development of ideas, which are expected to show the design process, not just the end product from the software.

Learning Outcome 5
Many candidates submitted work for LO.5 which looked very much like some more of that submitted for LO1. Mostly, though, they did carry out further developmental work and some achieved scores across all three mark bands.

EG309 – Principles and Applications of Engineering Science

Four centres submitted work, and the assessment was deemed to be fairly accurate across the board. Many seem to be teaching, then assessing, a learning outcome at a time, possibly because there is little by way of links between them – making holistic assessment difficult due to the wide range of topics within this unit. The use of fractional marks must be avoided as this leads to problems which were mentioned earlier in this report.

Learning Outcome 1
There is some evidence of internal moderation due to more than one set of marks being included, but it is unclear where and if the overall marks have been modified. Elements of this unit require considerable research and it is an expectation that learners at this level should be quoting reference sources, if only in a bibliography, although referencing should be an element of work by level 3 candidates. There were several mathematical errors – both in algebraic manipulation and with units, multiples and submultiples and trigonometry. However, LO1 was generally well evidenced at MB1, but with 3 or 4 forces required in MB2 and MB3 there were some difficulties with understanding of what was required, for some candidates.

Learning Outcome 2
For LO2, the set tasks were answered by almost all candidates and were correct. However for most candidates, some marks were lost due to giving only partial answers, especially for mark band 3. Candidate presentation skills were poor in some cases, and arithmetical errors were common.

Learning Outcome 3
Although most candidates were able to make reasonable attempts at the tasks they had been set for LO3, several seemed to have difficulty with the use and manipulation of formulae. Several did, however, provide accurate and complete answers. Some candidates lost marks due to providing poor explanations of how simple generators and motors work.

Learning Outcome 4
LO.4 was covered reasonably well by many candidates, apart from those that suffered from mathematical errors, SI Units and the manipulation of formulae. If any part of LO4 were in need of general improvement, then it is the practical application of problems, particularly using the first law of thermodynamics.

Learning Outcome 5
The chemistry requirements for LO5 are renowned for being a new venture for many post-GCSE candidates, where many of them may not have met bonding and Lewis structures, etc, needs teaching from the basics. Most of the portfolio contents appear to have been done by research, and very little was included about practical applications other than general ones, or what could be found on a website, somewhere. The major area for development is stills the understanding of industrial processes associated with petrochemicals required for MB3, as this continues to be most challenging for most candidates.

Learning Outcome 6

LO6 was evidenced well by most candidates, apart from arithmetic or transposition errors. Most candidates were able to apply laws appropriately and the majority of marks would have been achieved had the candidates not made arithmetic or transposition errors when manipulating and using the key formulae.

Statistics

Level 3 Unit 2 Applications of Computer Aided Design

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	54	48	42	36	31	26
Points Score	14	12	10	8	6	4	2

Level 3 Unit 3 Selection and Application of Engineering Materials

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	54	48	42	36	30	24
Points Score	14	12	10	8	6	4	2

Level 3 Unit 4 Instrumentation and Control Engineering

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	54	48	42	36	30	24
Points Score	14	12	10	8	6	4	2

Level 3 Unit 5 Maintaining Engineering Plant Equipment and Systems

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	53	47	41	35	29	24
Points Score	7	6	5	4	3	2	1

Level 3 Unit 6 Investigating Modern Manufacturing Techniques used in Engineering

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	54	48	42	36	30	24
Points Score	14	12	10	8	6	4	2

Level 3 Unit 7 Innovative Design and Enterprise

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	54	48	42	36	30	25
Points Score	14	12	10	8	6	4	2

Level 3 Unit 9 Principles and Application of Engineering Science

	Max. Mark	A*	A	B	C	D	E
Raw boundary mark	60	53	47	41	35	29	23
Points Score	21	18	15	12	9	6	3

Notes
Maximum Mark (raw): the mark corresponding to the sum total of the marks shown on the Mark Scheme or Marking Grids.
Raw boundary mark: the minimum mark required by a learner to qualify for a given grade.

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481

Email publications@linneydirect.com

Order Code DP022747 January 2010

For more information on Edexcel qualifications, please visit www.edexcel.com/quals

Edexcel Limited. Registered in England and Wales no.4496750
Registered Office: One90 High Holborn, London, WC1V 7BH