Model Assignment

Issued September 2008

OCR Level 3 Principal Learning in Engineering

Unit F560: Maintaining engineering systems

Please note:

This OCR model assignment may be used to provide evidence for the unit above. Alternatively, centres may 'tailor' the assignment within permitted parameters (see 'Notes for Tutors). It is the centre's responsibility to ensure that any adaptations made to this assignment allow learners to meet all the assessment objectives and provide sufficient opportunity for learners to demonstrate achievement across the full range of marks.

The scheme codes for these qualifications are:

OCR Level 3 Principal Learning in Engineering	500/2400/0

The QCA Accreditation Number for this unit is:

Unit F560: Maintaining engineering systems	D/501/1901

This OCR model assignment remains live for the life of these qualifications.

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OCR Level 3 Principal Learning in Engineering

Unit F560: Maintaining engineering systems

Model Assignment

Description of Model Assignment.

This unit will enable you to develop your knowledge and understanding of the maintenance of engineered systems.

You will develop an understanding of the importance of determining appropriate maintenance strategies on engineering systems and the subsequent effects on strategic business aims and performance.

After developing your theoretical understanding of maintenance strategies, you will undertake a practical maintenance activity.

The evidence required for assessment will be in the form of a folder including a series of **detailed wall charts** which could be used to present a specific engineering maintenance system to an employer.

Read through all of the following tasks carefully, so that you know what you will need to do to complete this assignment.

Tasks

Task 1: Statistical methods in engineering maintenance

Planned maintenance is a key activity for many engineering companies. Poor maintenance practice can result in systems or component breakdown. This can lead to possible injury, loss of facility and loss of business. Products may need to be scrapped or reworked leading to increased costs. Delays and inconvenience to customers could damage the company's reputation and lead to loss of revenue.

Methods to predict failure rates of components are therefore important. These methods allow maintenance to be planned and components to be replaced prior to breakdown.

Assessment Criterion 1.1

Your task is to:

- determine appropriate maintenance strategies to include a risk assessment for the system identified
- carry out a maintenance activity on the identified system e.g. for the hoist system: fit a replacement motor, carry out a visual inspection, check and adjust charge rate of standby battery system, carry out full function test.

You will need to:

- identify a complex engineering system. Suitable systems are:
    - process control systems for production lines
    - timing systems for vehicle engines
    - electro/mechanical systems for control of items such as hoists, elevators or stock picking systems
    - hydraulic systems for off-road plant or agricultural equipment
    - valve control systems for utility industries
- select, collect and structure complex production and maintenance data for components within the identified product or system. Apply statistical methods to this data to determine appropriate maintenance strategies for the engineered system
- analyse data trends for a complex engineering system:
    - mean time to recovery (MTTR)
    - mean time to failure (MTTF)

- consider the type of maintenance operation and identify the advantages/disadvantages of :
    - preventative measures: use of safeguards, inspections, regular cleaning, checking and replacing consumables, operator training

  - predictive measures: monitoring methods, evaluating condition
  - repair on demand or run to failure: cost of repair versus cost of prevention
- produce a detailed maintenance strategy for the product/system identified.

Work for this task should be presented as **a series of detailed wall charts** to present the proposed engineering maintenance system to an employer with additional evidence contained in the folder. Additional evidence could be in the form of diagrams, photographs and detailed explanations of the selected engineering system, its failure modes and the predictive methods used to determine the nature of maintenance operations. This should be evidenced.

Task 2: System failures and their consequences

In order to determine the appropriate maintenance strategy for an engineering system, it is necessary to understand the various types of system failure and to be able to predict when system failure may occur.

Assessment Criteria 2.1, 2.2

Your task is to:

- identify and explain various types of system failure and their consequences. Factors could include:
  - maladjustment
  - maloperation
  - run to failure
  - stress fracture
  - fatigue
  - wear
  - embrittlement
  - overloading
  - seizure
  - lubrication failure
  - fouling
  - vibration
  - anodic and chemical corrosion
  - poor training
- explain methods used to predict systems failure such as:
  - condition monitoring
  - visual inspection
  - shock pulse metering
  - vibration analysis
  - oil debris analysis
  - electrical current monitoring
  - tool wear
  - infra red thermography
  - ultrasonic testing

You will present your work for this task using diagrams, photographs and text as part of your research folder.

Task 3: Appropriate maintenance strategies

Assessment Criteria 3.1, 3.2

Your task is to:

- evaluate the effects of different approaches to maintenance on operational and strategic efficiency and consider:
    - operator safety
    - scrap and rework
    - poor product quality
    - lost production
    - improved product reliability
    - failure to deliver
    - loss of competitiveness
    - loss of business
    - difficulty in planning production
    - reduction of waste: energy savings
    - poor corporate image
- carry out a cost benefit analysis of a maintenance programme considering:
    - materials and equipment against financial values of reduced costs and increased business
    - financial value of time
    - correct stock level of spares

You will present your work for this task as part of your folder.

Model Assignment: Tutor Information

OCR Level 3 Principal Learning in Engineering

Unit F560: Maintaining engineering systems

Guidance for Centres

1 General

1.1 OCR model assignments are issued free to participating centres and are also available to download from our website: www.ocr.org.uk.

1.2 Centres may choose to:

- use OCR model assignments for formal summative assessment of learners
- tailor OCR model assignments for formal summative assessment of learners

It is intended that this model assignment can be used by centres without modification. However, in order to provide appropriate contextualisation, improve access or increase local relevance, centres may 'tailor' the model assignments within set parameters. Details of the scope of adaptation are provided in the 'Notes for Tutors' section of this document.

1.3 This assignment has been designed to meet the full assessment requirements of the unit. Learners will need to take part in a planned learning programme that covers the underpinning knowledge and skills of the unit.

2 Before carrying out the assignment

2.1 Learners should be provided with a copy of the *Learner Information* section of this assignment or the centre adapted model assignment.

2.2 Learners may carry out preparations prior to undertaking the tasks; there is no time limit for this.

3 When completing the assignment

3.1 All assessment evidence must be produced under **controlled conditions** so that the overall level of permit control secures validity and reliability, provides good manageability for all involved and allows teachers to authenticate the work confidently. Further guidance on **controlled conditions** is provided within the OCR Principal Learning Handbook.

3.2 Learners should be allowed 15 guided learning hours (glh) to complete all of the tasks. The amount of time may vary depending on the nature of the tasks and the ability of individual learners. It is suggested that evidence is produced in several sessions.

3.3 Each learner must produce individual and authentic evidence for each task within the assignment.

3.4 Centre staff may give support and guidance to learners. This support and guidance should focus on checking that learners understand what is expected of them. It is not acceptable for presenters to provide model answers or to work through answers in detail.

3.5 Learners may use information from any relevant source to help them with producing evidence for the tasks.

3.6 Learners must be guided on the use of information from other sources to ensure that confidentiality is maintained at all times.

4 After completing the assignment

4.1 Learners' evidence is assessed by the centre's assessor against the qualification specification contained in the Principal Learning Handbook. When marking learners' work, centres **must** use the descriptors provided within the unit. For further information about assessment please refer to the section on Assessment and Moderation in the Principal Learning Handbook.

4.2 Assessors' decisions should be quality assured across the centre through internal moderation. For further information about internal moderation please refer to the section on Assessment and Moderation in the Principal Learning Handbook.

5 Presentation of work

5.1 Centres may wish to discourage learners from excessive use of plastic wallets for presentation of their evidence as this may hinder the assessment process. Instead centres may wish to encourage learners to present their work so that it is easily accessible, e.g. spiral bound, stapled booklet, CD-ROM.

6 Acceptable evidence

6.1 For guidance on generation and collection of evidence please refer to the section on Assessment and Moderation in the Principal Learning Handbook.

7 Plagiarism and unauthorised collaboration

7.1 Centres should have adequate procedures in place to ensure that plagiarism and unauthorised collaboration are identified and responded to.

7.2 When supervising tasks, tutors are expected to:

- offer learners advice about how best to approach such tasks
- inform learners of the ramifications of unfair practice
- exercise continuing supervision of work in order to monitor progress and to prevent plagiarism

- ensure all copied materials is suitably acknowledged
- ensure copied material is not given credit in the assessment process

As with all controlled assessments, the presenter must be satisfied that the work submitted for assessment is the learner's own work.

Notes for Tutors

Introduction to the Tasks

The tasks have been designed to enable learners to demonstrate their knowledge and understanding of Maintaining engineering systems.

The model assignment has been designed so that all of the assessment criteria in Unit F560 are addressed.

The evidence required for assessment is a series **of detailed wall charts and the accompanying folder** which could be used to present a specific engineering maintenance system to an employer.

The detailed wall chart should include:

- diagrams, photographs and detailed explanations of an engineering system and its failure modes and the predictive methods that would be used on the system

The accompanying research folder outlining the method of data collection and analysis should include:

- spreadsheet analysis of the data structures and analysis of the applied formulae
- sequential and hierarchical flow charts showing the correlation between the maintenance plan and its effects
- costs benefits calculations with appropriate explanations of the procedure and justification; and also
- evidence of undertaking a maintenance procedure

Care should be taken when guiding learners towards the maintenance procedure to ensure it has sufficient scope to support other learning in this unit to enable learner's complete access to the assessment criteria.

Learners will need to consider and understand the usefulness of MTTF and MTTR in respect of:

- mean gives MTTF
- mode gives frequency of breakdowns
- median shows accuracy of Mean (widely different values indicate presence of extreme data)

They will need to:

- consider the significance of Standard deviation in detecting extreme performance variations of different clusters
- consider the significance of sample size
- decide appropriate strategy from MTTF, MTTR and Frequency

They will need to understand:

- preventative measures: use of safeguards, inspections, regular cleaning, checking and replacing consumables, operator training
- predictive measures; monitoring methods, evaluating condition
- repair on demand or run to failure: advantages and disadvantages, cost of repair versus cost of prevention

They will need to be aware of causes of failure of mechanical and electrical systems.

Learners will also need to consider how different maintenance practices, effect the operational efficiency of plant and the subsequent effects on strategic business aims by examining and evaluating examples of good and bad practice such as:

- operator safety
- scrap and rework
- poor product quality
- lost production
- improved product reliability
- failure to deliver
- loss of competitiveness
- loss of business
- difficulty in planning production
- reduction of waste, energy savings
- poor corporate image

They must also be able to carry out a cost benefits analysis of a maintenance programme taking into account the following financial factors:

- materials and equipment against financial values of reduced costs and increased business
- financial value of time
- correct stock level of spares

These guidance notes should be used in conjunction with the unit specification and Principal Learning Handbook.

Scope of permitted Model Assignment modification

The model assignment is self-contained in its present form. The set of tasks form a coherent whole addressing all the assessment criteria. No changes to the assessment criteria are permitted.

The model assignments can be changed in terms of:

- the context for the model assignment that will reflect the project undertaken
- the maintenance activity
- the range of case study material
- each specific task linked to a particular assessment criteria which may be appropriately contextualised.

When completing this model assignment it may be possible to generate evidence for completing a task in a variety of formats. This list is not exhaustive and will depend on the approach taken to complete the task or model assignment. In some cases the task or model assignment will require a specific format for the outcome and this will be clearly marked in the table.

Depending on the approach taken to the model assignments it may also be possible to demonstrate additional PLTS coverage and some additional opportunities have been listed below.

Task activity	Nature of evidence generated	Potential Assessment Criteria coverage
Task 1 Statistical methods in engineering maintenance.	Application of statistical mathematical methods to production and maintenance data. Analysis of data trends for a complex engineering system. Determination of appropriate maintenance strategies to include a risk assessment for a system or product. (IE4 CT1) (Maths) Evidence of carrying out a maintenance activity	**Assessment Criteria** • 1.1 • 1.2 • 1.3 • 1.4 **PLTS** • IE4 • CT1 • SM3
Task 2 System failures and their consequences.	Identification and explanation the various types of system failure and their consequences. Explanation of methods used to predict systems failure.	**Assessment Criteria** • 2.1 • 2.2 **PLTS** • None
Task 3 Appropriate maintenance strategies.	Evaluation of the effects of different approaches to maintenance on operational and strategic efficiency. Carry out a cost benefits analysis of a maintenance programme.	**Assessment Criteria** • 3.1 • 3.2 **PLTS** • None