SQA Advanced Unit Specification

General information for centres

Unit title: Industrial Plant Maintenance

Unit code: HV2K 47

Unit purpose: This Unit is designed to introduce candidates to the planning and organisation of maintenance programmes for industrial plant. The Unit allows candidates to develop the knowledge and skills necessary to select an appropriate style of maintenance program suitable for a particular industrial setting, whilst implementing the necessary health and safety procedures.

On completion of the Unit the candidate should be able to:

1. Explain standard techniques involved in plant maintenance.
2. Explain typical health and safety regulations pertaining to plant maintenance systems.
3. Develop a maintenance strategy for a given simple industrial scenario.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: Candidates should have a basic knowledge of either mechanical or electrical principles and technology. However, entry requirements are at the discretion of the centre.

Core Skills: There may be opportunities to gather evidence towards the following Core Skills or Core Skills components in this Unit, although there is no automatic certification of Core Skills or Core Skills components:

- Written Communication (reading) at SCQF level 6
- Written Communication (writing) at SCQF level 6
- Using Graphical Information at SCQF level 5
- Using Information Technology at SCQF level 5
- Problem Solving at SCQF level 6
- Working with Others at SCQF level 4

Context for delivery: This Unit was developed for the SQA Advanced Diploma in Electrical Engineering award. If the Unit is to be used in another group award it is recommended that it should be taught and assessed within the subject area of the group award to which it contributes.

Assessment: The assessment for this Unit will consist of two parts. An assessment paper is used to cover Outcomes 1 and 2 and an assignment/report to assess Outcome 3. Candidates will sit the assessment paper at one single assessment event lasting one and a half hours. The assessment paper should be composed of a suitable balance of short answer, restricted response and structured questions. This assessment should be conducted under controlled, supervised conditions. For Outcome 3, candidates will devise a maintenance plan for a given industrial scenario, and write a short report justifying the plan. The assessment paper should be carried out after the delivery of Outcome 2 and the assignment should be submitted after the completion of the Unit.

SQA Advanced Unit Specification: statement of standards

Unit title: Industrial Plant Maintenance

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on

Outcome 1

Explain standard techniques involved in plant maintenance.

Knowledge and/or skills

- Reactive Maintenance (RM)
- Planned Preventative Maintenance (PPM)
- Total Productive Maintenance (TPM)
- Reliability Centred Maintenance (RCM)
- Condition Monitoring (CM)

Outcome 2

Explain typical health and safety regulations pertaining to plant maintenance systems.

Knowledge and/or skills

- Basic understanding of the typical health and safety issues arising as a result of plant maintenance procedures.
- Awareness of the need to comply with all statutory health and safety requirements.
- Basic understanding of Risk Assessment
- Basic understanding of COSHH, noise related health and safety regulations, PPE
- Understanding of Permit to Work procedures.

Evidence Requirements

Evidence for the knowledge and/or skills in Outcomes 1 and 2 will be provided on a sample basis. The evidence may be presented in response to specific questions. Each candidate will need to demonstrate that she/he can answer correctly, questions based on a sample of the items shown under the knowledge and skills shown above. In any assessment of this Outcome **three out of five** knowledge and/or skills items should be sampled for Outcome 1 and **three out of five** knowledge and/or skills items should be sampled for Outcome 2.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of three out of five knowledge and/or skills items from Outcome 1 and three out of five knowledge and/or skills items from Outcome 2 are required each time the Unit is assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

Outcome 1

- Describe Reactive Maintenance, discuss the advantages and disadvantages of RM.
- Explain Planned Preventative Maintenance, giving examples of industrial scenarios where PPM is valid.
- Explain Total Productive Maintenance (TPM)
- Explain the basic principles of Reliability Centred Maintenance (RCM).
- Describe the application of Condition Monitoring in industrial plant maintenance.

Outcome 2

- Explain the typical health and safety issues arising as a result of plant maintenance procedures.
- Explain the duties of employees and employers with regard to complying with relevant health and safety legislation.
- Explain the basic procedure involved in Risk Assessment
- Explain specific legislation relating to health and safety, such as, COSHH, noise, PPE.
- Explain typical permit to work systems.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be permitted to use scientific calculators during the assessment.

Assessment guidelines

The assessment for Outcomes 1 and 2 should be combined together to form one assessment paper. This single assessment paper should be taken at a single assessment event lasting one and a half hours and carried out under supervised, controlled conditions. Such a paper should be composed of an appropriate balance of short answer, restricted response and structured questions.

Outcome 3

Develop a maintenance strategy for a given simple industrial scenario.

Knowledge and/or skills

- Requirements of a Maintenance Policy.
- Role of Plant records and history.
- Use of bar charts for planning maintenance work.

- Basic understanding of how CMMS (Computerised Maintenance Management system) software can contribute to setting up and running of plant maintenance systems.
- The various factors affecting cost effectiveness.
- Appreciate importance of skills and qualifications of workforce.
- Understand the need to prioritise tasks based on critical path analysis.

Evidence Requirements

All knowledge and /or skills items in Outcome 3 should be assessed. Evidence for Outcome 3 will be provided by means of an assignment. The candidate will compile a maintenance program suitable for a given simple industrial scenario. This should be an electrical/mechanical plant setting appropriate to the candidate's own industrial experience or area of study. The candidate's response will include the necessary documentation such as, maintenance schedules, standard operating procedures and relevant health and safety considerations. CMMS software, if available, can be employed in completing the assignment. A report of not less than 800 words plus diagrams, appendices etc. justifying the chosen strategy should be submitted as part of the assignment. The report should also include an explanation of how CMMS software, where used, is employed in the maintenance program, or alternatively where the software is not used, how it would be employed if available. The industrial scenario will be of sufficient complexity, that the response, along with the report, will cover the knowledge and skills items listed for Outcome 3.

Outcome 3

- Demonstrate awareness of typical organisational requirements of a Maintenance Policy.
- Demonstrate awareness of the role of plant records and history.
- Demonstrate the use of bar charts/graphs etc in the planning of maintenance work.
- Explain/demonstrate how CMMS software can contribute to the running of plant maintenance systems.
- Explain the various factors affecting cost effectiveness of a maintenance policy.
- Explain the importance of skills and qualifications of the workforce.
- Explain the necessity to prioritise tasks based on critical path analysis.

Assessment Guidelines

Evidence for this Outcome should be gathered by means of the candidate preparing a maintenance program and a report, related to a given industrial scenario. This should cover all the knowledge and skills items for this Outcome. Centres may wish to issue candidates with guidance notes relating to both the assignment itself and the report.

Administrative Information

Unit code: HV2K 47

Unit title: Industrial Plant Maintenance

Superclass category: VG

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit Specification: support notes

Unit title: Industrial Plant Maintenance

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This Unit has been written in order to allow candidates to develop their knowledge and competence in the following areas:

1. Standard techniques involved in plant maintenance.
2. Typical health and safety regulations pertaining to plant maintenance systems.
3. Organisational requirements of successful plant maintenance systems and the role of CMMS software.

Guidance on the delivery and assessment of this Unit

Delivery of this Unit should relate to Current Codes of Practice and legislation eg

- Health and Safety at Work Act, 1974 (HSW Act)
- Electricity at Work Regulations 1989
- The Management of Health and Safety at Work Regulations 1999
- IEE Wiring Regulations (current edition) BS7671

1. Explain standard techniques involved in plant maintenance. (14 hours)

- RM: advantages/disadvantages, where applicable.
- PPM: highlight where PPM is applicable. Discuss advantages such as: more even spread of maintenance work, better budgetary control, fewer emergency breakdowns, extension of working life of plant, scheduling of maintenance at organisationally convenient or economically beneficial time.
- TPM: advantages. Highlight the importance of staff training/cooperation. Discuss overall equipment effectiveness (OEE).
- RCM: explain how this stresses the maintenance of items critical to the continued reliable operation of plant. Attempts to maximise reliability. Seeks to eliminate unnecessary preventative maintenance.
- Condition Monitoring: explain CM, Monitoring vibration, temperature, thermal imaging, allows recording of trends and comparisons with initial base line measurements. Allows remedial measures to be taken before breakdown. Give examples such as monitoring of high voltage cables, steam turbines and generators. Explain that conditions are monitored according to the most likely failure modes expected. CM Software allows viewing of history in graphs, charts etc and publishing of reports.

2. Explain typical health and safety regulations pertaining to plant maintenance systems. (11 hours)

- Highlight the necessity of being informed of, and complying with, all statutory health and safety requirements.
- Responsibilities for personnel under Health and Safety at Work Act 1974, Management of Health and Safety at Work Regulations 1999. Explain Hazard and risk and give typical examples. Explain the rudiments of sensible risk assessment procedure.
- Explain provisions of COSHH regulations. The need to protect personnel from potentially dangerous substances either through removal of substance or provision of appropriate PPE. Explain noise hazards. Noise related health and safety regulations.
- Explain the purpose of the permit to work procedure and the need to identify all potentially hazardous work activities to be carried out and the measures required to minimise any risks. Highlight the need for an operational plan involving safe isolation and locking off.
- Give examples of typical health and safety issues, which arise as a result of plant maintenance procedures pertinent to the industry, within which the candidate is involved.

3. Develop a maintenance strategy for a given simple industrial scenario. (14 hours)

This Outcome should provide the candidate with an opportunity to apply the principles of plant maintenance learned, to a given industrial scenario.

- Organisational requirements of a maintenance Policy, administrative structures, analysis of particular industrial scenarios so that appropriate maintenance strategies, including safe systems of work, are employed.
- Recording of information and updating plant records, spares inventories and standard operating procedures for plant.
- Value of using charts and graphs in analysing the history of particular systems and planning of plant maintenance.
- Importance of employing cost effective strategies for maintenance.
- Importance of ensuring skills and qualifications of workforce are adequate, diagnostic skills, fitting skills, electrical engineers, plant servicing skills, etc. Vocational qualifications and experience.
- Value of critical path network analysis techniques.
- Contribution of CMMS software in the management of plant maintenance systems.

Assessment :
The assessment for this Unit will be composed of two parts. A single assessment paper lasting one and a half hours carried out under supervised controlled conditions and an assignment. It is recommended that the assignment is presented to the candidates toward the conclusion of Outcome 2 and should be completed before the end of the delivery of the Unit.

Open learning

This Unit could be delivered on an open learning basis. The centre would have to ensure that the written assessment was carried out under controlled and supervised conditions.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Industrial Plant Maintenance

This Unit has been designed to allow you to develop the knowledge and skills involved in setting up a plant maintenance policy. The initial part of the course involves an introduction to current standard techniques employed in plant maintenance. In the maintenance of industrial plant there are often many issues relating to health and safety, therefore Outcome 2 focuses on the typical health and safety regulations pertaining to plant maintenance systems. Permit to work, risk assessment and responsibilities of employers and employees under the health and safety at work act are all examined. During the delivery of the concluding Outcome you will have the opportunity to develop an understanding of computerised maintenance management system software. Also you will able to apply what you are learning, by way of an assignment and report. In this, you will develop a program of maintenance for an industrial scenario and a report justifying your program. The particular industrial setting will be drawn as closely as possible from your own industrial experience or area of study.

Formal assessment will be composed of two parts:

1. A written test lasting one and a half hours based on what you have learned in the first two Outcomes in the Unit.
2. A combined assignment and report.