higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ENGINEERING PRACTICE AND MAINTENANCE
NQF LEVEL 3

(6021003)

7 March 2018 (X-Paper)
09:00–12:00

This question paper consists of 9 pages.

NCV

TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

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QUESTION 1

1.1 Complete the following sentences by using the words given in the list below. Write only the word(s) next to the question number (1.1–1.5) in the ANSWER BOOK. Each word can only be used once.

accidents; reliability; steam; rub; safety

1.1.1 Organisations are often judged not only by the … of their systems but their ability to respond effectively when failure occurs.

1.1.2 Work safely at all times, complying with health and … and other relevant regulations and guidelines.

1.1.3 In all types of machines, the surfaces of moving or sliding or rolling parts … against each other.

1.1.4 Poor housekeeping can frequently contribute to … by hiding hazards that cause injuries.

1.1.5 In a simple steam power plant, at the top of the boiler high-pressure superheated … leaves the steam drum, also referred to as a steam generator, and enters the turbine.

(5 × 1) (5)

1.2 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

1.2.1 Common aids are …, instruments, equipment, and information.

A tools
B trailers
C jobs
D gloves

1.2.2 Random means happening without any definite …, aim or pattern.

A plant
B analysis
C plan
D failure

1.2.3 A fault is when a part or component of the … or system has broken or is not working.

A voltage
B product
C symptom
D troubleshooting

1.2.4 Identify potential … in the workplace and report them to the health and safety committee or employer.

A dangers
B slipping
C designs
D viscosity

1.2.5 … is to improve and modernise a product, and to modify a product is to make changes to a product.

A Punching
B Tagging
C Insulating
D Upgrading

(5 × 1) (5)

1.3 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–E) next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B
1.3.1	Patent	A reduces temperature between objects
1.3.2	A tool	B the investigation of the cause of malfunction in machinery
1.3.3	Fault-finding	C an item used for a specific purpose
1.3.4	Lubricant	D legal rights given to a person
1.3.5	Benchmarking	E systematic process for identifying best or better practices

(5 × 1) (5)

1.4 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.4.1–1.4.5) in the ANSWER BOOK.

1.4.1 When the manufacturing process goes wrong, the resulting products may fail to meet the manufacturer's own design specification standards.

1.4.2 Any substance introduced between two moving/sliding surfaces with a view to reduce the friction (or frictional resistance) between them, is known as a failure.

1.4.3 A fault is another word for a problem.

1.4.4 Manuals can be textbooks.

1.4.5 Testing electrical equipment can be hazardous.

(5 × 1) (5)
[20]

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QUESTION 2

Read the passage below and answer the questions.

CAUSE OF WINDOW HANDLE FAILURE

A failure came to light when a lady in a wheelchair sustained bad cuts to her hand and arm when closing her window. The handle mechanism was exceptionally stiff, requiring a good deal of effort to close it properly. At the instant of failure, the lady was giving the handle a forceful pull, when the handle gave way, causing her to lose her balance and fall forward in her wheel chair. In trying to save herself from falling out of the chair, her hand went through the glass, causing extensive injury to her hand and arm.

The handle was a plated zinc die casting, and observation showed corrosion and cracking away from the fracture site. Corrosion staining was also present on the inside of the pivot hole. The fracture surface contained markings, indicative of fatigue. Therefore, the failure mechanism was one of corrosion assisted fatigue. The design of the handle could not be criticised, in that its casting quality, plating and section were within limits. However, observation of the lock mechanism and hinges showed that there had been little or no lubricant applied to relevant parts, causing increasing difficulty in both opening and closing the window unit. This continually increasing service loading lead to ultimate failure – enhanced and assisted by the influence of corrosion. As the housing unit was owned and run by a local council for disabled tenants, they were held liable for injury.

[Adapted from: Gagg C, 2005, *Engineering Failure Analysis,* vol. 12,issue 5, p799, viewed 23 October 201, from *www.sciencedirect.com*]

2.1 Which part of the window failed? (2)

2.2 Why did this part of the window fail? (2)

2.3 State FOUR things that were observed on the product which could be the cause of the failure. (4)

2.4 State the systematic fault-finding technique that was used to locate faults on the window unit. (2)

2.5 What caused the difficulty in both opening and closing of the window unit? (2)

2.6 The role of the engineer is to respond to a need by building or creating something along a certain set of guidelines (or specifications) which performs a given function. Just as importantly, that device, plan or creation should perform its function without fail.

State FOUR skills that are needed by engineers when designing a new product. (4 × 2) (8)

[20]

QUESTION 3

3.1 Fault detection is recognising that a problem has occurred, even if you don't yet know the root cause.

State FIVE techniques that are used to locate faults and deduce their cause. (5)

3.2 When shopping for a new car, the last thing customers want is to buy a model that will continually require repairs due to manufacturer defects. As an engineer of the company, you need to write a report providing good reasons to justify why changes should be made to the existing product.

State FIVE reasons that you would provide to justify why modifications on an existing design need to be made. (5)

3.3 Explain the following terms used in engineering:

3.3.1 A life cycle design

3.3.2 A failure in a system

3.3.3 A dry sump lubrication system

3.3.4 An extraction plant

3.3.5 Simulations

(5 × 2) (10)

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QUESTION 4

4.1 Explain each of the following terms used in engineering:

4.1.1 Product recall

4.1.2 Defect

4.1.3 Design

4.1.4 Design process

4.1.5 Technical report (5 × 2) (10)

4.2 To expertly troubleshoot electrical equipment, problems must be solved by replacing only defective equipment or components in the least amount of time. One of the most important factors in doing this, is the approach used. Expert troubleshooters use a system or approach that allows them to logically and systematically analyse a circuit to determine exactly what is wrong.

State FIVE systematic fault-finding techniques that can be used to locate and rectify problems. (5 × 2) (10)

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QUESTION 5

5.1 Fault-finding is a skill required in just about every industry. In general, those areas of industry which demand high-level technical skills have developed well-documented fault-finding methods.

State ONE positive aspect of each of the following fault-finding techniques:

5.1.1 Direct observation

5.1.2 Measurement-based

5.1.3 Simulations

5.1.4 Manufacturer's service diagnostic data

5.1.5 Operational tests

(5 × 2) (10)

5.2 Great care should be taken when using any machinery to avoid both personal injury and damage to equipment. Only trained and authorised persons should be allowed to use hazardous equipment, and adequate arrangements should be made to prevent their use by unauthorised persons.

State FIVE prescribed safety measures to be adhered to when operating hazardous equipment. (5 × 2) (10)

[20]

TOTAL: 100

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