higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

N1650**(E)**(N14)H
NOVEMBER EXAMINATION

NON-NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

PLANT ENGINEERING: MINES AND WORKS

(8190306)

14 November 2016 (X-Paper)
09:00–12:00

REQUIREMENTS: Graph paper

CLOSED-BOOK EXAMINATION

Programmable calculators must NOT be used by any candidate.

This question paper consists of 6 pages.

PLENGMIAW

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NON-NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY

PLANT ENGINEERING: MINES AND WORKS

TIME: 3 HOURS

MARKS: 100

NOTE: If you answer more than the required number of questions, only the required number of questions will be marked. All work you do not want to be marked, must be clearly crossed out.

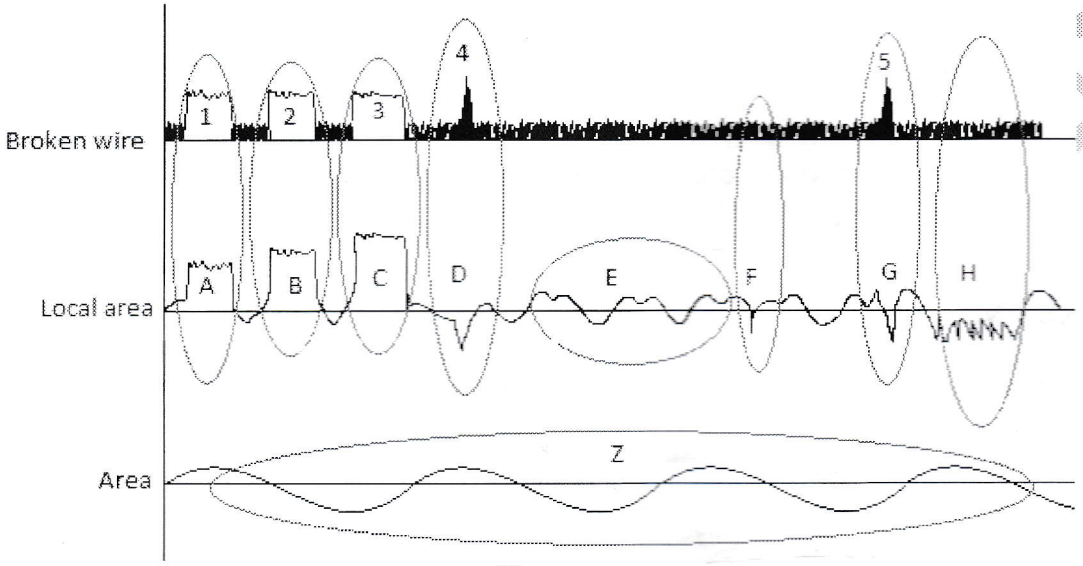
INSTRUCTIONS AND INFORMATION

1. ALL the questions in SECTION A are COMPULSORY.
2. Answer any TWO of the four questions in SECTION B.
3. Read ALL the questions carefully.
4. Number the answers according to the numbering system used in this question paper.
5. Rule off across the page on completion of each question.
6. Show ALL calculations.
7. Examination results will be disqualified if the candidate had not been accepted by the Commission of Examiners prior to the examination.
8. Candidates arriving 30 minutes late will NOT be allowed to sit for the examination. NO candidate writing the examination may leave the examination room before ONE hour after commencement has elapsed.
9. Write neatly and legibly.

SECTION A

QUESTION 1

You as a shaft engineer are doing your rope examinations monthly. During the last Electro Magnetic Testing (EMT) exam one of your student engineers wanted to know how to read a rope trace. He supplied you with the following abbreviated rope trace for an explanation:



1.1 How would you explain the results of sections 1,A / 2,B / 3,C to him? (2)

1.2 How would you explain the trace of section 4,D to him? (2)

1.3 How do you interpret the trace at position F and how would you explain it? (2)

1.4 What would be the cause of the result of the trace at position 5,G as indicated? (2)

1.5 What would be the cause of the trace behaving as recorded at position H? (2)

1.6 How do you calibrate the EMT head before you do the EMT examination? (4)

1.7 In practice, how would you remove a broken wire? (2)

1.8 Explain, by means of a simple drawing, the working principle of the EMT testing head. (4)
[20]

QUESTION 2

You are a newly appointed engineer in a process plant. The plant needs upgrading and your electrical reticulation system needs to be upgraded as well. You need to make a decision to install transformers in parallel and there are several conditions that need to be met. When making your decisions you must consider the maintenance of the transformers.

2.1 In your opinion, why would you install transformers in parallel rather than to install one big transformer? (2)

2.2 If you decide to install the transformers in parallel, what will be the advantages of doing so?

Name and describe FOUR advantages. (8)

2.3 Name FOUR conditions to fulfil before you can install transformers in parallel. In your own words, describe why you think these conditions are necessary. (8)

2.4 Name any FOUR routine tests that you will be doing on these transformers. (2)

[20]

QUESTION 3

You are an engineer in a high production shaft and you have three boilermakers and one coded welder working for you. You have given them permission to do metal arc welding during maintenance and on unscheduled maintenance days.

3.1 What is meant by *metal arc welding*? (1)

3.2 Discuss the effect of the arc length in welding. (14)

3.3 Write the procedure for the transportation and storage of oxyacetylene cylinders. (5)

[20]

TOTAL SECTION A: 60

SECTION B

Answer any TWO of the four questions in SECTION B.

QUESTION 4

Two 3-phase, 6,6 kV, star-connected alternators supply a load of 300 kW at 0,8 pf lagging. The synchronous impedance per phase of machine A is (0,5 + j10) ohms and of machine B is (0,4 + j12) ohms. The excitation of machine A is adjusted so that it delivers 150 A at a lagging power factor and the governors are set in such a way that the load is shared equally between the two machines.

4.1 Determine the current, power factor, induced EMF and load angle for each machine. (16)

4.2 Sketch an autotransformer and describe its use. (4)
[20]

QUESTION 5

A 200 tonnes electric train runs according to the following quadrilateral speed/time curve:

- A uniform acceleration from rest of 2 km/h/s for 30 seconds
- Coasting for 50 seconds
- Duration of braking is 15 seconds

5.1 Determine the schedule speed. (6)

5.2 Determine the specific energy consumption. (6)

5.3 How will specific energy change if there is a downward gradient of 1% rather than an upward gradient in the tracks? (8)
[20]

QUESTION 6

6.1 Lamps with an intensity of 300 candelas are used in an underground mine haulage.

If the average distance from roof to floor can be taken as 4,5 m, determine, using practical assumptions:

6.1.1 The illuminance directly beneath the lamp in the middle

6.1.2 The illuminance midway between two lamps in the haulage

(2 × 2) (4)

6.2 Briefly describe the considerations that should be taken into account before installing a booster fan in a coal mine. (6)

6.3 State TEN issues that must be addressed by engineers with regard to providing early detection and preventing ignition of flammable gas. (10)
[20]

QUESTION 7 (Graph paper needed for this question.)

7.1 The run-off water from a slime dam is pumped from a large pan to the evaporator pond through a straight pipeline, 2,5 km long and with an inside diameter of 230 mm, followed by a pipe, 1,5 km long and with an inside diameter of 190 mm. The height of the pond above the pan is 6 m. The pump runs at 900 r/min and has a performance curve as given below. The friction factor for the pipe is 0,007.

Head (m)	22	22	22	21,9	21,4	20,7	20	18,7
Flow (l/s)	0	10	20	30	40	50	60	70
Efficiency (%)	0	30	47	60	64	66	64	63

7.1.1 Calculate the power consumption of the pump. (4)

7.1.2 A second pump is connected in series just after the first pump to pump away the additional water during periods of high rainfall. The second pump should run at the highest allowable speed to handle the higher volumes.

(a) Calculate the maximum speed of the second pump, given that it is limited by the 600 kPa rating of the pipeline while keeping the speed of the first pump constant. (6)

(b) Calculate the power drawn by the two pumps operating in series at the above point. (6)

7.2 State the cause of unbalanced forces on a single inlet impeller and discuss preventative measures. (4)
[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100