higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T40(E)(J11)H
JUNE EXAMINATION

NON-NATIONAL CERTIFICATE

PLANT ENGINEERING – MINES AND WORKS

(8190306)

11 June 2015 (Y-Paper)
13:00–16:00

CLOSED-BOOK EXAMINATION

Nonprogrammable calculators may be used.

No cell phones are allowed in the examination room.

This question paper consists of 7 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NON-NATIONAL CERTIFICATE
PLANT ENGINEERING – MINES AND WORKS
TIME: 3 HOURS
MARKS: 100

NOTE: If you answer more than the required number 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.   SECTION A is COMPLULSORY.

2.   Answer only TWO questions from 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.   Use only BLUE or BLACK ink.

7.   Drawing must be done in pencil.

8.   Candidates are not allowed to leave the examination room before ONE hour after commencement of the examination.

9.   Candidates must be in the examination room 15 minutes before the examination starts.

10. Candidates without acceptance by the commission of examiners will be disqualified.

11. Write neatly and legibly.

SECTION A (COMPULSORY)

QUESTION 1

You have a maintenance plan in place to ensure your sheave wheels are maintained properly. After an audit was done it came to light that the maintenance plan in terms of your daily and monthly inspection criteria need to be revised. You also need to make modifications to your sheaves by installing inserts.

1.1   Which points would you include in your daily inspection program that need to be done by the artisans?

1.2   You as the engineer, as part of your duties, need to do a monthly inspection on the sheaves.

What would you look at when inspecting the sheaves?

1.3   Indicate, by means of a simple labelled cross-section diagram, how inserts are installed on a sheave.

1.4   What important information needs to be recorded in the Sheave Wheel Logbook?

(4 x 5)   **[20]**

QUESTION 2

2.1   You are appointed on a small incline shaft as the 2.13.1 engineer and your section has the following equipment installed:

- 5 conveyor belts with electrical motors of 45 kW, power factor 0,9 lagging and efficiency of 85% each
- One 250 kVA lighting transformer
- 7 pumps with induction motors of 60 kW, power factor 0,85 lagging
- 3 crushers with 120 kW, power factor 0,85 lagging motors
- A smelter of 400 kW
- 8 x 30 kW sorters, power factor 0,707 lagging

Calculate the following:

2.1.1   The total apparent power

2.1.2   The total power factor of the plant

2.1.3   The size of capacitors per phase required to improve the power factor to 0,98 lagging

(3 x 5)   (15)

2.2   A new milling machine is installed and it is decided to use a 150 kW, 50 Hz, power factor 0,5 leading, synchronous motor.

Determine the improvement in power factor correction afterwards.

(1 x 5)   (5)

[20]

QUESTION 3

3.1   What are the TWO main categories of causes of accidents in a mine or works? (4)

3.2   Explain the purpose of planned inspections. (2)

3.3   Name FOUR substandard conditions you can find within the engineering environment in a mine or works in each of the following plants and/or equipment:

    3.3.1   Conveyor belts

    3.3.2   Trackless workshop underground

    3.3.3   Underground rails

    3.3.4   Underground substation

    3.3.5   Shaft structures

(5 x 2)   (10)

3.4   Explain the purpose of planned task observations. (2)

3.5   Give TWO reasons why an orepass system is equipped with a grizzly. (2)

[60]

TOTAL SECTION A: 60

SECTION B
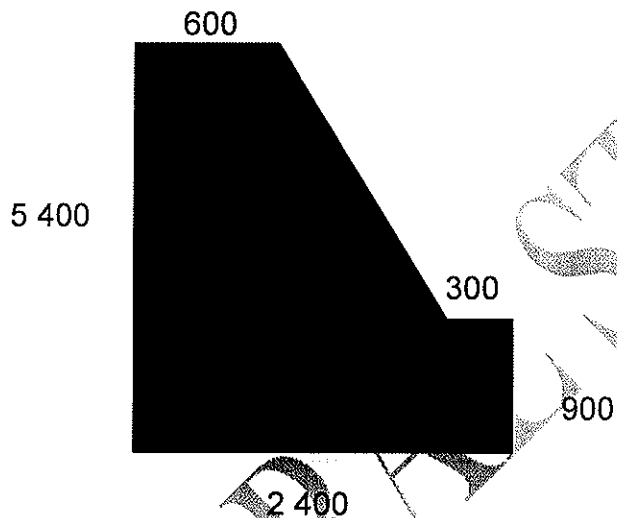
Answer only TWO questions from this section.

QUESTION 4

4.1   Explain why excess water is detrimental to a mix of concrete.   (8)

4.2   Verify, by means of calculations, that the retaining wall depicted in the sketch below of bulk density of 2,2 t/m^3 is capable of retaining sand of bulk density of 1,5 t/m^3.
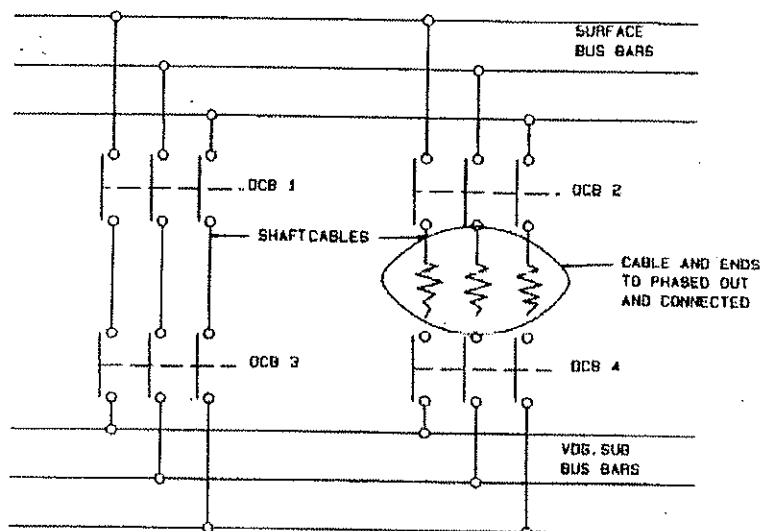
$$Rankine\ Formula\ is\ p = q\ \left(\frac{1 - \sin 30°}{1 + \sin 30°}\right)$$

600

5 400

300

900

2 400

(8)

4.3   Calculate the maximum foundation pressure in kPa.   (4)
                                                                            [20]

QUESTION 5

5.1 Prepare a maintenance schedule for a shaft electrical substation. (5)

5.2 List the checks to be carried out prior to using a phasing stick. (5)

5.3 Draw a safety procedure for phasing in the parallel feeder cables depicted in the sketch below.

(10)
[20]

QUESTION 6

A second-hand belt drive is to be used to drive a pump and consists of four V-belts in parallel on identical 300 mm diameter grooved pulleys. The angle of the groove is 30°. The cross-sectional area of each belt is 300 mm^2, the coefficient of friction is 0,12 and the maximum allowable safe stress in the material is 7,2 MPa.

Ignore the reduction in belt tension due to centrifugal force and assume an appropriate efficiency for the pump.

6.1 Verify that the belts are suitable to drive a slurry pump running at 960 r/min and elevating 260 t/h of solids, in the form of a pulp, to a total head of 15 m.

The relative density of the solids is 2,7 and for the pulp is 1,2. (15)

6.2 Name and explain FIVE causes of premature V-belt failure. (5)
[20]

QUESTION 7

7.1 A three-phase, four wire 380 V electrical distribution system consists of a three-phase load of 100 kW at a power factor of 0,8 and three single-phase loads of 30, 40, and 59 kW respectively.

Determine the current in each of the FOUR conductors. (10)

7.2 The delivery of a sludge pump must be varied by changing the slip-ring motor speed to 50% of the speed when the slip rings are short-circuited with a 4% slip.

Calculate the additional star-connected resistance to be connected to the slip rings to achieve the decrease in speed.

The three-phase 8-pole slip-ring motor is rated at 750 kW. The star-connected rotor winding has a resistance of 0,1 Ω/phase and a standstill leakage reactance of 0,5 Ω/phase. (10)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

$P = VI \cos \phi$