This question paper consists of 7 pages.

Programmable calculators may NOT be used.

CLOSED-BOOK EXAMINATION

09:00-12:00
6 June 2016 (X-Paper)
8190306

PLANT ENGINEERING: MINES AND WORKS

COMPETENCE

NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF

JUNE EXAMINATION

N1610(E)(J6)(H)

REPUBLIC OF SOUTH AFRICA
Higher Education and Training
Department:

Higher Education & Training
INSTRUCTIONS AND INFORMATION

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.

MARKS: 100
TIME: 3 HOURS

PLAN ENGG; MINES AND WORKS
NATIONAL CERTIFICATE: ENGINEERING CERTIFICATE OF COMPETENCY
REPUBLIC OF SOUTH AFRICA
DEPARTMENT OF HIGHER EDUCATION AND TRAINING

N1610bEEX16bH
-2-
(6190206)

1. SECTION A is COMPULSORY and must be answered by ALL the candidates.

2. Answer any TWO questions in SECTION B.

3. Read ALL the questions carefully.

4. Number the answer according to the numbering system used in this question paper.

5. Rule of across the page on completion of each question.

6. Show ALL the 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.

9. Write neatly and legibly.
(4) What are the fundamental differences between these current transformers?

In QUESTION 2.1 you have made a selection on the type of current transformer.

(4) What is meant by the knee point of a current transformer?

Transformer Protection

Differential Protection

Protection Solutions:

2.1.1 What type of current transformers (CTs) will you specify for the following protection for your transformers:

2.1.2 feeder differential protection for the feeders and ordinary overcurrent and earth-fault

You have to select from the available selection of protection circuitry. You have decided to use the transformer and you need to decide what current transformers to specify.

You are an engineer on the site and you need to upgrade your consumer substation.

QUESTION 2

[20]

What is the function of the voltage cards in the Escort controller?

(4) Briefing system.

(4) Draw a typical speed/distance graph of what you expect to see from an Escort.

(4) Explain the function of the Escort controller.

(6) Answer: need to perform its function. Write down a simple formula to deduce your in simple terms, what TWO programmable inputs does the Escort controller.

(4) Where is the most obvious place you would look for the fault?

InVESTIGATE THE COMPLAINT.

YOU ARE AN APPOINTED SHUNT ENGINEER ON A DEEP-LEVEL PRODUCTION SHARC. THE MAIN PROBLEM IS THE WINDING OF THE BRIDGES BECAUSE THEY WERE FUNCTIONING UNSTABLY. YOU HAVE TO INVESTIGATE THE COMPLAINT.

THE FINAL COMMISSIONING OF THE WINDERS THE DRIVER COMPLAINED THAT THERE WAS SOMETHING WONG WITH THE BRIDGES BECAUSE THEY WERE FUNCTIONING UNSTABLY. YOU HAVE TO INVESTIGATE THE COMPLAINT. THE WINDERS THE DRIVER COMPLAINED THAT THERE WAS SOMETHING WONG WITH THE BRIDGES BECAUSE THEY WERE FUNCTIONING UNSTABLY. YOU HAVE TO INVESTIGATE THE COMPLAINT.

QUESTION 1

ALL QUESTIONS IN THIS SECTION ARE COMPULSORY.

SECTION A
TOTAL SECTION A:

[20]

(6) Give reasons for your decision.

(4) Whether a cracked steel join in the wind or welding of the mine transport workshop you must decide.

(2) As a responsible person of the mine transport workshop you must decide.

(4) What provisions will you make to protect the health and safety of employees working in that area of the mine?

(4) What is meant by a second escape?

(2) Portion of that section do not have a second escape.

(4) You have also just been made aware that employees at the bottom most personnel;

(4) What additional measures can you make to ensure the health and safety of employees?

3.1 You have just been appointed in a new subshell section of the mine. It has occurred to you that the closest refuge chamber for employees in that section is over 1 km away.

QUESTION 3

[20]

(4) Indicate the differences of the current transformers by means of a graph.

(4) Name FOUR factors which will influence the accuracy of a current transformer.

2.4 One of the considerations when selecting CTS depends on the accuracy.
QUESTION 4

A slimes dam return pump station is equipped with four pumps driven by 55 kW, 3-phase, 550 V, 0.83 power-factor motors. Water is delivered to it by a short supply and pumps cannot be stopped for any reason. Repairs are done by replacing a pump with a spare one as fast as possible. The proper to the pump station is supplied with a 4-core, 150 mm², 1 kV, 750 m long PVC/PEVA cable, buried for the whole distance. The water shortage could be eased during the rainy season if a fifth pump could be added.

4.1 Decide whether a fifth pump could be added to the supply without overloading the cable or replacing it. Develop a proposal supported by the necessary calculations that could be presented to the chief engineer.

4.2 As sectional engineer of an underground section, you are required to introduce a vehicle avoidance system (VDS) to the vehicles and personnel at your mine. At the meeting with the various suppliers of vehicle avoidance systems, the suppliers discussed electromagnetic interference.

4.2.1 What is electromagnetic interference?

4.2.2 What dangers does this introduce in a mine?

4.2.3 How is it detected, and what tests must be carried out by the suppliers of this VDS equipment?

4.2.4 What other equipment items affect the VDS?

5.1 Briefly explain the cause of heat generation in plain bearings.

5.2 State THREE ways of reducing the generation of heat in a plain bearing.

5.3 Briefly explain how turning hot can cause a plain bearing to seize.

5.4 What causes seizure of a metal-to-metal plain bearing?

5.5 State FIVE causes of vibrations and their prevention in main ventilation fans.
QUESTION 6

The following information was obtained for an underground mining area that is to be cooled by chilled service water and air heat exchangers:

- Mass ratio of service water to mined rock
- Mass flow of service water
- Temperature difference of the chilled water across the heat exchangers
- Temperature difference of the chilled water across the heat exchangers
- Quantity of refrigeration to cool the air
- Quantity of refrigeration to cool the mined rock

Determine the following:

6.1.1. The quantity of chilled service water
6.1.2. The quantity of chilled water to cool the air
6.1.3. The total quantity of chilled water to be provided
6.1.4. The capacity of the refrigeration plant, pump used to elevate the settled slime up a vertical shaft:

6.2. The following are particulars of a three-throw, single-acting belt-driven plunger pump used in the mining area:

- Diameter of plunger
- Length of stroke
- Speed of pump
- Relative density of the solids
- Relative density of the slime
- Diameter of pipe line
- Depth of shaft
- Volumetric efficiency
- Pump efficiency

Determine the following:

6.1.1. The mass of dry solids pumped in kg/s
6.1.2. The power of the electric driving motor
7. The power supply in a mine was extended from an existing underground 6.6 kV substation to two mini-substations. Each mini-substation is supplied separately from a joint box at the split in the haulage and the joint box is supplied with a single feeder cable from a 6.6 kV substation. The mining process consists of drilling, blasting, scraping into slope chutes and transport by train.

Describe six tests required before switching on to ensure the safety of operating personnel and to ensure the dependability of the power supply after an earth fault has occurred on one of the machines.

A 4.8 MW, 11 kV, separately excited motor drawing 5,333 MVA at a 0.9 power factor leading drives a 50,000 m³/h air compressor and is connected in parallel with a process plant drawing 5 MW at a 0.8 power factor lagging. Besides thermal overload protection, describe the function of FOUR other electrical protection devices you would expect to find installed to safeguard the compressor motor.

TOTAL: 100