the dme
Department:
Minerals and Energy
REPUBLIC OF SOUTH AFRICA

MINE MANAGERS EXAMINATION

METALLIFEROUS AND COAL MINING
MECHANICAL AND ELECTRICAL ENGINEERING

DATE: 16 OCTOBER 2008

TOTAL MARKS: 100
TO PASS: 50

TIME ALLOWED: 3 HOURS
(12h30 - 15h30)

NOTE:

1. Answer all questions.
2. All calculations must be shown.

- This question paper consists of four pages.
- All answers and sketches must be presented in a neat and decipherable manner.
- Papers will not be marked if undecipherable.
- Restrict the use of highlighters.
- Do not use a red pen.
- Read the directions on the front page of your answer book carefully.
- The use of computers, laptops and palmtops is prohibited.

QUESTION 1

You are the manager in charge of a brand new undeveloped mine. You arrange to have a vertical shaft sunk to a depth of 500m, and are charged with planning every detail of the sinking operation. The concrete lined shaft is to have a final diameter of 16m.

The sinking company you commission informs you that they have the following equipment available to sink the shaft:

- Two 4t kibbles, immediately available;
- A mechanical loader, immediately available;
- A 75t mobile crane, immediately available;
- A single stage sinking platform to be suspended by steel ropes from six air-winches, immediately available;
- Six electrically operated mobile winches, immediately available;
- A Scott Derrick Hoist, available in ten weeks time;
- A double-drum winder, available within three months;
- A stage winder, available within three months.

You are required to start with sinking operations without undue delay.

1.1 Explain how you are planning the operation without any waste of time and how you are going to commence with the pre-sink operations, including at which shaft depth you will cease the pre-sink operation and how you intend guiding the kibble during the sinking operations;

TIP: Don't forget the legal aspects and how you will ensure compliance.

(6)

1.2 Indicate which of the above-mentioned equipment you will utilize, including the anticipated time to complete the shaft sinking operation;

(4)

1.3 When will you use the above-mentioned equipment and why?

(2)

1.4 What will you use the above-mentioned equipment for and under which conditions will you use them?

(4)

1.5.1 How will you ensure that the cover over the platform is adequate to protect workers below whilst hoisting mineral? Remember to be realistic in your approach.

(2)

1.5.2 How will you ensure sufficient space available to allow the mechanical loader to pass through the stage?

(2)

[20]

QUESTION 2

A chairlift is to be installed between the surface and levels 1, 2 and 3, being 120m, 140m and 170m respectively vertically below surface. The chairlift must be able to transport 350 persons per hour;

Given:

- Rope speed 1,5m/s
- Winze angle 30^{o} to the horizontal
- Drive efficiency 75%
- Installation friction resistance 6,5kN
- Mass per person 75kg

2.1 What size of the electric motor is required to operate the chairlift?

(6)

2.2 How many single chairs are required on the installation?

(6)

2.3 In the event of the motor tripping whilst all ascending chairs are occupied and none of the descending chairs are occupied and all brakes fail, how will the passengers be safeguarded?

(2)

2.4 What means will prevent persons from being transported around the drive sheave?

(2)

2.5 What are the required dimensions and clearances at the landings on the various levels?

(4)

[20]

QUESTION 3

Overhead trolley locomotives are used along a haulage-way underground. The overhead conductor has a DC supply voltage of 500V and a resistivity of 0,0025Ω/m. The rail, which serves as the negative, has a resistivity of 0,0037Ω/m.

Two locomotives operate along this haulage-way. Locomotive “A” is 1,8km from the source of supply and draws a current of 45A and locomotive “B” is 2,5km from the source of supply and draws 50A.

3.1 Calculate the voltage at Locomotive “A”, as well as the resistance of the locomotive electric motor.

(10)

3.2 Calculate the voltage at Locomotive “B”, as well as the resistance of the locomotive electric motor.

(10)

[20]

QUESTION 4

A three phase 380V electric motor is used to drive a pump. The vee-pulley attached to the pump drive shaft has a diameter of 600mm whilst the motor vee-pulley has a diameter of 400mm. The vee-pulley centres are 1800mm apart. The motor operates at a full-load speed of 980rpm.

Calculate the following:

4.1 The rate of rotation of the pump shaft.

(5)

4.2 The length of the vee-belts.

(5)

4.3 The angle of wrap of each pulley.

(5

4.4 When the motor draws a current of 45A, determine the pump shaft torque.

(5)

[20]

QUESTION 5

A locomotive accelerates at 0,08m/s^2 and braking is such that deceleration of 0,12m/s^2 is achievable. The locomotive is required to transport ore from a loading box to an ore-pass 2,5km away. The time to load all hoppers is 15 minutes and the discharge time is 5 minutes. The average top speed is 13km/h when fully loaded and 16km/h when empty.

Calculate the time to complete one full cycle.

[20]

TOTAL [100]