



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

MINE TRANSPORTATION

EMI 3104

Final Examination Paper

January 2020

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr D. Chawira

INSTRUCTIONS

1. This paper contains One section with Five questions
2. Answer Question One (28 marks) and any other **Three** questions (24 marks each)
3. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
4. Start each question on a new page

NB: DO NOT TURN OVER THE QUESTION PAPER OR COMMENCE WRITING UNTIL INSTRUCTED TO DO SO

Additional Requirements

Non-Programmable Calculator

MARK ALLOCATION

Question 1	28Marks
Question 2 to 5	24 Marks
Part Questions	As shown in each part question
Total Attainable	100

Question 1 (28 marks)

Given:

A mining engineer was in charge of two iron ore mines in two different locations around the world; Location One and Location Two. At the locations, the mine is 30 kilometres from the processing plant. The engineer had two choices available for the ore transportation from the mine to the plant; conveyor or trucks. The mining engineer decided that: for Location One ore is transported to the plant by conveyor and for Location Two by trucks.

Required:

- a) Pretending that you were the mining engineer in this case study; discuss the **five** factors that influenced you to reach the selection of transportation method for each of these mines. Please discuss each mine separately. [10]
- b) What other transportation method besides these two might have been considered and why might it have been disregarded? [4]
- c) Draw and fully label a conveyor belt system. [4]
- d) As the mining engineer, a conveyor belt of width 35cm is to be installed running at a speed 0.65m/s carrying iron ore of density 2.6g/cm^3 from the ore stockpile to the processing plant. Determine the carrying capacity of the belt and the hourly production. [10]

Question 2 (24 marks)

- a) Safety has been regarded as a critical aspect in mining operations in safeguarding the business reputation and as well as a cost driver. What safety features can be found on conveyor belts and what are their respective use? [10]
- b)

Given:

Xplats is on a reef platinum mine intending to install a mine dewatering system with both electrically and pneumatically powered pumps. One type of pumps will be required for pumping water for a horizontal distance of up to 50m from working areas to sumps along the decline while for the other type will pump from one sump to the next until the water is out of the mine over a head of 300m.

- i. When selecting which pump is allocated to the working areas of decline, which four characteristics of pumps do you put into consideration? [4]
- ii. Explain, with the aid of a diagram, the difference between suction head and discharge head as applied in pumping systems. [4]

iii. What is the Kilowatt power rating for a centrifugal pump required to pump water under the following conditions:

- Total Head 250m
- Overall efficiency 93%
- Rate of water delivery 22litres/sec

[6]

Question 3 (24 marks)

(a) The Caterpillar 740B is designed specifically for high-production mining and construction sites. It is 4.2 metres high and 12.5 metres long and costs between \$600 000 to \$1.3 million. A single tire for the 740B costs more than \$3 000; it is 1.5 metres high and weighs over 2,000 kilograms. The truck is so large that it can't be driven on the highway, so it is taken on a low bed trailer to the job site. For such an off-highway truck, discuss its:

- Basic design
- Powering mechanism
- Principle of operation
- Machine costing
- Safety features

[14]

(b) Provided you are employed as a Planning Engineer at Mine X. Which factors do you consider before arriving at the decision to buy or lease equipment/machinery?

[10]

Question 4 (24marks)

a) The design process for a mine hoisting system should be understood by the mining engineer, even though the design and installation are contracted to an engineer-constructor firm and the equipment bid to a hoist manufacturer. In most cases, the mining company developing the mine assigns its own engineering department to monitor the whole process from planning to the actual construction of the surface hoist plant.

i) Discuss three factors that govern the selection of a hoist system.

[6]

ii) Compare drum hoisting systems over friction hoisting systems as applied in mine transportation.

[4]

b) Modern process plants use powerful centrifugal pumps which are either electrically or pneumatically powered. Which four advantages do these pumps have over other rotodynamic and positive displacement pumps? [4]

c) Discuss water reticulation for an open pit mining operation explaining where water comes from, where it collects and how it can be managed to ensure a dry working environment. [10]

Question 5 (24 marks)

‘Speed affects cycle time, cycle time drives production and ultimately production determines cost.’ This ripple effect of machine speed prompts equipment planners to always synchronize machine capabilities with operating environment during equipment selection.

- i) Calculate the number of trucks theoretically required and the production of this combination;
- ii) Calculate the expected production if two trucks are removed from the fleet.

Shovel production at 100% efficiency	283 BCM/h	
Job efficiency	0.75	
Truck capacity	15.3 BCM	
Truck cycle time, excluding loading	0.5 h	[10]

- iii) Although machine speed is critical in ore haulage, safety has to be borne in mind for an accident free working environment. Which safety features have been introduced in mobile machinery through Information and Communication Technology (ICT) and Automation to drive mining towards the achievement of zero harm? [4]
- iv) A truck with 23ton GVW is moving up a 4% grade. What is the force required to overcome grade resistance? If the same truck has dumped its load, the NVW is now 12ton and on return it is moving down the 4% grade. What is the force required to overcome grade resistance? [6]
- v) Draw and label a ‘mine haul road design.’ [4]