



FACULTY OF ENGINEERING AND THE ENVIRONMENT
DEPARTMENT OF MINING ENGINEERING
Mine Planning and Design/Mine Design
EMN4201/EMI5203
Final Examination Paper

April 2025

This paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner: Mr T.C Dombo

INSTRUCTIONS

1. This paper contains TWO sections.
2. Answer all questions in Section A and any Three questions in Section B.
3. Each question carries 20 marks.
4. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
5. Illustrate your answer, where appropriate, with clearly labeled diagrams.
6. Started each question on a new page.
7. This paper comprises of 4 printed pages.

Additional requirements

Calculator and graph paper.

Section A

Question 1

A mining company is considering mining a deposit with the following characteristics:

- Ore body depth: 200 metres below the surface
 - Ore shape: steeply dipping, narrow ore zone
 - Ore grade: 1.5% copper
 - Surrounding rock conditions: hard rock
 - Environmental constraints: protected wildlife area on the surface.
- a) The company is having some difficulties in choosing between surface mining and underground mining. As a mine planning engineer, explain and justify a suitable mining method. **(5 marks)**
- b) Discuss the key considerations when designing a shaft system for an underground mine. **(6 marks)**
- c) Describe how you would design a ventilation system for an underground mine's brownfield project. **(9 marks)**

Question 2

- (a) Briefly explain 5 Environmental aspects of Mine Planning and Design using a Case study of any coal mine in Zimbabwe. **(5 marks)**
- (b) Explain the role of software tools in addressing environmental concerns encountered during Mine planning and Design. **(6 marks)**
- (c) Describe how the changes in the following factors would affect the life of the mine:
- i. Mineral price
 - ii. Mining methods
 - iii. Equipment availability **(9 marks)**

Section B

Question 3

- (a) Differentiate between strategic mine planning and operational mine planning. How does each influence the overall success of a mining project? **(6 marks)**
- (b) Explain the factors that influence the selection of mining equipment both in open-pit and underground mining operations. Provide examples of specific equipment types suitable for each method. **(8 marks)**
- (c) Discuss the role of community engagement and corporate social responsibility programs in mitigating negative social impacts during mine development and operation. **(6 marks)**

Question 4

Rock Technology mining company is assessing the economic viability of a gold deposit with the following data:

- Ore grade: 5.0 g/t
 - Mining cost: \$50/t
 - Processing cost: \$25/t
 - Gold price: \$1200/oz
 - Mill throughput: 2000t/day
 - Daily gold production: 2kg
 - $31.1 \text{ g} = 1 \text{ oz}$
- a) Explain the concept of cut-off grade and discuss how it influences the production scheduling process. **(10 marks)**
 - b) Calculate the cut-off grade. **(5 marks)**
 - c) Define geostatistics and its role in mineral resource estimation in mining. **(5 marks)**

Question 5

A mining company is evaluating a copper deposit and has gathered the following information:

- Ore grade: 1.8% Cu
- Price of copper: \$8000/t
- Mining cost: \$30/t
- Recovery rate: 90%
- Annual ore production: 1 Million tonnes
- Life of the mine: 12 years
- Capital expenditure: \$100 million
- Discount rate: 8%

- (a) Describe feasibility study in the context of mine planning. **(8 marks)**
- (b) Calculate the net present value of the project assuming constant revenues and costs over the life of the mine. Provide all necessary assumptions. **(8 marks)**
- (c) Explain how changes in commodity prices and operating costs affect the feasibility of a project. **(4 marks)**

Question 6

- a) Discuss the fundamental aspects required for planning and designing water management system for a deep underground mining operation. **(10 marks)**
- b) Describe the steps you would take for planning ventilation requirements for an underground greenfield mining project. **(10 marks)**

End of examination Paper.