



FACULTY OF ENGINEERING AND THE ENVIRONMENT
DEPARTMENT OF MINING ENGINEERING
UNDERGROUND MINING

EMI5201

Final Examination Paper

April 2025

This paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner: Mr. D Jaibes

INSTRUCTIONS

1. This paper contains SIX questions.
2. Answer all questions from section A and three questions from 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. Start each question on a new page.
7. Be concise and ensure clarity in your answers.
8. Support your answers with relevant examples and references where appropriate.
9. This paper comprises 4 printed pages.

Additional requirements:

Calculator

SECTION A: ANSWER ALL QUESTIONS

Question 1:

- a. Explain the key steps involved in the exploration phase of an underground mine. Discuss how geological surveys, drilling, and sampling help in identifying mineral deposits. (5 marks)
- b. Describe the process of mine development once a deposit is confirmed. What are the key aspects of creating tunnels, shafts, and access points for production? (5 marks)
- c. A mining company has identified a potential ore body at a depth of 500 meters below the surface. Describe the type of access method they might use (shaft mining, ramp mining, etc.) and why it is suitable for this situation. (5 marks)
- d. Discuss the importance of proper ventilation and dewatering systems during the development phase. (5 marks)

Question 2:

- a. Compare and contrast the following underground mining methods:
 - Room and Pillar Mining
 - Cut and Fill Mining

Include their advantages, disadvantages, and typical applications for each method. (8 marks)

- b. In the context of Longwall Mining, explain how a shearer works and the role of hydraulic supports. (4 marks)
- c. A mine uses a room and pillar method. The room dimensions are 8 meters by 10 meters, and the pillars are 4 meters in height. If the mine has 12 rooms, calculate the total volume of ore extracted assuming 40% of the total area is reserved for the pillars. (8 marks)

SECTION B: ANSWER ANY THREE QUESTIONS

Question 3:

- a. Discuss the importance of rock mechanics in underground mining. What are the common rock properties that influence mine stability, and how are they assessed before mining operations begin? *(6 marks)*
- b. The in-situ stress of the rock at a mine site is measured at 40 MPa. If the stress is concentrated over a tunnel with a cross-sectional area of 10 m², calculate the total force exerted by the surrounding rock. *(6 marks)*
- c. A section of the mine shows signs of rock mass failure during excavation. Explain the potential causes of rock mass failure and outline the steps to address these issues through reinforcement techniques. *(8 marks)*

Question 4:

- a. Discuss the different methods used to transport ore and waste material in underground mining. Include the advantages and disadvantages of rail, conveyor, and truck haulage. *(6 marks)*
- b. If a conveyor system is designed to transport 1,200 tons of ore per day, and the conveyor belt travels at a speed of 2 meters per second, calculate the total length of the conveyor belt required to handle this capacity, assuming the belt carries ore at a rate of 500 tons per kilometer per hour. *(6 marks)*
- c. A truck is used to transport 40 tons of ore at a time from the underground mine to the surface. If the truck makes 6 trips per day, calculate the total amount of ore transported per month (assume 30 days of operation). *(4 marks)*
- d. Describe how mucking (removal of waste rock) is managed in underground mining. What factors influence the choice of mucking equipment? *(4 marks)*

Question 5:

- a. Explain the concept of **risk management** in underground mining. Discuss the tools and methods used to assess and mitigate risks related to ground stability, fire hazards, and equipment failure. *(8 marks)*
- b. A mine experiences a significant methane gas build-up in an isolated section. The concentration of methane is measured at 5%, and the lower explosive limit (LEL) for methane is 5%. Describe the safety measures that should be implemented immediately to address this situation. *(6 marks)*

c. Discuss the role of **real-time monitoring systems** in ensuring the safety of underground miners. How do systems such as seismic monitoring, gas detection, and ground deformation tracking contribute to a safer mining environment? *(6 marks)*

Question 6:

- a. Describe the environmental concerns related to underground mining, including habitat destruction, water contamination, and dust pollution. How can these issues be mitigated? *(8 marks)*
- b. A mine uses a backfilling technique to fill voids created by extraction. The backfill consists of waste rock and cement, and the ratio of cement to waste rock is 1:3. If the mine requires 1,500 cubic meters of backfill per month, calculate the total amount of cement needed per month. *(6 marks)*
- c. Explain the importance of mine rehabilitation and the steps taken to restore the environment after mining activities have ceased. *(6 marks)*

End of Examination