



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

**EMN 4205 - MINERAL RESOURCES EVALUATION
Examination Paper JUNE 2025**

Time Allowed: **3 hours**
Total Marks: **100**

Examiner's Name: **MANESWA G**

Additional Requirements

- Calculator

INSTRUCTIONS:

1. This paper contains **TWO** sections
2. Answer all questions in Section **A** and any **3** questions in Section **B**.
3. Show all calculations.
4. Start each question on a new page.

This examination paper consists of 3 pages

SECTION A (40 Marks)

Answer all questions

Question One

- a) Discuss the different methods used for evaluating ore reserves, including their advantages and disadvantages. [8 marks]
- b) Describe how geostatistical methods can improve the accuracy of mineral resource estimates compared to traditional methods. [4 marks]
- c) Describe and explain the Volume variance effect [4 marks]
- d) Sketch an exponential semivariogram model and explain nugget effect and range [5 marks]
- e) Given the following variogram values at different distances:

Distance (m)	10	20	30
Variance	0.5	1.0	1.5

Calculate the range of the variogram. [4 marks]

- f) A mining company has conducted a drilling program on a mineral deposit and obtained the following sample grades (in grams per ton): 12, 15, 10, 14, 13, 16, 11, 15, 17, 18. Calculate the following:
 - i) Mean grade [2 marks]
 - ii) Variance and standard deviation [10 marks]
 - iii) 95% confidence interval for the mean grade [3 marks]

SECTION B (60 Marks)

Answer any 3 questions

Question Two

There are no prescriptive rules for resource classification. It is often left to the Qualified Person to decide on the resource categories that summarizes their confidence in the resource model.

- a) Describe two quantitative factors that are taken into consideration for resource classification. [10 marks]
- b) Give two examples of how the variogram can be used classify resources, use sketches to show your reasoning. [10 marks]

Question Three

Analyze the various economic factors that influence the valuation of mineral resources. Discuss how commodity prices, extraction costs, and market demand impact the estimation of ore reserves [20 marks]

Question Four

A mineral deposit has a block model with the following data:

- Block tonnage: 500,000 tons
- Average grade: 8% copper
- Recovery rate: 85%
- Price of copper: \$4.00 per gram

Calculate:

- a) The total amount of copper in the block (in grams). [5 marks]
- b) The expected revenue from this block after recovery. [5 marks]
- c) Discuss the implications of recovery rates on resource valuation [10 marks]

Question Five

A mining company employs Ordinary Kriging to estimate the grade of a mineral deposit. The following variogram model parameters are provided:

Nugget variance = 0.1; Sill = 0.6; Range = 100 m

If the estimated grade at a point is 20% and the surrounding sample weights are 0.3, 0.5, and 0.2, calculate the final estimated grade using Kriging. Discuss how the nugget effect can influence resource estimation. [20 marks]