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Rock Engineering
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EXAM, 3 hours
28.10.2003

OK
2002
EXAM

EMC - EUROPEAN MINING COURSE
Mak-32.341 MINING TECHNOLOGY AND ECONOMICS

No literature allowed:

1 Describe the main methods and their typical features for the investment analysis of mining projects.
4p

2 What should a feasibility study contain?
4p

3 How are the ore reserves classified?
4p

Literature allowed:

4 Annual production rate of a Zn-mine is 400 000 t. In-situ grades of ore are 6.2 % Zn, 3.3 % Pb and 45 g/t Ag. Estimated dilution is 9 %. Ore is processed to Zn-concentrate (Zn) and Pb-concentrate (Pb and Ag). The recovery of Zn to ZnC is 83 % and the grade of Zn in ZnC is 55 %. The grade of Pb in PbC is 60 % and recovery of Pb is 78 % and recovery of Ag is 72 %.

a) Calculate the grades of feed, tonnages of ZnC and PbC and the grade of Ag in PbC. 3p

b) Determine the cut-off grade for the mine as Zn, when the fixed costs of the mine are 4 million euro per year and variable costs are 12 euro/t. Use Zn-price 0.55 euro/kg, which is net price of Zn after freight, smelting and refining costs. 3p

5 Draw a break-even chart and determine break-even point and operating margin. Use data of the Problem 4.
3p

6. The mining project is in the feasibility study stage. Known minable reserves are 6.2 million tons and average grades are 2.2 % Cu and 1.2 g/t Au. Planned production rate is in the first year 250 000 t and full production rate during other years is 500 000 t. Alternatives for hoisting system are ramp hoisting and shaft hoisting. In the both options a ramp is excavated and pre-production time is 2 years. The cost estimate is following:

Cost Item	Shaft hoisting	Ramp hoisting
1. Investments (milliion euro)		
- ramp	6.5	5.3
- main developments	1.3	0.7
- ore passes	0.7	
- ventilation raises	1	1.2
- crushing system	2	1.2
- hoisting system	5	0.3
- equipment	4	2.5
	20.5	
2. Operating Costs (euro/t)		
- excavation	3	3
- mucking	0.7	0.7
- transportation	0.9	0
- crushing	0.3	0.9
- hoisting	2.6	3.3

Select the hoisting method and specify the selection criteria (i=12 %) 6p

7 Following cost functions have been evaluated for a mine (C = capacity Mt/a) :

$IC = 28.5\ C^{0.27}$ (Investment Costs, million euro)

$OC = 12.5\ C^{-0.30}$ (Operating Costs, euro/t)

Estimate total costs for a mine annually (million euro/a) and for a ton of ore (euro/t), when capacities are:

- 200 000 t/a
- 500 000 t/a
- 1 000 000 t/a

Investments are divided into ten years and rate of interest is 12 %. Draw and analyse the results.3p