NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND SPATIAL SCIENCES

DEPARTMENT OF MINING AND PROCESS ENGINEERING

QUALIFICATION: BACHELOR OF ENGINEERING IN MINING ENGINEERING	
QUALIFICATION CODE: 08BMIN	**LEVEL: 8**
COURSE CODE: SUM710S	**COURSE NAME: SURFACE MINING 315**
SESSION: JUNE 2022	**PAPER: THEORY**
DURATION: 2 HOURS	**MARKS: 100**

SECOND OPPORTUNITY QUESTION PAPER	
EXAMINER(S)	**Mr. Privilege Shava**
MODERATOR:	**Dr. Mallikarjun Pillalamarry**

INSTRUCTIONS

1. Answer all questions.
2. Read all the questions carefully before answering.
3. Marks for each question are indicated at the end of each question.
4. Please ensure that your writing is legible, neat and presentable.

PERMISSIBLE MATERIALS

1. Examination paper.
2. Scientific Calculator

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)

Question 1

a) An open pit zinc mine with a head grade of 3% and a processing recovery of 77% has the following cost structure per tonne of ore.

Item	Cost (N$)
Mining	156.73
Processing	202.86
General and administrative (G&A)	105.06
Freight, Smelting and Refining	56.81
Depreciation	89.23

The current market price of Zinc metal is US$1.23/ lb.

Required:

I. Net value per tonne of ore in N$. [3]

II. Estimate break-even cut-off grade. [3]

You are further required to evaluate the effect of the following:

III. Improved recovery of 82%. [3]

IV. Cost escalation of 7%. [3]

Use the following conversions for this question:

1 lb = 0.453592 kg; 1US$ = N$14.50

b) Explain the following terms:

I. Stripping ratio. [2]

II. Overall slope angle. [2]

c) Explain how the above terms (in part b) impact on the ultimate pit limit (UPL). [4]

d) With the aid of a diagram(s), explain the term "strip mining". [5]

Question 2

a) You are Mining Engineer at a quarry operation where rock is supposed to be carried from pit to the crusher. The density of the rock is 1600kg/m^3. Required hourly production as demanded by the crusher stands at 2100tonne/h. The following shovel parameters are provided:

Maximum loader activity per hour – 50 mins

Bucket Size	$14m^3$
Bucket fill factor	0.88
Loader Internal charge/h	$240/h
Hauler Internal charge/h	$180/h
First Bucket	0.2 mins
Each Additional Bucket	0.4 mins

On site are Cat 777D trucks with an empty mass of 64 359kg and a Gross Vehicle Weight of 163 293kg with a permissible over and underload of 5% of payload. The distances to be covered by the trucks in their HDR (Haul-Dump-Return) route and the respective speeds are tabulated below:

segment	location	Distance	Speed (km/h)
1	Quarry pit	100	43
2	Haul road	550	17
3	Haul road	700	34
4	Haul road	500	21
5	Dump area	200	43
Return			45

Truck exchange time is 0.5mins. Assume an additional fixed time per cycle of 1.5 mins. Assume the trucks return at a constant speed of 45km/h through the entire 5 segments.

Evaluate the following:

I. Number of shovels and trucks for satisfying the hourly production requirements. [5]

II. Cost per ton for satisfying the hourly requirement. [5]

III. Number of trucks and shovels to give minimum production cost per ton. [3]

IV. Cost per ton for (iii) [5]

V. Difference in cost, in percentage terms between the two scenarios. [3]

VI. Make a comment on the two alternatives, cost-wise and efficiency-wise. [4]

You are provided with queue tables to aid you in answering this question.

Question 3

A mining company X has recently discovered a significant offshore diamond deposit off the coast of Namibia.

a) Explain the process leading to the discovery of the diamond deposit and identify the factors that the company would have considered to declare the deposit mineable? [4]
b) With the aid of a suitable diagram, advise the company on a potentially suitable mining method to economically exploit the deposit. [6]
c) One of the key factors in the equipment selection for the proposed offshore project is capital cost versus Life-of-Mine. Explain this factor within the context of the proposed mining method in b. [5]
d) With the aid of a suitable diagram, explain Strip Mining. [10]
General Guide: *type of deposits amenable to strip mining, equipment used, production cycle, and how it differs from other conventional surface mining methods.*

Question 4

a) You have been tasked to select equipment for a new uranium open-pit mining operation. The General Manager assigns you to give an overview of what considerations you would make in selecting equipment for the entire operation. Highlight and explain the considerations you would present to the company General Manager. [5]
b) Explain in detail how the equipment selection process fits into the surface mine optimization process, clearly outlining its role and significance within the entire mine optimization and evaluation framework. [5]
c) Evaluate the concept of in-pit crushing from a productivity and economic viewpoint. [5]
d) Evaluate the factors that affect slope stability in an open-pit mine, clearly outlining their importance in maintaining slope stability. [6]
e) State the factors one would consider in determining the following:
    I. Bench height [2]
    II. Haul road location [2]

--End of Question Paper--