INTERNAL EXAMINER(S): DR J POCOCK

INTERNAL MODERATOR(S): PROF BK LOVEDAY

EXTERNAL MODERATOR: DR L MAHARAJ

INSTRUCTIONS:

1. ALL questions should be attempted.

2. Any programmable or non-programmable calculator may be used provided it has been cleared of any information that would subvert the purpose of the examination.

3. Calculations must be shown in sufficient detail to illustrate your understanding of the procedure.

4. This examination question paper, together with all associated diagrams MUST BE HANDED IN TOGETHER WITH YOUR SCRIPT.

Student Number:
SECTION A – SELF STUDY

QUESTION 1
Flotation circuit design varies with the grade and value of the ore being concentrated. Using two examples from the presentations, illustrate this statement and explain why this is so.

TOTAL /20/

QUESTION 2
Health and safety in the mining and minerals processing industry is an area where significant advances have been made over the past fifty years. Using examples, explain what the major dangers that can be encountered in mining are, as well as the occupational health dangers in both mining and minerals processing plants and how these dangers are being minimised by the industry.

TOTAL /15/

QUESTION 3
Diamond recovery from marine deposits is a major production route for South African diamonds. Briefly describe how the marine deposits formed and using a block diagram, show how the diamonds are recovered.

TOTAL /15/
SECTION B – LECTURED MATERIAL

QUESTION 4

a) Dense medium separation is commonly used in the minerals processing industry. How does this differ from gravity concentration, and why is it more efficient?

(6)

b) Diamond bearing ore is being processed using Dense Medium Cyclones. The diamonds are concentrated in the more dense fraction. Given the sink-float data below, and using an Ep of 0.05 for the cyclones, what will be the recovery of diamonds and grade of product with a separation density of 2800kg.m\(^{-3}\)?

(14)

DATA:

<table>
<thead>
<tr>
<th>Density Range (as SG units)</th>
<th>Mass Percentage in Feed (%)</th>
<th>Diamond Content in Feed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.4</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>2.4-2.6</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>2.6-2.8</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>2.8-3.0</td>
<td>21</td>
<td>22</td>
</tr>
<tr>
<td>3.0-3.2</td>
<td>12</td>
<td>55</td>
</tr>
<tr>
<td>+3.2</td>
<td>8</td>
<td>69</td>
</tr>
</tbody>
</table>

Tromp Curve expressions are provided on page 5.

TOTAL /20/
QUESTION 5

a) Froth flotation of phosphate ore is being carried out using the circuit shown in figure 1. Develop an expression for the overall recovery \( R(k) \) in terms of the stage recoveries \( (r_1, r_2 \text{ etc.}) \).

![Diagram of flotation circuit](image)

Figure 1


b) Why do flotation rate constants determined in a laboratory have to be adjusted when modelling a full plant circuit?


TOTAL /20/
QUESTION 6

a) What is the difference between ferromagnetism and paramagnetism?  

(2)

b) Why should ferromagnetic material always be removed before using a high intensity magnetic separator?  

(2)

c) Using a diagram, show how a WHIMS (Wet High Intensity Magnetic Separator) functions.  

(6)

TOTAL /10/
FORMULA SHEET

Tromp Function Equations:

For recovery to the underflow

\[ T(x) = 50 \exp \left[ \frac{(x-x')}{z} \right] \text{ for } x' > x \]
\[ T(x) = 100 - 50 \exp \left[ \frac{(x-x')}{z} \right] \text{ for } x' < x \]

\[ z = \frac{E_p}{\ln 0.5} \]

\( x' \) = separation density in SG units
\( x \) = nominal fraction density in SG units
\( E_p \) = Ecart moyen probable

Gy’s sampling formula

\[ M = \frac{C d^3}{S^2} \]