

# THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

## DEPARTMENT OF MINING ENGINEERING

2021 FIRST SEMESTER FINAL EXAMINATION

Bachelor of Engineering in Mineral Processing Engineering  
Third (3) Year

### MP 335 – MINERAL TECHNOLOGY 11 INDUSTRIAL MINERALS PROCESSING

DATE : THURSDAY – JUNE 17<sup>th</sup> 2021  
TIME : 12:50 PM  
ROOM : MN 001

TIME ALLOWED : 3 HOURS

### INFORMATION FOR CANDIDATES

1. You have ten minutes to read this paper. You should not begin writing during this period.
2. All answers must be written on the answer book(s) provided. No other written materials will be accepted. You should not tear any page from the answer book
3. Attempt ALL FIVE questions given
4. Write your NAME and NUMBER clearly on the ANSWER BOOK(S) provided

### Marking Scheme

Marks for each question is indicated.

Aids which candidates are permitted to take into the examination room: *Calculators, rulers, pens & brain.*

**Question – One:**

- 1.1 What is Calcium Carbonate describe this industrial mineral and its application in which industry, name two of this industries and the products that are made using this industrial mineral.
- 1.2 What is Industrial Sand, describe this industrial mineral and its application in which industry, name two of these industries and the products that are made using this industrial mineral

*20 Marks*

**Question – Two:**

- 2.1 List the raw materials used in cement clinker manufacturing and describe the purpose of each raw materials and its source.
- 2.2 There are five very important qualities that the cement customer expects from the cement you manufactured, name two of these quality requirements and explain them.

*20 Marks*

**Question – Three:**

- 3.1 Definition of Glass and name two types of Glass, describe the raw materials and the chemical composition, its usage and market application.
- 3.2 Name two different problems that affect the glass quality, describe them and explain how these problems can be minimized during glass manufacturing operation.

*20 Marks*

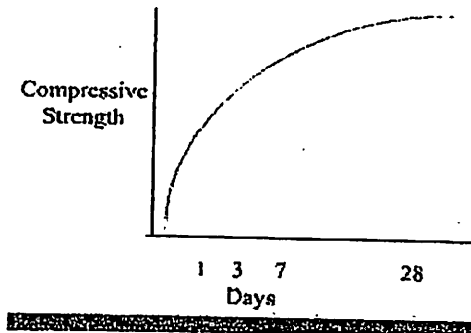
**Question – Four:**

- 4.1 Name the four different mineral phases that exist in the cement clinker and describe them in detail.
- 4.2 Name three different Moduli used in calculating the raw mix composition of cement clinker and explain each moduli in detail and its purpose.

*20 Marks*

**Question – Five:**

5.1 Refer to the Graph below and explain the strength development of the concrete and explain which of the four mineral phases in the cement contributed towards the strength development.



5.2 Below is the clinker quality certificate, use this certificate to calculate the potential phase composition and the total clinker percentage by weight using Bouge's Equation.

**Quality Certificate**

**Chemical Analysis**

Silicon Dioxide	(SiO <sub>2</sub> ), .....	21.8 %
Aluminum Oxide	(Al <sub>2</sub> O <sub>3</sub> ), .....	5.6 %
Ferric Oxide	(Fe <sub>2</sub> O <sub>3</sub> ), .....	3.2 %
Calcium Oxide	(CaO), .....	65.5 %
Magnesium Oxide	(MgO), .....	1.3 %
Sulphur Trioxide	(SO <sub>3</sub> ), .....	0.5 %
Sodium Oxide	(Na <sub>2</sub> O), .....	0.24 %
Potassium Oxide	(K <sub>2</sub> O), .....	0.41 %
Equivalent Alkalies	(Na <sub>2</sub> O+0.658K <sub>2</sub> O), .....	0.51 %
Loss on Ignition	(ig.loss), .....	0.3 %
Insoluble residue	(insol), .....	0.1 %
Chloride	(Cl), .....	0.003 %
Free Calcium oxide	(F.CaO), .....	1.0 %

This clinker is suitable for the production of Ordinary Portland Cement according to ASTM C-150, 1997 Type I.

20 Marks

End of Exams