



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

SUPPLEMENTARY/SPECIAL EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF**

BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY

COURSE CODE: SCI 260

COURSE TITLE: INDUSTRIAL SEPARATION TECHNIQUES

DATE: FRIDAY 29TH JULY 2022

TIME: 11.00 AM-1.00 AM

INSTRUCTIONS TO CANDIDATES

Answer all the Questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

Question One**(19 Marks)**

- a. Differentiate between the following terms as used in separation techniques (8 Marks)
- i. Strong and weak anionic resin
 - ii. Syngas and acid gases
 - iii. Absorption and adsorption
 - iv. Batch and continuous processes
- b. Multistage distillation is an important system in industrial separation technologies. Briefly explain any TWO types of multistage distillation used in the industry (6 Marks)
- c. State any FIVE applications of ion exchange as a separation technique (5 Marks)

Question Two**(18 Marks)**

- a. The pores in adsorbents fall into three categories: Micropores ($d_{\text{pore}} < 2 \text{ nm}$), Mesopores ($d_{\text{pore}} = 2\text{--}50 \text{ nm}$), Macropores ($d_{\text{pore}} > 50 \text{ nm}$). Outline how these pore sizes interact with guest molecules (2 Marks)
- b. Explain why it is important to consider the following factors when selecting a solvent for liquid-liquid extraction (6 Marks)
- i. Toxicity, compatibility and flammability
 - ii. Thermal and chemical stability
 - iii. Environmental impact
- c. i. The most frequently applied heat transfer mechanisms are convection drying and contact drying. Explain the differences between these two mechanisms (4 Marks)
- ii. Explain the following types of driers used in the industry (6 Marks)
- ✓ Direct-heat dryers
 - ✓ Radiation heating
 - ✓ Dielectric drying

Question Three**(16 Marks)**

- a. Explain how the following factors limit the use of distillation as separation technique (6 Marks)
- i. Small capacities
 - ii. Product degradation
 - iii. Column fouling

b. Outline any FOUR techniques that you can use to make crystals from a saturated solution
(4 Marks)

c. Membrane separation processes possess a number of advantages and disadvantages compared to other separation techniques. State any THREE advantages and THREE disadvantages of membrane based separations
(6 Marks)

Question Four

(17 Marks)

a. Co-precipitation is a common occurrence during precipitation reactions. Briefly explain any THREE types of co-precipitations
(8 Marks)

b. An industrial chemist was carrying out adsorption studies. Explain the THREE adsorption isotherms that can be used to describe adsorption studies
(6 Marks)

c. Design a separation operation that can be used to remove dyes from waste water (5 Marks)