NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING

DEPARTMENT OF CHEMICAL ENGINEERING

CHEMICAL PROCESS SYSTEM ENGINEERING
TCE 6205
Special Examination Paper

July 2024

This examination paper consists of **TWO pages**

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

INSTRUCTIONS

1. Answer **ALL** questions in **SECTION A**
2. Answer **ANY TWO** questions in **SECTION B**
3. Each question carries 25 marks

MARK ALLOCATION

QUESTION	MARKS
A1	**25**
A2	**25**
B1	**25**
B2	**25**
B3	**25**
TOTAL ATTAINABLE MARK	**100**

SECTION A: Answer ALL questions in this section.

QUESTION A1

a) Discuss the step of process modelling and simulation **[12 Marks]**
b) Discuss the importance of boundary conditions in CFD simulations.**[7 Marks]**
c) Explain the different types of boundary conditions and provide examples of their application in solving fluid flow problems **[6 Marks]**

QUESTION A2

Derive the momentum and energy equations for a viscous flow in integral form **[25 Marks]**

SECTION B: Answer any TWO (2) questions in this section.

QUESTION B1

Explain the basic principles of computational fluid dynamics. How does CFD simulate fluid flow and what are the main steps involved in a typical CFD analysis?

[25 Marks]

QUESTION B2

Explain the concept of coupling CFD and DEM. What are the main advantages of using a coupled approach over individual CFD or DEM simulations? Provide examples of applications where coupled CFD-DEM modeling is beneficial. **[25 Marks]**

QUESTION B3

Discuss the challenges and strategies involved in mesh generation for discrete element simulations. How are particles represented in the computational domain, and what are the considerations for generating an appropriate particle assembly. **[25 Marks]**

END OF QUESTION PAPER