AHMEDABAD UNIVERSITY
School of Engineering and Applied Science
2025-2026 Monsoon

CHE508 Advanced Transport Phenomena
End-Term Examination
3rd December, 2025, Wednesday, 11.00 AM – 1.00 PM

Name:	Roll no.	A	U							Marks 50

Write your answers on the answer book. Answer all questions. Numbers on the right indicate marks for respective question. Assume suitable data wherever necessary and specify it clearly in your answers.

1. Nitric oxide emissions from auto exhaust can be reduced by a catalytic converter and following reaction occurs at the catalyst surface: NO + CO → ½ N_2 + CO_2. The rate equation is given as:
$r_A = -kC_A$ where k is the rate constant in m/s. It may be assumed that NO reaches the catalyst surface by one dimensional diffusion only process through a thin gas film of thickness L. The exhaust gases are at a temperature of 500 C and pressure of 1.2 bar. The thickness of the film is 0.7 mm and the reaction rate constant is 0.07 m/s. The catalyst surface area is 250 cm^2. The diffusion coefficient $D_{AB} = 1x10^{-4}$ m^2/s and the mole fraction of NO in the exhaust gases is $X_{AL} = 0.15$. Derive the expressions for the mole fraction of NO at the surface and NO removal rate. Evaluate the following below and select the right option from the options given. *20 M*
What is the mole fraction of NO at the catalyst surface?
What is the NO removal rate for a surface area A = 250 cm^2?

2. Consider a fluid flowing across a flat plate of length L. The flow is steady, laminar and the fluid is incompressible. Consider zero pressure gradient in the boundary layer. A boundary layer develops with its thickness a function of x. Use the two dimensional Navier-Stokes equation to find an expression for the thickness of the boundary layer. Convert the partial differential equation into ordinary differential equation. Use the method of separation of variables for this purpose. Also find the wall shear stress. *30 M*