

Department of Chemical Engineering, IIT Kharagpur

CH49019: CAPE Laboratory Autumn 2021

Assignment 5: Due on October 10, 2021

**Email Your Assignment (pdf only) to**

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Consider a catalytic reactor of length  $L = 1$  where a first-order reaction  $A \rightarrow B$  takes place. The reactor model that describes the concentration of A in the reactor ( $C_A$ ) and concentration of A on the catalyst surface ( $C_{As}$ ) can be described as follows.

$$u \frac{dC_A}{dz} = -k_g a (C_A - C_{As})$$

$$0 = k_g (C_A - C_{As}) - k C_{As}$$

Model parameters are given as:  $u = 1$ ,  $k_g = 0.02$ ,  $k = 0.01$ ,  $a = 200$ ,  $C_A(0) = 1$

Determine the axial profiles of concentration  $C_A$  and  $C_{As}$  in the reactor.

- (a) Solve the above DAE using an ODE solver (say ode45) and algebraic equation solver (say fsolve).
- (b) Analytical solution is possible here. Compare your numerical solution with analytical solution.