Department of Chemical Engineering
Assignment No.2

Subject: Chemical Process Simulation Semester: 7th, Chemical Engineering
Note: ***Due date of submission: 26th September 2016.***

Q1. Develop a mathematical model for a simple gravity þow tank into which an incompressible liquid is pumped at a variable þow rate of F_0 (m^3/s) .This inþow rate can vary with time because of changes in operations upstream. The height of the liquid in the vertical cylindrical is h (m). The þow rate out of the tank is F (m^3/s).Discuss the Newton-Raphson algorithms for solving the modeled equations.

Q2. A ýrst order irreversible exothermic reaction A Ÿ B occurs in a series of three perfectly mixed CSTRs. Feed enters the ýrst reactor and product leaves the third reactor. Derive the mass balance and component continuity equations considering isothermal and constant holdups. Assume constant density for the system, which is a binary mixture of A and B.

Q3. A þuid of constant density r is pumped into a cone-shaped tank of total volume H=´ R2/3. The þow out of the bottom of the tank is proportional to the square root of the height ðhô of liquid in the tank. Derive the equations describing the system and discuss the computer simulation for solving the equations.

Q4. An irreversible exothermic reaction is carried out in a single perfectly mixed non-isothermal CSTR. The reaction is AŸ B. The reaction is nth order in reactant A and has heat of reaction ɔ (energy units/mole of A reacted). Negligible heat losses and constant densities are assumed. To remove the heat of reaction, a cooling jacket surrounds the reactor. Cooling water is added to the jacket at a constant volumetric þow rate. Develop a mathematical model for the system assuming that the CSTR has a non-uniform cooling jacket. State all the assumptions made and explain the notation scheme used clearly.