R·I·T School of Mathematical Sciences

Compartmental Analysis

MATH 211 - 01

1. A tank contains 100 gallons of water. Five gallons of brine per minute flow into the tank, and each gallon of brine contains 1 pound of salt. Five gallons of solution flow out of the tank per minute. Assume the tank is well stirred. Find a differential equation for the number of pounds of salt in the tank assuming the tank initailly contains no salt. Solve the differential equation. How much salt is in the tank after one hour? At what time will there be 499 lbs of salt in the tank?

2. A tank contains 100 gallons of brine solution in which 4 pounds of salt is initially dissolved. Repeat problem #1.

3. A large tank initially holds 400 gallons of water into which 1600 pounds of a certain salt has been dissolved. An inflow pipe brings in water containing 2 pounds of the same salt per gallon at a rate of 5 gallons per minute. An outflow pipe allows the fully mixed fluid in the tank to exit at the same rate of 5 gallons per minute. Find the initial value problem that models the amount of the salt in the tank at any time. Solve the initial value problem.

4. A large tank holds 1000L of pure water into which a brine solution begins to flow at a constant rate of 6L/min. The solution inside the tank is kept well stirred and is flowing out at the same rate. If the concentration of salt in the brine solution entering the tank is 0.1kg/L, determine when the concentrationin the tank will reach 0.05kg/L.

5. A brine solution of salt flowsata constant rate of 8L/min into a large tank that initially held 100L of brine solution in which was dissolved 0.5kg of salt. The solution inside the tank is kept well stirredand flows out of the tank at the same rate. If the concentration of salt in the brine entering the tank is 0.05kg/L, determine the mass of the salt in the tank at any time.