Topics for Exam 1

1. **Construction of Models**

   1.1 Conservation principles

   1.2 Constitutive equations

2. **Case Studies**

   2.1 Bacterial growth in a chemostat.

   2.2 Continuous deterministic modeling of traffic flow.

3. **Types of Models**

   3.1 Continuous models

   3.2 Deterministic models

   3.3 Systems of ordinary differential equations

   3.4 First order partial differential equations

4. **Analysis of Models**

   4.1 Nondimensionalization

   4.2 Stability analysis: linearization

   4.3 Method of characteristic curves

Relevant sections in the online class notes: Sections 2.1, 2.2, 2.3, 3.1 and 3.2.

Important Concepts: Conservation principle, parameters, dimensionless variables and parameters, equilibrium points, stability, characteristic curves.

Important Skills: Know how to construct models through application of conservation principles; know how to nondimensionalize systems of ordinary differential equations and partial differential equations; know how to perform stability analysis through the principle of linearized stability; know how to determine characteristic curves; know how to analyze a first order partial differential equation through the method of characteristic curves.