Detailed Outline:

Part 1: Cellular Metabolism and Transport Processes

  A. Introduction
  B. Central Metabolic Pathways
      1.   Glucose uptake
      2.   Glycolysis
      3.   Pentose phosphate pathway
      4.   Tricarboxylic acid cycle
          a. Charging the TCA cycle
          b. The TCA cycle
          c. Anaplerotic pathways
      5.   Other important pathways
      6.   Balancing the electrons
          a. In the presence of O_2
          b. In the absence of O_2
      7.   Summary of principal carbon flow
  C. Effect of Knockouts
      1.   *zwf* – glucose-6P 1-dehydrogenase
      2.   *pgi* – phosphoglucose isomerase
      3.   *pykF* – pyruvate kinase
  D. Material Balances
      1.   Material balances around metabolic nodes

Part 2: Behavior of Cells in a Bioreactor

  A. Models to describe cell growth
      1.   Introduction
      2.   Empirical models to describe cell growth rate
  B. Model to describe substrate utilization
      1.   Maintenance
      2.   Cell mass
      3.   Products
          a. Growth associated
          b. Non-growth associated
          c. Mixed-growth associated
          d. My personal preference
      4.   Summary
  C. General material balances
      1.   Derivation
      2.   Common simplifications
  D. Batch operation
      1.   Introduction
      2.   Incorporating growth and substrate utilization models
      3.   Simulation