

# Chemical Engineering Department

## CHE 302: Computer Calculations of Material and Energy Balances

### **Catalog Data:**(2 credit hours – 2 contact hours)

The use of computer software for the calculations of material and energy balances. The application of degree-of-freedom methodology for the identification of independence of material and energy balance equations . Single unit configurations. Multi-unit process flow sheets.

### **Pre-requisites:** CHE 202

### **Textbook:**

Introduction to Material and Energy Balances, G.V.Reklaitis and Daniel R. Schneider, John Wiley & Sons, Inc., 1983.

### **References:**

Elementary Principles of Chemical Processes, Richard M. Felder and Ronald W. Rousseau, John Wiley & Sons, Inc., Third Edition, 2000.

### **Goals:**

The course is designed to train the student in the application of computer calculations of material and energy balances. The identification of the degree of freedom of a process is an integral part of the course. The use of species and element balance techniques. Construction of an independent set of reaction equations for systems with incomplete stoichiometry.

### **Topics to be covered:**

1. The use of computer software for the solution of simultaneous linear and nonlinear algebraic equations.
2. Degree of freedom analysis for material balance problems involving a single unit.
3. Degree of freedom analysis for material balance problems involving multiple units.
4. Species balances in reacting systems involving single and multiple reactions.
5. Linear independence of reactions. Independent specifications.
6. Element balances. Degree of freedom analysis based on element balances. The relationship between element and species balances. The relationship between atom matrix and reaction stoichiometry. Construction of a set of independent reactions.
7. Material balances in process flowsheets. Sequential solution with complete and partial solutions. The Simultaneous solution strategy.
8. Energy balances in process flowsheets. Simultaneous material and energy balances in process flowsheets. Degree of freedom analysis.

**Class requirements:**

1. Homework assignments.
2. Two mid-semester examinations.
3. Final examination.

**Computer usage:**

The use of computer software, such as EZ-SOLVE, EXCEL, MATLAB in the calculations of material and energy balances of multi-unit process flow sheets.

**Laboratory projects:**

Class work to be solved in college computer lab.

**Assessment of course goals:**

The success in the course work is based on a combination of a grade awarded for the semester work (50% of the total grade) and a grade for the final examination (50% of the total).

**Contribution to professional component:**

Engineering Science   2   credits

Engineering Design        credits

Mathematics or Basic Science        credits

**Prepared by:** Professor Kamil M. Wagialla

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