



**FIRST SEMESTER 2023-2024**  
Course Handout Part II

Date: 11-08-2023

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CHE F211  
Course Title : Chemical Process Calculations  
Instructor-in-Charge : **Iyman Abrar**

**Scope and Objective of the Course:**

Chemical Process Calculations is one of the most fundamental courses of Chemical Engineering and serves as an introduction to the entire field. The course will introduce concepts, equations, processes and systematic problem solving techniques that the students will require and revisit while learning several other courses of Chemical Engineering and while solving various practical problems.

At the end of the course, the student should be able to:

- Solve material balance problems with or without chemical reaction for single and multiple units
- Using the concepts of recycle, bypass and purge in material balances
- Solve energy balance problems with and without chemical reactions using thermodynamic tables, psychrometric charts and basic thermodynamic principles
- Solve material and energy balance problems simultaneously
- Develop relationships between process variables for individual process units and some complex real-world processes common in chemical engineering.
- Present calculations and problem solutions in a professional manner.

**Textbooks:**

1. D. M. Himmelblau & J. B. Riggs, “Basic principles & calculations in chemical Engg”, PHI, 8th ed., 2012.

**Reference books**

1. R. M. Felder, R. W. Rousseau & L. G. Bullard, “Elementary Principles of Chemical Processes”, John Wiley & Sons, Inc., 4th ed., 2016.

**Course Plan:**

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction to Chemical Engineering	Brief history and contributions, current prospects, future research and directions	Ch 1
2, 3	Units, Dimensions and their conversion, Dimensional consistency in equations	Units and Dimensions	Ch 2 (2.1-2.5)
4, 5	Mole, density and concentration, Choosing a basis	Density, specific gravity, mole fraction and mass fraction, concentration, how to choose a basis	Ch 2 (2.6-2.9)
6	Different units of temperature, pressure	Temperature and Pressure	Ch 2 (2.10-2.12)
7-10	Introduction to material balances	Concept of material balance, open and closed systems, steady state/unsteady state	Ch 3
11-12	Solving material balance problems without chemical reactions	Material balances without chemical reactions	Ch 4
13-14	Stoichiometry	Chemical reaction equations and stoichiometry	Ch 5 (5.1, 5.2)
15-17	Solving material balances with chemical reactions	Material balances with chemical reactions	Ch 5 (5.3-5.5)
18-19	Material balances involving multiple subsystems	Solving material balance problems involving multiple subsystems	Ch 6 (6.1, 6.2)
20-23	Material balances with recycle and bypass	Recycle bypass and purge calculations	Ch 6 (6.3-6.5)
24-25	Calculation procedures for ideal gas systems	Ideal gas law calculations, ideal gas mixtures and partial pressure	Ch 7
26-27	Two phase systems	Vapor pressure, saturation, phase diagrams	Ch 8
28-30	General energy balances for open and closed systems without chemical reactions	The general energy balance	Ch 9
31-32	Calculation of enthalpy changes using heat capacity equations and enthalpy tables	Calculation of enthalpy changes	Ch 9
33-35	Enthalpy balances with chemical reaction	Energy balances that account for chemical reactions	Ch 10
36-37	Calculation of heat of mixing and heat of solution	Heats of solution and mixing	Ch 13
38-39	Humidity chart and its use in determining the properties of moist air	Humidity charts and their use	Ch 11

40-42	Solving simultaneous material and energy balances	Miscellaneous Examples	-
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**Evaluation Scheme:**

Component	Duration (minutes)	Weightage (%)	Date & Time	Nature of Component
Mid semester Test	90	30	14/10 - 2.00 - 3.30PM	CB
Class Test (Min. 2)	-	20	Evenly spaced throughout the semester	OB
Assignment (Min. 1)	-	10		OB
Comprehensive Exam.	180	40	21/12 FN	CB

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** Notices concerning the course will be displayed on the CMS.

**Make-up Policy:** Make-up for mid-semester and comprehensive examinations will be granted only for genuine cases with valid justification and only with a prior permission of the Instructor-in-charge. No make-up will be given for class tests and assignments.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Dr. Iyman Abrar**  
**Instructor-in-charge**  
**Chemical Process Calculations**