

SRM Institute of Science and Technology

Faculty of Engineering and Technology

Department of Chemical Engineering

Course Code & Title: **15CH202 Chemical Process Calculations**

Course Strategy Description

Course description:

This course deals with the material and energy balance calculations involved in the chemical processes. This course helps to formulate and evaluate (i) Composition of mixtures (ii) Basic principles of stoichiometry and material balance (iii) Material balance with and without reactions (iv) Energy balance calculations (v) Combined material and energy balance for simple process flow sheets.

Compulsory/Elective course: Compulsory for B.Tech. Chemical Engineering

Credit hours: 4 credits

Course coordinator(s): Dr.M.P.Rajesh , Professor and Head, Department of Chemical Engineering

Instructor(s):

Name of the instructor	Room number	Email (@ktr.srmuniv.ac.in)	Consultations (day order/periods)
Dr.M.P.Rajesh	PGA 206	hod.chem	Day – 1: 2 and 3
Ms.E.Kavitha	PGA 205	kavitha.e	Day – 2: 4 and 5
Dr.Krishna Srihari	PGA 204	krishnasrihari.b	Day – 5: 3 and 4

Relationship to other courses

Course category: Professional core

Prerequisite: Nil

Co-requisite: Nil

Following courses: Nil

Text book(s) and/or required materials:

1. David M. Himmelblau, James B. Riggs "*Basic Principles and Calculations in Chemical Engineering*", 8thEdn., Pearson - Prentice Hall International
2. B. I. Bhatt and S. B Thakore., "*Stoichiometry*", 5thEdn., Tata McGraw-Hill Publishing Company, New Delhi
3. B. Lakshmikutty, K. V. Narayanan, "*Stoichiometry and Process Calculations*", PHI Publishers, Delhi.

Reference book(s):

4. Richard M. Felder, Ronald W. Rousseau, "*Elementary Principles of Chemical Processes*", 3rd Edition, John Wiley & Sons, Inc..

Class schedule: D Slot; Four 50 minutes lecture sessions per week, for 15 – 16 weeks

DAY ORDER: HOUR	TIMING
DAY - 1: 5	11.35 AM – 12.25 PM
DAY - 3: 5	11.35 AM – 12.25 PM
DAY - 4: 6&7	12.30 AM – 2.15 PM

Instructional Objectives (IOs) and Student Outcomes (SOs)

S.No.	Instructional Objectives	Student Outcomes				
		a	e	k		
1.	Composition of mixtures	a	e			
2.	Basic principles of stoichiometry and material balance	a	e	k		
3.	Material balance with and without reactions	a	e	k		
4.	Energy balance calculations	a	e	k		
5.	Combined material and energy balance for simple process flow sheets	a	e	k		

Teaching plan

Section	Topics	L / T	Text book/chapter	IOs	SOs	Problem solving (Y/N)
UNIT I – BASIC CONCEPTS AND COMPOSITION OF MIXTURES		12				
1 - 3	Units and dimensions.	1	1	1	a, e	Y
1 -3	Temperature, Pressure and concept of mole	2	1	1	a,e	Y
1 -3	Predicting PVT properties of gases using ideal gas equation	2	1	1	a,e	Y
1 -3	Composition of mixtures, Basis of calculations.	1	1	1	a,e	Y
1 -3	Composition of gases based on mole, mass, volume and partial pressure. Density of gas mixtures	2	1	1	a,e	Y
1 -3	Solutions and their concentrations	2	1	1	a,e	Y
1 -3	Problems	2	1	1	a,e	Y
UNIT II MATERIAL BALANCE FOR NON REACTIVE SYSTEMS		13				

1 -3	Basic concepts involved in material balance calculations	1	1,2	2, 3	a,e,k	Y
1 -3	Material balance problems without chemical reactions: mixing	1	1,2	2, 3	a,e,k	Y
1 -3	Drying, crystallization,	2	1,2	2, 3	a,e,k	Y
1 -3	Material balance problems on membrane separation	1	1,2	2, 3	a,e,k	Y
1 -3	Distillation and extraction.	2	1,2	2, 3	a,e,k	Y
1 -3	Partial saturation and humidity, types of humidity	1	1,2	2, 3	a,e,k	Y
1 -3	Material balances involved in two-phase gas-liquid systems as in humidification and dehumidification.	2	1,2	2, 3	a,e,k	Y
1 -3	Problems	3	1,2	2, 3	a,e,k	Y
UNIT III: MATERIAL BALANCE FOR REACTIVE SYSTEMS		13				
1 -3	Chemical equation and stoichiometry	1	1,2	2, 3	a,e,k	Y
1 -3	Limiting reactant, excess reactant, conversion, selectivity, yield.	2	1,2	2, 3	a,e,k	Y
1 -3	Material balances for processes with reactions.	3	1,2	2, 3	a,e,k	Y
1 -3	Combustion as special case of material balance with reactions.	1	1,2	2, 3	a,e,k	Y
1 -3	Fuels, types of fuel, flue gas, Orsat analysis, theoretical air, excess air	1	1,2	2, 3	a,e,k	Y

1 -3	Analysis of products of combustion, calculation of excess air	2	1,2	2, 3	a,e,k	Y
1 -3	Problems	3	1,2	2, 3	a,e,k	Y
UNIT IV: ENERGY BALANCE		11				
1 -3	Thermo physics: Heat capacity, Kopp's rule	1	1,2	4	a,e,k	Y
1 -3	Sensible heat, latent heat and enthalpy	1	1,2	4	a,e,k	Y
1 -3	Energy balance for non reactive systems	2	1,2	4	a,e,k	Y
1 -3	Thermo chemistry: Standard Heat of formation, standard heat of combustion, Hess law	2	1,2	4	a,e,k	Y
1 -3	Heat of reaction from heat of formation or combustion	2	1,2	4	a,e,k	Y
1 -3	Enthalpy changes in reactions with different temperatures	2	1,2	4	a,e,k	Y
1 -3	Theoretical flame temperature.	1	1,2	4	a,e,k	Y
UNIT V: MATERIAL BALANCE FOR MULTI UNIT SYSTEMS		11				
1 -3	Introduction to material balance for sequential processes.	1	1,2	5	a,e,k	Y
1 -3	Basic concepts of recycle, bypass and purge streams.	1	1,2	5	a,e,k	Y
1 -3	Material balances for systems with recycle stream.	3	1,2	5	a,e,k	Y

1 -3	Material balances for non reactive systems with bypass and purge stream.	2	1,2	5	a,e,k	Y
1 -3	Material and energy balance analysis for multi unit processes - Case studies with simple process flow sheets	4	1,2	5	a,e,k	Y

Evaluation methods

S.NO.	Test	Topics covered	Marks	Test/Exam duration (min)
1.	Cycle test – I	Unit I and II	15	100
2.	Cycle test – II	Unit III, IV and V	25	180
3.	Surprise test	Questions from any units	5	20
4.	Assignment	Questions from any units	5	-
5.	Final exam	All the units	50	180

Surprise test

The surprise test will not be announced. The questions for this test will be covered until the previous class.

Home assignments

A few units will have home assignment. All the assignments should be submitted on or before the last date of submission.

Teaching Methodology

Chalk and talk for the entire course

Prepared by: Ms. E. Kavitha, Assistant Professor (Sr.G.), Department of Chemical Engineering

Dated:

Revision no.: 1

Date of revision:

Revised by:

Course Coordinator

Academic Coordinator

HoD/Chemical