COURSE TITLE : CHEMICAL PROCESS PRINCIPLES
COURSE CODE : 3071
COURSE CATEGORY : B
PERIODS/ WEEK : 4
PERIODS/ SEMESTER : 60
CREDIT : 4

MODULE	TOPICS	PERIODS
1	Gas laws and their applications	15
2	Material Balances involving without chemical reactions	15
3	Material balances involving with Chemical reactions.	15
4	Fundamentals of Thermodynamics &Energy balance equations.	15
TOTAL		**60**

COURSE OUTCOMES

SL.NO	SUB	STUDENT WILL BE ABLE TO
1	1	Understands gas laws in chemical processes
2	2	Apply material balance in processes without chemical reactions
3	3	Apply material balance in processes with chemical reactions
4	4	Apply the fundamental principles of thermo dynamics

SPECIFIC OUTCOMES

MODULE – I

1.1.0 Apply gas laws in Chemical processes

1.1.1 State Charle's ,Boyle's, Dalton's and Amagat's law
1.1.2 Solve the problem based on Charle's and Boyle's law
1.1.3 Compute Ideal gas equation
1.1.4 Identify the universal gas constant in various units
1.1.5 Explain ideal gas law and deviations from ideal gas law
1.1.6 Solve problems in gas mixtures applying Dalton's law and Amagat's law
1.1.7 Derive the relation volume % = mole % = Partial pressure %
1.1.8 Solve problems using above relations
1.1.9 Calculate the average molecular weight of gas mixture
1.1.10 Calculate densities and specific gravity of ideal gas mixture
1.1.11 Solve problems with volume change and composition changes
1.1.12 Solve problems using wet, dry basis composition

MODULE- II

2.1.0 Apply Material Balances in processes without chemical reactions

2.1.1 State law of Conservation of mass

2.1.2 List the unit operations in Chemical industries

2.1.3 Deduce the overall and component balances of various unit operations with block diagrams of the following

1) Evaporation,
2) Distillation
3) Crystallization
4) Absorption
5) Leaching,
6) Extraction,
7) Drying
8) Mixing/blending

2.1.4 Solve material balance problems of above operations

2.1.5 State key component

2.1.6 Solve material balance equations using key component

2.2.0 Analyse Bypass,Recycle and Purge

2.2.1 State bypass operation

2.2.2 Draw the block diagram of by pass

2.2.3 State Recycle operations

2.2.4 Draw the block diagram of Recycle operation

2.2.5 State purge operation

2.2.6 Draw the block diagram of purge operation

2.2.7 Solve the problems based on above operations

2.2.8 List the advantages of Recycle operations

MODULE- III

3.1.0 Know material balance involving chemical reactions

3.1.1 Define the term:

1) Stoichiometric ratio
2) Stoichiometric Coefficient
3) Stoichiometric proportion
4) Limiting reactant
5) Excess reactant

3.1.2 State about conversion

3.1.3 State about yield and selectivity

3.2.0 Apply material balance involving chemical reactions

3.2.1 Solve the problem based on stoichiometric proportions of reactants and products

3.2..2 Solve the percentage conversion and percentage yield

3.2.3 Solve material balance problems involving incomplete, complete reactions.

3.2.4 Solve material balance problems in combustion of fuels

3.2.5 Estimate the percentage of excess air

3.2.6 Estimate the ratio of air to fuel, flue gases to fuel

MODULE- IV

4.1.0 Apply the fundamental principles of Thermodynamics

4.1.1 Outline development of thermodynamics as a science

4.1.2 Define a system.

4.1.3 Classify the system

4.1.4 Explain the terms system and surroundings
4.1.5 Explain the relation between pressure, temperature, work, energy etc
4.1.6 Explain the laws of thermodynamics
4.1.7 Explain the terms enthalpy, internal energy, entropy etc.

4.2.0 Apply energy balances equations

4.2.1 Define law of conversation of energy
4.2.2 state first law of thermo dynamics
4.2.3 state second law of thermodynamics
4.2.4 Define heat capacity and mean heat capacity
4.2.5 Solve problems in enthalpy and heat capacity
4.2.6 State Hess's law of heat of summation
4.2.7 Define heat of reaction, heat of formation heat of combustion, heat of solution
4.2.9 Solve problems by heat balance equation for simple process.

COURSE CONTENT

MODULE-I GAS LAWS AND THEIR APPLICATIONS

Gas laws-Ideal gas law-Derive ideal gas equation-Identify the universal gas constant in various units-ideal gas law and deviations from ideal gas law- Solve problems in gas mixtures applying Dalton's law and Amagat's law- Derive the relation volume % = mole % = Partial pressure %- average molecular weight of gas mixture-Solve the density and specific gravity of the gas mixture- Solve problems with volume change and composition changes- Solve problems using wet, dry basis composition

MODULE-II MATERIAL BALANCES-NOT INVOLVING CHEMICAL REACTIONS

Law of Conservation of mass- unit operations in Chemical industries- over all and component balances of various unit operations with block diagrams of the following-Evaporation-Distillation- Crystallization – Absorption- Leaching - Extraction- Drying- Mixing/blending-key component-by pass- recycle-purge-problems involving by pass and recycle

MODULE-III MATERIAL BALANCES INVOLVING CHEMICAL REACTIONS

Chemical reactions-Complete and incomplete reactions-stoichiometric proportions of reactants and products -limiting reactant -excess reactant-percentage conversion – yield-Material balance Calculation involving chemical reaction including combustion problems.

MODULE-IV: FUNDAMENTALS OF THERMODYNAMICS AND ENERGY BALANCE

Introduction-explain the terms system and surroundings-pressure –volume- temperature –work –energy -internal energy -Concept of perfect gas-Thermodynamic explanation of first and second law of thermodynamics-.Define the term entropy-law of conservation of energy and applications-enthalpy simple problems -heat capacities -heat of reaction-heat of combustion- heat of formation -Hess's law-solve problem by heat balance equations

REFERENCE

B. I. Bhatt & S. M Vora - Stoichiometry

Chem. Engg., Edn Development Centre, IIT Madras - Process Calculations for chemical engineers

Houghen., O. A Waston K. M, Regatz. R. A - Chemical process Principles