

Course Code	Course Title	L	T	P	C
1151BT107	Principles of Chemical Engineering	3	1	0	4

Course category : *Program Core*

a. Preamble : *To study and understand various emphases of basic concepts on process calculations, thermodynamics and fundamental principles in biochemical engineering.*

b. Prerequisite courses: *None*

c. Related courses : *None*

d. Course outcomes : *Upon the successful completion of the course, students will be able to:*

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	To explain the theoretical concepts of stoichiometry and thermodynamics were it applies to energy conversion in technological applications	K2
CO2	To demonstrate the capability to analyze the energy conversion performance in a variety of modern applications in systems	K2
CO3	To explain the characteristics of the solution and its types to interpret its data to implement in the biological system	K3
CO4	To carry out basic engineering experiments and interpret fundamental data to do the design and operation of chemical or bioprocess	K3
CO5	To understand the functional criteria for the single and multiple reaction to overcome its effect on its equilibrium	K3

e. COURSE CONTENT:

UNIT-I

INTRODUCTION TO CHEMICAL CALCULATIONS AND THERMODYNAMICS

General concepts in unit conversion-humidity and gas laws- laws of thermodynamics – Equation of State – Property changes in thermodynamics – Maxwell relation

UNIT-II

MATERIAL AND ENERGY BALANCE

Material balance – without chemical reactions-with chemical reactions – Energy balance- Sensible and Latent Heat- thermo chemical calculations- Application in Bioprocess calculations

UNIT –III

SOLUTION THERMODYNAMICS

Partial molar properties – Chemical potential – Ideal and non-ideal solutions- Excess properties – Activity coefficient- Gibbs-Duhem equation.

UNIT-IV PHASE AND CHEMICAL REACTION EQUILIBRIA

Phase equilibria-criteria-VLE Calculations – Liquid-liquid Equilibria- Solid-Solid Equilibria.

UNIT-V CHEMICAL REACTION ENGINEERING

Equilibrium criteria - Homogenous chemical reactions- Equilibrium constant – Effect of Temperature- Effect of pressure- Equilibrium conversion for single and multiple reactions.

TEXT BOOKS:

1. Bhatt, B.I. and S.M. Vora “Stoichiometry (SI Units)”, 3rd Edition, Tata McGraw- Hill, 1996.
2. Smith J.M., Van Ness H.C., and Abbot M.M. “Introduction to Chemical Engineering Thermodynamics”, 6th Edition. Tata McGraw-Hill, 2003.
3. Narayanan K.V. “A Text Book of Chemical Engineering Thermodynamics”, PHI, 2003.

REFERENCES:

1. Himmelblau, D.M. “Basic principles and calculations in Chemical Engineering”, 6th Edition, PHI, 2006.
2. Narayanan, K.V. and Lakshmi Kutty “Stoichiometry and Process Calculations”, PHI, 2006.
3. Coulson, J.M. et al. “Coulson & Richardson’s Chemical Engineering”, 6th Edition, Vol. I & II, Butterworth – Heinman (an imprint of Elsevier), 2004.
4. Perrys Chemical Engineers Hand Book.
5. Sandler S.I. “Chemical and Engineering Thermodynamics”, John Wiley, 1989.