BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

CHEMICAL ENGINEERING THERMODYNAMICS

HANDOUT

Course Title	CHEMICAL ENGINEERING THERMODYNAMICS
Course No(s)	CHE F213
Credit Units	3
Credit Model	
Content Authors	Anirban Roy

Course Description:
Development and applications of the combined first and second laws; relations between state properties; Equation of State and its applications; Vapor liquid equilibrium, chemical equilibria in reacting and non-reacting systems

Scope & Objective:
The purpose of this course is to provide a comprehensive treatment of thermodynamics from a chemical engineering viewpoint. The objective of course is (i) to equip the students tackle fundamental level and applied problems in chemical engineering thermodynamics and (ii) develop problem solving skills from practical view point.

Text Book:

- J.M. Smith and Others, "Introduction to Chemical Engineering Thermodynamics", Mc Graw Hill, 4th ed.

Reference Books:

- Y.V.C. Rao, (2004) "Chemical Engineering Thermodynamics", University Press.
- Stanley Walas (1985) "Phase Equilibria in Chemical Engineering", ISBN 978-0-409-95162-2.
- Sonntag, R. E., Borgnakke, C., & Wylen, G. J. (2003). Fundamental of thermodynamics, sixth edition.

4. Course Plan:

Lecture	Topics to be covered	Reference/Ch./ Sec.#(Book)
Week 1 – Week 2	Scope and Objectives of course, methodology; First Law of Thermodynamics, Closed System, State and State functions, Equilibrium, Phase rule, Reversible Process, Const-V and Const-P Processes, Enthalpy, heat capacity, First law for Open systems	Chap. 1 & Chap. 2
Week 3 – Week 5	Statements of second law, Heat engines, Thermodynamic temperature Scale, Entropy, ΔS for an ideal gas, Entropy balance for Open Systems, Ideal work, Lost work, Third law	Chap. 5
Week 5 – Week 7	Volumetric Properties of Pure Fluids: PVT behavior of pure substances, Virial equations, Ideal gas, Generalized correlations for gases and liquids	Chap. 3

Week 7	Sensible heat effects, Latent heat, Standard heats of reaction, formation, and combustion, Temperature dependence of heat of reaction, heat effects of industrial reactions	Chap. 4
Week 7 – Week 8	Property relations for homogeneous phases.	Chap. 6
Week 9	MID SEM	
Week 10 – Week 11	Two-phase systems, thermodynamic diagrams and tables Generalized property correlations for gases	Chap. 6
Week 12	Refrigeration cycles; Carnot, Vapor-Compression cycles. Comparison of cycles, absorption refrigeration, heat pump	Chap.9
Week 13 – Week 14	Introduction to vapour/liquid Equilibrium: Nature of Equilibrium, Phase rule, Duhem's theorem, VLE; Qualitative behavior, Simple models for VLE, VLE by Modified Raoult's law, K-value correlations	Chap. 10
Week 14-15	Basic concepts of Solution Thermodynamics**:** Fundamental Property Relation, Chemical potential, Phase equilibrium, Ideal Solution, Excess Properties	Chap. 11
Week 15-16	Liquid-phase properties from VLE data	Chap. 12
Week 17	Chemical Reaction Equilibria: Reaction coordinate, Equilibrium criteria for chemical reactions, Equilibrium constants and their variation with temperature, Relation with compositions.	Chap. 13
	COMPREHENSIVE EXAMINATION	

5. Evaluation Scheme:

I. **Quizzes, Projects & Assignments: 25% {Assignments will be graded for only those who are present in the class during announcement of the same, Quizzes : Surprise, Projects: Total 2 projects to be done in groups – grading will be done for group and not dependent on attendance}**
II. **Attendance: 5%**
III. **Midsem examination: 30%**
IV. **Comprehensive examination: 40%**