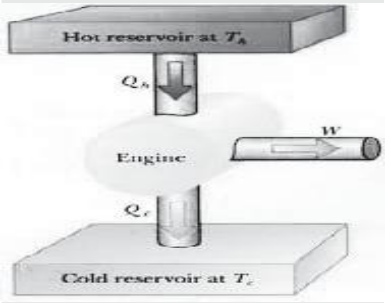
16CH301 CHEMICAL ENGINEERING THERMODYNAMICS-II



Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
25	45	-	-	5	5

Course Description and Objectives:

This course deals with the theory and applications of classical thermodynamics. The objective of this course is to familiarize student with solution thermodynamics, thermodynamic properties, equations of state and methods used to describe and predict the vapor liquid equilibria and chemical reaction equilibria.

Course Outcomes:

The student will be able to :

- calculate energy requirement during the course of reaction.
- analyze and calculate thermodynamic properties for a given system or process at specified conditions.
- use vapor liquid equilibrium relations to solve the process separation problems.
- evaluate the chemical reaction equilibrium for conversion/composition calculations.

SKILLS:

- ✓ *Energy calculations for a given chemical process.*
- ✓ *Estimation of solution thermodynamic properties.*
- ✓ *Modeling of vapor liquid equilibria.*
- ✓ *Equilibrium conversions.*

ACTIVITIES:

- *Extracting equilibrium data.*
- *Identification of ideal and non-ideal behavior.*
- *Modeling of vapor liquid equilibrium.*

UNIT - 1 **L- 9, T-3**

HEAT EFFECTS : Sensible heat effects, Latent heats of pure substances, Standard heat of reaction, Standard heat of formation, Standard heat of combustion, Temperature dependency of $\ddot{A}H^0$, Heat effects of industrial reactions.

UNIT - 2 **L-9, T-3**

SOLUTION THERMODYNAMICS THEORY : Fundamental property relation, Chemical potential and phase equilibria, Partial properties, Ideal gas mixtures, Fugacity and fugacity coefficient: pure species, Fugacity and fugacity coefficient: species in solution, Generalized correlations for the fugacity coefficient, Ideal solution, Excess properties.

UNIT - 3 **L-9, T-3**

SOLUTION THERMODYNAMICS APPLICATIONS : Liquid phase properties from VLE data, Models for the excess gibbs energy, Property changes of mixing, Heat effects of mixing processes.

UNIT - 4 **L-9, T-3**

VAPOR / LIQUID EQUILIBRIUM : Nature of equilibrium, Phase rule. Duhem's theorem, VLE: Qualitative behaviour, Simple models for VLE, VLE by modified Raoult's law, VLE from K-value correlations.

UNIT - 5 **L-9, T-3**

CHEMICAL REACTION EQUILIBRIA : Reaction coordinate, Application of equilibrium criteria to chemical reactions, Standard gibbs energy change and equilibrium constant, Effect of temperature on equilibrium constant, Evaluation of equilibrium constants, Relation of equilibrium constants to composition.

TEXT BOOKS:

1. J.M.Smith, and H.C.Vanness, "Introduction to Chemical Engineering Thermodynamics", 6th edition, Tata McGraw-Hill, 2003.
2. Kyle.B.G. "Chemical and Process Thermodynamics", 2nd edition, Prentice Hall of India, 1990.

REFERENCE BOOKS:

1. Dodge B.F "Chemical Engineering Thermodynamics", 1st edition, Tata McGraw-Hill, 1960.
2. Sandler, S.I "Chemical and Engineering Thermodynamics", 4th edition, John Wiley & Sons, 2006.