GUJARAT TECHNOLOGICAL UNIVERSITY

CHEMICAL ENGINEERING (COMPUTER AIDED PROCESS DESIGN) (16)
ADVANCED THERMODYNAMICS
SUBJECT CODE: 2711601
SEMESTER: I

Type of course: Core-I (M.E.CAPD)

Prerequisite: --

Rationale: --

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**REFERIGERATION :** Vapour compression cycle, Industrial vapour compression cycle: selection criteria, flow sheet, Calculations of net refrigeration effect, TR,COP, etc Vapour absorption cycles, Industrial vapour absorption cycles: Ammonia vapour absorption cycle, Lithium bromide water vapour absorption cycle, selection criteria, flow sheets, Calculations of net refrigeration effect, TR,COP, steam required, Solvent required, etc, Importance of economizer in refrigeration cycles.	10	20
2	**CHEMICAL REACTION EQUILIBRIA:** Criteria of chemical equilibrium, Equilibrium extent of reaction, Equilibrium constant, Effect of temperature and pressure on K, evaluation of K by various methods. Evaluation of equilibrium extent of reaction for exothermic, endothermic, reversible, irreversible reactions and various combinations. Thermodynamic analysis of some important industrial reactions. liquid phase and heterogeneous reactions, multireaction equilibria, simultaneous, consecutive reactions and various combinations, adiabatic reactions.	11	20
3	**VAPOUR-LIQUID EQUILIBRIUM :** Non ideal system, evaluations of activity coefficient and fugacity coefficient, dew point and bubble point calculations, BUBLP,DEWP,BUBLT and DEWT Calculations, P-T Flash calculations, Adiabatic Flash calculations, Block diagrams of these calculations.	11	20
4	**LIQUID-LIQUID EQUILIBRIUM :** Criteria of equilibrium, Different types of liquid-liquid solubility diagram, evaluation of LLE data.	11	20
5	**VAPOUR-LIQUID-LIQUID EQUILIBRIUM:** Criteria of VLLE, *Txy* diagram of VLLE at constant pressure and for	11	20

	several pressures, *Pxy* diagram at constant temperature.		

Reference Books:
1. Smith J.M, Van Ness H.C., Abbott M. M, "Introduction to Chemical Engineering Thermodynamics", The McGraw Hill Companies, Inc., USA, 7th Ed., 2005.
2. Perry's chemical engineers handbook,7th edition, McGraw-Hill, USA,2000.
3. Elliot J. R. and Lira C.T, "Introductory Chemical Engineering Thermodynamics ", Prentice Hall, 1999.
4. Hougen O.A., Watson K.M., and Ragatz R.A. , "Chemical Process Principles Part-II" Thermodynamics, John Wiley 1970

Course Outcome:
After learning the course the students should be able to:

1. Understand the importance of economizer in refrigeration cycles.
2. Design the Calculations of net refrigeration effect, TR, COP, steam required, Solvent required etc.
3. Evaluate the Equilibrium extent of reaction & Equilibrium constant.
4. Thermodynamic analysis of some important industrial reactions.
5. Evaluate of activity coefficient and fugacity coefficient.
6. Calculate Dew Point & Bubble Point.
7. Evaluate of LLE data.
8. Design the *Txy* diagram of VLLE at constant pressure and for several pressures.
9. Design the *Pxy* diagram at constant temperature.

List of Open Source Software/learning website:

- www.eng.su.ac.th/me/elearning/.../3RefrigerationCycle
- www.saylor.org/site/.../BolesLectureNotesThermodynamicsChapter10
- eweb.chemeng.ed.ac.uk/jack/newWork/Chemeng/Chemeng/theory.html