

DEPARTMENT OF CHEMICAL ENGINEERING
FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
COURSE PLAN

Course code : CH0217 Course Title : Stoichiometry and Engineering Thermodynamics
Semester : III Course Time : July – Dec, 2011

Required Text Books:

1. David M. Himmelblau, “Basic Principles and Calculations in Chemical Engineering”, 6th Edn. Prentice-Hall of India, New Delhi, 1998.
2. Bhatt B.I. and Vora S.M., “Stoichiometry”, 3rd Edn. Tata McGraw-Hill Publishing Company, New Delhi, 1996.
3. Rao Y.V.C, “Chemical Engineering Thermodynamics”, University Press (I) Ltd., Hyderabad, 1997.
4. Smith, J.M., Van Ness, H.C., and Abbott, M.M., “Introduction to Chemical Engineering Thermodynamics”, 6th Edn. McGraw Hill International Edition, Singapore 2001.

Web resources

1. <http://web.mit.edu/16.unified/www/FALL/thermodynamics/notes/index.html>
2. <http://www.tutorvista.com/content/chemistry/chemistry-ii/stoichiometry/formula-percentage-composition.php>
3. <http://www.tutorvista.com/content/chemistry/chemistry-iii/chemistry-concepts/stoichiometry.php>

Prerequisite : Engineering Mathematics, Physics, Physical chemistry concepts

Objectives

To familiarize:

- Basic principles of process calculations.
- Material balance calculations.
- Basic concepts and first law of thermodynamics.

- Volumetric properties of pure fluids.
- Second law of thermodynamics

Assessment Details

Cycle Test-I	: 10 Marks	Surprise Test	: 5 Marks
Cycle Test-II	: 10 Marks	Model Exam	: 20 Marks
Attendance	: 5 Marks		

Out comes

Students who have successfully completed this course will have full understanding of the following concepts

Course Outcome	Program outcome
1. Students can be able to understand the basic principle of process calculation. 2. It can be able to understand the knowledge's about Chemical equations and material balances. 3. Basic concepts of Thermodynamics and first law can be understood. 4. PVT behaviors of fluids and Ideal gas processes can be understood. 5. Heat engines and Entropy concepts can be understood.	1. Synthesize course information and apply it to practical, everyday issues such as acid rain, air and water pollution, limited resources on Planet Earth. Develop informed opinions on chemical matters affecting society by applying critical thinking skills to evaluate public issues and current events involving chemistry. 2. Students will demonstrate an understanding of the concepts of conservation of mass, conservation of energy, and the second law of thermodynamics. 3. To train students to identify, formulate and solve engineering problems in classical thermodynamics involving closed and open systems for both steady state and transient processes. 4. Students will demonstrate an understanding of the concepts of irreversibility, exergy (availability), adiabatic efficiency, and effectiveness.

Detailed Lesson plan

UNIT-I – INTRODUCTION					
Sess	Topics to be covered	Time	Ref	Teaching	Testing

ion No		(Min)		method	method
1	Introduction to Stoichiometry and Thermodynamics	50	1,2	GB	Quiz
2	Units and Dimensions	50	1,2	GB	Quiz
3	Mole fraction (or percent) and mass fraction (or percent)	50	1,2	GB	Quiz
4	Analyses of a mixture	50	1,2	GB	Quiz
5	Concentrations, basis of calculations	50	1,2	GB	Quiz, problems
6	P-V-T properties of gases and calculation of density	50	3,4	GB	Problems solving
7	Ideal gas law and problems	50	3,4	GB	Problems solving
8	Van der Waals equation and problems	50	3,4	GB	Problems solving
9	Redlich-Kwong equation and problems	50	3,4	GB	Problems solving
UNIT-II CHEMICAL EQUATION AND MATERIAL BALANCES					
1	Basics of chemical equation and stoichiometry	50	1,2	GB	Quiz
2	Limiting reactant	50	1,2	GB	Problems solving
3	Excess reactant	50	1,2	GB	Surprise Test-I
4	conversion, selectivity, yield	50	1,2	GB	Quiz
5	Basic concepts involved in material balance calculations	50	1,2	GB	Problems solving
6	Material balance problems without chemical reactions	50	1,2	GB	Problems solving

7	Membrane separation	50	1,2	GB	Discussion
8	Drying, Crystallization	50	1,2	GB	Quiz
9	Basic concepts of recycle, bypass and purge streams	50	1,2	GB	Problems solving
UNIT-III BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS					
1	Introduction to work, energy, heat, , internal energy	50	3,4	GB	Quiz
2	extensive and intensive properties	50	3,4	GB	Discussion
3	state and path functions	50	3,4	GB	Discussion
4	First law of thermodynamics, energy balance for closed systems	50	3,4	GB	Discussion
5	Equilibrium, , the reversible process	50	3,4	GB	Quiz
6	constant-v and constant-p processes	50	3,4	GB	Quiz
7	enthalpy, heat capacity	50	3,4	GB	Discussion
8	energy balances for steady-state flow processes	50	3,4	GB	Problems solving
9	Problems on First law	50	3,4	GB	Problems solving
UNIT-IV VOLUMETRIC PROPERTIES OF PURE FLUIDS					
1	P-T and P-V diagram for pure fluids	50	3,4	GB	Quiz
2	Virial equations of state	50	3,4	GB	Quiz
3	The ideal gas	50	3,4	GB	Surprise Test-II
4	Isothermal process, Isobaric process	50	3,4	GB	Discussion
5	Isochoric process, Polytropic process	50	3,4	GB	Discussion
6	Adiabatic process	50	3,4	GB	Discussion, Problems solving
7	Cubic equations of state: van der Waals equation, Redlich/Kwong equation	50	3,4	GB	Problems solving

8	Theorem of corresponding states	50	3,4	GB	Quiz
9	Acentric factor.	50	3,4	GB	Discussion
UNIT-V SECOND LAW OF THERMODYNAMICS					
1	Statements of second law of thermodynamics	50	3,4	GB	Quiz
2	Heat engines, heat pump	50	3,4	GB	Quiz
3	Carnot's theorem	50	3,4	GB	Discussion
4	Carnot's equations for ideal gases	50	3,4	GB	Problems solving
5	Concept of entropy	50	3,4	GB	Quiz, Discussion
6	Entropy changes of an ideal gas undergoing a mechanically reversible process in a closed system	50	3,4	GB	Discussion, Problems solving
7	Mathematical statement of the second law	50	3,4	GB	Discussion
8	Entropy balance for open systems	50	3,4	GB	Discussion
9	Statement of the third law of thermodynamics and problems discussion	50	3,4	GB	Quiz