SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Chemical Engineering	LP: CH22408 Rev. No: 00
B.Tech : Chemical Engineering Regulation: 2022 Sub. Code / Sub. Name : **CH22408/** **CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)** Unit : I	Date: 23.01.2024

Unit Syllabus : Fundamental property relation, Chemical potential, Partial properties, The ideal gas mixture model, The ideal solution model, Excess properties.
Objective : To impart concepts in evaluating the properties of solutions.

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Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction to Fundamental property relation	2 – Ch.7; Pg.255 - 256	Google classroom
2	Introduction to Chemical potential and Partial molar properties	2 – Ch.7; Pg.257 - 260	Google classroom
3	Calculation of partial molar properties.	2 – Ch.7; Pg.257 - 260	Blackboard, PPT
4	Behaviour of different types of solutions, standard states	2 – Ch.7; Pg. 274 - 275	Blackboard, PPT
5	Derivation of Gibbs-Duhem equation and its other forms	2 – Ch.7; Pg. 283 - 287	Blackboard, PPT
6	Excess properties. Property change on mixing	2 – Ch.7; Pg. 292 - 296	Blackboard, PPT
Practicals			
7-12	Prediction of Heat of solution by solubility method.		

Content beyond syllabus covered (if any): New concepts are discussed and necessary to deal with the solutions, the concepts of partial molar properties being the most important of them. This serves as an index of chemical equilibrium in the same manner as temperature and pressure.

* Session duration: 50 minutes

Sub. Code / Sub. Name: CH22408/

CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)

Unit : II

Syllabus : Activity coefficient, Excess Gibbs Energy, Models for the excess Gibbs energy, Property changes of mixing, Heat effects of mixing process. Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity

Objective : To understand the procedure for calculating Property changes of mixing

Session No *	Topics to be covered	Ref	Teaching Aids
13	Introduction to Activity coefficient	2 – Ch.7; Pg. 293	Google classroom
14	Calculation of Excess Gibbs Energy	2 – Ch.7; Pg. 302	Blackboard, PPT
15	Models for the excess Gibbs energy, Property changes of mixing	2 – Ch.7; Pg. 308	Google classroom
16	Heat effects of mixing process - calculations	2 – Ch.7; Pg. 310	Blackboard, PPT
17	Criteria for equilibrium between phases in multi component non-reacting systems	2 – Ch.8; Pg. 330	Blackboard, PPT
18	Criteria for equilibrium between phases in multi component non-reacting systems	2 – Ch.8; Pg. 341	Google classroom
Practicals			
19-24	Phase diagrams for partially miscible and immiscible systems		

Content beyond syllabus covered (if any): vapour – liquid equilibrium problems essentially involve the calculation of the composition of the liquid and vapour phases.

* Session duration: 50 minutes

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CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)

Unit : III

Unit Syllabus Application of phase rule - vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap - effect of temperature and pressure on azeotrope composition - liquid-liquid equilibrium - ternary liquid-liquid equilibrium.

Objective : To understand the procedure to predict phase equilibrium data.

Session No *	Topics to be covered	Ref	Teaching Aids
25	Vapor liquid equilibria for ideal and non ideal situations	2 – Ch.8; Pg.324 - 330	Blackboard, PPT
26	Phase diagrams for binary solutions	2 – Ch.8;Pg.324 - 330	Google classroom
27	Effect of pressure on VLE; T-x-y diagrams, Example of calculating T-x-y and P-x-y diagrams	2 – Ch.8; Pg.362 - 363	Blackboard, PPT
28	Non-ideal solutions and azeotropes	2 – Ch.8; Pg.362 - 363	Blackboard, PPT
29	Phase diagrams for partially miscible and immiscible systems	2 – Ch.8; Pg.376 - 377	Google classroom
30	Liquid-liquid equilibria	2 – Ch.8; Pg.381 - 382	Google classroom
Practicals			
31-36	Prediction of azeotropic composition and VLE data by vanlaar model		

Content beyond syllabus covered (if any): vapour – liquid equilibrium problems essentially involve the calculation of the composition of the liquid and vapour phases.

* Session duration: 50 minutes

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CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)

Unit : IV

Unit Syllabus : Activity coefficient-composition models - thermodynamic consistency of phase equilibria - application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

Objective : To check the thermodynamic consistency of phase equilibrium data.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Activity coefficient composition models	2 – Ch.8; Pg.347 - 355	Google classroom
38	Consistency tests for VLE data – various methods	2 – Ch.8; Pg.347 - 355	Google classroom
39	Derivation of co-existence equation	2 – Ch.8;Pg.367 - 371	Blackboard, PPT
40	Problem on checking consistency of VLE data – mid point method	2 – Ch.8; Pg.371 - 376	Blackboard, PPT
41	Problem on checking consistency of VLE data – Zero area method	2 – Ch.8; Pg.371 - 376	Blackboard, PPT
42	Tutorials	2 – Ch.8; Pg.362 - 367	Blackboard, PPT

Practicals

43 - 48	Validating Thermodynamic consistency test using othmer VLE still

Content beyond syllabus covered (if any): The discussion on VLE equilibrium for systems of limited miscibility was done which would be helpful for the analysis of separation processes.

* Session duration: 50 minutes

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CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)

Unit : V

Unit Syllabus : Standard free energy change and reaction equilibrium constant - evaluation of reaction equilibrium constant - prediction of free energy data - calculation of equilibrium compositions for homogeneous chemical reactors.

Objective : To calculate the equilibrium compositions for various homogeneous chemical reactions.

Session No *	Topics to be covered	Ref	Teaching Aids
49	Reaction coordinate and derivation of equilibrium compositions in single reactions	2 – Ch.9; Pg.398 - 400	Google classroom
50	Problem on calculation of equilibrium composition	2 – Ch.9; Pg.400 - 402	Blackboard, PPT
51	Tutorial on deducing the relation for equilibrium compositions/equilibrium constant	2 – Ch.9; Pg.400 - 419	Blackboard, PPT
52	Criterion for chemical reaction equilibrium and equilibrium constant	2 – Ch.9; Pg.402 - 409	Blackboard, PPT
53	Effect of temperature and pressure on equilibrium constant	2 – Ch.9; Pg.408 - 413	Blackboard, PPT
54	Problem on estimating free energy and equilibrium constant	2 – Ch.9; Pg.408 - 419	Blackboard, PPT
Practicals			
55-60	Determination of equilibrium constant for the given system.		

Content beyond syllabus covered (if any): Discussion of multiple reaction equilibrium and problems associated with it helps students understand the complexity under practical conditions.

* Session duration: 50 minutes

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CHEMICAL ENGINEERING THERMODYNAMICS II (INTEGRATED)

TEXT BOOKS:

1. Smith, J.M., VanNess, H.C., & Abbot M.C, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill VII Edition 2004.
2. Narayanan K.V "A Text Book of Chemical Engineering Thermodynamics" Prentice Hall of India Pvt. Ltd. 2001.

REFERENCES:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II", Thermodynamics, John Wiley, 1970.
2. Dodge, B.F., "Chemical Engineering Thermodynamics", McGraw-Hill, 1960. 3. Sandler, S.I., "Chemical and Engineering Thermodynamics", 2nd Edition, Wiley, 1989.
3. Stanley M.Walas" Phase equilibrium in Chemical Engineering",Elsiever Science and Technology books.1984
4. S.Sandler, "Chemical, Biochemical and Engineering Thermodynamics", 4th edition,Wiley,India.

	Prepared by	Approved by
Signature		
Name	Dr. Sudha. G	Dr. N. Meyyappan
Designation	Associate Professor	Professor & Head
Date	24.01.2024	24/01/24
Remarks *:		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD