Format K1

Maharashtra State Board of Technical Education, Mumbai

TEACHING PLAN (TP)

Academic Year: **2025-26 (EVEN)**

Institute Code and Name: 0078- K. K. Wagh Polytechnic, Nashik **Semester**: Fourth
Programme and Code: Chemical Engineering (CH) **Course Index:** 403
Course and Code: Chemical Engineering Thermodynamics (CET) - 314308
Name of Faculty: Mr. P.M.Pathak **CLASS: SYCH**

INDUSTRY EXPECTED OUTCOME

Students will be able to achieve & demonstrate the following COs on completion of course based learning.

COURSE LEVEL LEARNING OUTCOMES (COS)

- CO403-1 - Use basic concepts of thermodynamics for given chemical processes.
- CO403-2 - Apply first law of thermodynamics to improve the chemical process.
- CO403-3 - Apply second law of thermodynamics to describe entropy of system.
- CO403-4 - Use P-V-T graphical representation of fluids for different process.
- CO403-5 - Apply concept of chemical equilibrium in chemical process.

TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314308	CHEMICAL ENGINEERING THERMODYNAMICS	CET	DSC	4	2	-	-	6	3	03	30	70	100	40	50	20	-	-	-	-	150

Total IKS Hrs for Sem.: 2 Hrs
Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

THEORY LEARNING OUTCOME (TLO)

TLO No.	Title of TLO
TLO 1.1	Enlist different types of system
TLO 1.2	Differentiate between extensive and intensive properties of system
TLO 1.3	Identify state and path function
TLO 1.4	State zeroth law of thermodynamics for given situation/system
TLO 1.5	Explain thermodynamic equilibrium
TLO 2.1	State first law of thermodynamics

TLO 2.2	Explain internal energy and enthalpy
TLO 2.3	Write relation between heat capacity at constant volume and heat capacity constant pressure
TLO 2.4	Derive an expression for work done for given process
TLO 3.1	Explain second law of thermodynamics
TLO 3.2	Describe basic concepts of second law of thermodynamics
TLO 3.3	Write mathematical expression of Clausius inequality
TLO 3.4	Calculate entropy change for given system
TLO 3.5	State third law of thermodynamics
TLO 4.1	Explain P-V-T behaviour of pure fluids
TLO 4.2	Draw P-H (Pressure Enthalpy), T-S (Temperature Entropy), H-T (Enthalpy Temperature) and H-S (Enthalpy Entropy) diagram for given chemical process
TLO 4.3	Explain phase diagram for water system
TLO 4.4	Use Vander Waals equation to calculate volume of real gas TLO 4.5 Calculate degree of freedom for given system
TLO 5.1	Explain chemical equilibria for the given system
TLO 5.2	Apply Le-Chatelier's principle for given system
TLO 5.3	Write relation between ΔG & K
TLO 5.4	Explain variation of equilibrium constant with temperature based on Van't Hoff's equation

SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	-	1	-	1			
CO2	2	2	1	1	2	-	1			
CO3	2	2	1	1	2	-	1			
CO4	2	2	2	1	2	-	1			
CO5	2	2	2	-	1	-	1			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

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K-1

Academic Year: 2025-26
Program: Chemical Engineering
Course: Chemical Engineering Thermodynamics (CET) - 314308
Name of faculty: Mr. P.M.Pathak

Institute Code: 0078
Course Code: 314308
Semester: Fourth (CH-4K)

Chap No. (Allotted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
Unit - I Basic Concept of Thermodynamics								
1 (10)	**CO-1**	**TLO 1.1**	1.1 Introduction to thermodynamics: System, boundary and surrounding	2	18/12/2025		Blackboard, Books, media, PPT	
		TLO 1.1	1.2 Classification of system: Homogeneous and heterogeneous, closed, open, isolated, and adiabatic	2	18/12/2025			
		TLO 1.2	1.3 Properties: Extensive and intensive, concept of energy, heat, work and power, simple numerical (based on heat and work)	1	19/12/2025 To 20/12/2025			
		TLO 1.3	1.4 Function: State and path function. (work and heat as path function)	1	20/12/2025			
		TLO 1.5	1.5 Process: Isobaric, isothermal, isochoric, adiabatic, reversible, irreversible, quasi static and cyclic process **MKCL Quiz 1**	2	26/12/2025 To 27/12/2025			
		TLO 1.5	1.6 Types of equilibrium: Stable, unstable, metastable, mechanical, chemical, thermal, and thermodynamic equilibrium	2	27/12/2025 To 01/01/2026			
		TLO 1.4	1.7 Zeroth law of thermodynamics and its application **Practice test 1**	2	18/12/2025			

Chap No. (Allotted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
Unit - II First Law of Thermodynamics								
2 (06)	**CO-2**	**TLO 2.1**	2.1 First law of thermodynamics: Mathematical equation and its application	3	18/12/2025		Blackboard, Books, media, PPT	
		TLO 2.2	2.2 Internal energy, standard enthalpy changes, temperature dependence of enthalpy. Simple numerical on enthalpy calculation	3	19/12/2025 To 20/12/2025			
		TLO 2.3	2.3 Relation between heat capacity at constant volume (Cv) and heat capacity at constant pressure (Cp)	3	20/12/2025			
		TLO 2.4	2.4 Derivation for work done for following processes: Isobaric process, sochoric/isometric, isothermal, adiabatic and polytropic process (simple numerical on determination of Q, W, ΔU & ΔH for the above processes) **Practice test 2 and MKCL Quiz 2**	3	26/12/2025 To 27/12/2025			
Unit - III Second Law of Thermodynamics								
3 (18)	**CO-3**	**TLO 3.1**	3.1 Second law of thermodynamics. (Kelvin-Plank statement, Clausius statement) and its application, limitations of first law of thermodynamics	3	27/12/2025 To 01/01/2026		Blackboard, Books, media, PPT	
		TLO 3.2	3.2 Basic concepts: heat reservoir, heat engine and heat pump or refrigerator, thermal efficiency and Coefficient of Performance (C.O.P), entropy	3	10/01/2026			
		TLO 3.3	3.3 Clausius inequality statement and mathematical expression	3	10/01/2026 To 15/01/2026			
		TLO 3.4	3.4 Entropy change of an ideal gas. Phase change, ideal gas processes, adiabatic, mixing, and isothermal mixing (numerical on entropy change)	3	15/01/2026 To 17/01/2026			
		TLO 3.5	3.5 Third law of thermodynamics and its application	2	17/01/2026 To 24/01/2026			
Unit - IV Pressure-Volume-Temperature(P-V-T)								

Chap No. (Allotted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
Behaviour of Pure Fluids								
4 (16)	CO-4	**TLO 4.1**	4.1 1 P-V-T behaviour of pure fluids: Graphical presentation of different thermodynamic processes on P-H (Pressure-Enthalpy), T-S (Temperature Entropy), H-T (Enthalpy – Temperature) and H-S (Enthalpy – Entropy) diagram. Phase diagram for water system	3	05/02/2026 To 12/02/2026		Blackboard, Books, media, PPT	
		TLO 4.2	4.2 Ideal gas and equation of state	2	12/02/2026 To 13/02/2026			
		TLO 4.3	4.3 Equations of state for real gas: Vander Waals and Virial equation, numerical on Vander Waals equation only. Compressibility factor	3	14/02/2026 To 20/02/2026			
		TLO 4.4	4.4 Degree of freedom, Gibb`s phase rule, numerical	2	21/02/2026 To 21/02/2026			
		TLO 4.5	4.5 Fugacity and fugacity coefficient	2	26/02/2026 To 28/02/2026			
Unit - V Chemical Equilibria								
5 (10)	CO-5	**TLO5.1**	5.1 Concept of chemical equilibria, equilibrium constant for gaseous mixture, derivation and numerical	2	05/03/2026 To 07/03/2026		Blackboard, Books, media, PPT	
		TLO 5.2	5.2 Gibbs free energy change and feasibility of chemical reaction from free energy change. Le Chatelier's principle	2	07/03/2026 To 12/03/2026			
		TLO 5.3	5.3 Chemical potential, law of mass action, relation between Gibbs free energy(ΔG) & equilibrium constant (K)	3	13/03/2026 To 26/03/2026			**13/04/2025 Extra Lecture**
		TLO 5.4	5.4 Van't Hoff's equation, variation of equilibrium constant with temperature for exothermic and endothermic reaction, numerical (based on Van't Hoff's equation	3	28/03/2026			**14/04/2025 Extra Lecture**

ASSESSMENT METHODOLOGIES/TOOLS

A. Formative assessment (Assessment for Learning) (FA-TH)

Tutorial of 50 Marks Two Class Test of 30 Marks

B. Summative Assessment (Assessment of Learning) (SA-TH)

- End Term Theory Examination - 70 Marks

SUGGESTED LEARNING MATERIALS / BOOKS

Sr. No.	Author	Title of Book	Publication
1	K. V. Narayanan	A Textbook of Chemical Engineering Thermodynamics	Prentice Hall India Pvt., Limited, ISBN: 9788120317321, 8120317327
2	Joseph Mauk Smith, Hendrick C. Van Ness, Michael M. Abbott, M. T. Swihart	Introduction to Chemical Engineering Thermodynamics	McGraw-Hill, ISBN: 9780071270557, 0071270558
3	Stanley I. Sandler	Chemical and Engineering Thermodynamics	Wiley, ISBN: 9780471017745, 0471017744
4	Y. V. C. Rao	Chemical Engineering Thermodynamics	Sangam Books, ISBN:9788173710483, 8173710481
5	P. K. Nag	Engineering Thermodynamics	Tata McGraw Hill, ISBN: 9780070591141, 0070591148

LEARNING WEBSITES & PORTALS

Sr. No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/103/103/103103144/	Video Lectures
2	https://archive.nptel.ac.in/courses/103/106/103106070/	Video Lectures
3	https://archive.nptel.ac.in/courses/103/104/103104151/	Video Lectures
4	https://unacademy.com/course/part-1-thermodynamics-chemical engineering/PPQGVSG1	Video Lectures
5	https://unacademy.com/course/part-ii-chemical-engineering-th ermodynamics-cet-ii/XO43QVZQ	Video Lectures
6	https://nptel.ac.in/courses/103101004	Video Lectures

Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Mr. P.M.Pathak
(Name & Signature of Staff)

Dr. P. S. Bhandari
(Name & Signature of HOD)