GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Master of Technology					Branch/Spec.	Chemical Engineering		
Semester	II					Version	1.0.0.0		
Effective from Academic Year		2026-27				Effective for the batch Admitted in			July 2026
Subject code	**3CH2102**		Subject Name			**Advanced Chemical Engineering Thermodynamics**			
Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	0	0	3	Theory	40	60	100
Hours	3	0	0	0	3	Practical	0	0	0

Pre-requisites:

Thermodynamics on UG level

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	Highlighting various equations of state to study the real fluid behavior
CO2	Apply equations of state to calculate thermodynamic properties of pure species.
CO3	Analyzing the liquid and vapor phase equilibrium with bubble and dew point calculations.
CO4	Composing the activity coefficient models using the VLE data and apply thermodynamic principles to chemical reaction equilibria

Theory syllabus

Unit	Content	Hrs
1	**Volumetric Properties of Pure Fluids:** General nature of PVT behavior of pure substances, Equation of states: Ideal gas law, Cubic equations of states – van der Waals equation of state, Redlich-Kwong equation of state, Soave-Redlich-Kwong equation of state, Peng-Robinson equation of state, generalized equations of state; the law of corresponding states, compressibility charts, Virial equation of state.	10
2	**Thermodynamic Property Relations:** Expressing various thermodynamic properties such as Internal energy, enthalpy, Helmholtz free energy, Gibbs free energy, etc., in terms of measurable thermodynamic properties, Gibbs equations, Maxwell's equations, and application of property relationships, Residual properties, Residual properties from equations of state, Generalized correlations for residual properties, Vapor pressure, Antoine equation.	10
3	**Solution Thermodynamics:** The chemical potential and equilibrium, partial properties, fugacity and fugacity coefficients of pure species and mixtures, and Generalized correlations for fugacity coefficients. The ideal solution model and excess properties. Raoult's law and Henry's law, Modified Raoult's law, Bubble point and Dew point calculations.	11
4	**Thermodynamic formulation for Vapor-Liquid Equilibrium:** Excess Gibbs Energy and activity coefficient, The Gamma/Phi formulation of VLE, Correlations for liquid-phase activity coefficients: The Redlich/Kister expansion, Margules equations, The van Laar equation, fitting activity coefficient model to VLE data.	9
5	**Chemical Reaction Equilibria:** The reaction coordinates, Application of equilibrium criteria to chemical reactions, The standard Gibbs free energy change and the equilibrium constant, Effect temperature on equilibrium constant, Evaluation of the equilibrium constant, Relation of equilibrium constant to composition for gas phase and liquid phase reactions, calculation of equilibrium conversion for single reaction	5

Text Books

1.	J. M. Smith, H. C. Van Ness, M. M. Abbott, M. T. Swihart: Introduction To Chemical Engineering Thermodynamics, 9 th Edition, McGraw-Hill Education, New York.
2.	J. M. Prausnitz, R. N. Lichtenthaler, E. G. Azevedo, Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd edition, Prentice Hall PTR.
3.	K.V.Narayanan "A Text book of chemical Engineering thermodynamics", Prentice Hall of India
4.	Stanley I. Sandler, "Chemical, Biochemical and Engineering Thermodynamics", Wiley India Pvt. Ltd., 4th ed., 2007.
Reference Books	
1	B. E. Poling, J. M. Prausnitz, J. P. O'Connell - The properties of gases and liquids, 5th edition, McGraw-Hill Professional.
ICT/MOOCs references	

https://nptel.ac.in/courses/103104151

Mapping of CO with PO and PSO:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1	2	-	-
CO2	3	3	-	1	2	-	-	-	-	-	1	3	-	-
CO3	3	3	1	1	2	-	-	-	-	-	1	3	1	-
CO4	3	3	2	2	2	-	-	-	-	-	2	3	2	-