



बिरसा मुंडा ट्रायबल युनिवर्सिटी

Birsa Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science

B.Sc. (Chemistry) Programme

Subject Code & Name: - BS06MJCHE2 & Physical Chemistry- IV

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				CCE		SEE	
L	T	P	Total	TH	PWE	TH	PWE
4	-	-	4	50	-	50	-

Programme Name	B.Sc.
Semester	VI
Course Code	BS06MJCHE2
Course Title	Physical Chemistry-IV
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions+ Lab. Per Week	4
Total Teaching/Lab. Hours	60
* 2 Laboratory = 1 Session	

Learning Objectives

1. Electrochemistry focus on understanding the relationship between chemical reactions and electricity, covering redox reactions, cell potential calculation (Nernst equation),
2. Thermodynamics of cells and practical applications like batteries and corrosion.
3. Students learn to identify components of galvanic and electrolytic cells, anode/cathode reactions, and electron.
4. The Second Law of Thermodynamics focus on understanding that heat spontaneously flows from hot to cold, entropy in the universe always increases, and 100% efficient heat engines are impossible.
5. Students learn to define entropy, analyze spontaneous/irreversible processes, calculate Carnot efficiency, and understand energy degradation.
6. The study of partial molar quantities focus on understanding how individual components contribute to the overall thermodynamic properties of a mixture, particularly in non-ideal solutions where properties are not strictly additive.

Prerequisites (if any)





बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science B.Sc. (Chemistry) Programme

Learning Outcomes

On the Completion of this course, students will able to:

1. The study of electrochemistry explains the relationship between chemical reactions and electrical energy through concepts like redox reactions and electrode potentials. It explains and apply electrochemical cells (galvanic and electrolytic) in predicting and driving chemical processes.
2. Analyze real-life applications such as batteries, corrosion, and electroplating using electrochemical principles.
3. The second law of thermodynamics states that the entropy of an isolated system always increases or remains constant, never decreasing. It explains the direction of natural processes, showing that heat flows spontaneously from hotter to colder bodies. It also implies that no heat engine can be 100% efficient due to unavoidable energy losses.
4. Understand the concept of partial molar quantities as the contribution of each component to an overall extensive property in a mixture.
5. Apply partial molar properties to calculate changes in Gibbs energy, volume, or enthalpy during mixing of multicomponent systems.
6. Use partial molar quantities to relate composition changes to thermodynamic behavior of real solutions.

Detailed Contents

UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Electrochemistry I Introduction of electrochemistry, Galvanic cell, standard EMF, Cell potential, Half-cell potential, cell representation, EMF series, Nernst equation, determination of nonstandard cell potential, relationship of EMF and equilibrium constant and application of Nernst equation, concentration cell, activity and non-ionic activity of electrolyte, Numerical based on about topics.	15
II	Electrochemistry II Electrolytic cell, laws of electrolysis, specific conductance, equivalent conductance, molar conductance, cell constant, variation of molar conductance with dilution, Kohlrausch law, Applications of Kohlrausch, transport number, methods of determination of transport number, moving boundary method, Debye-Huckel Onsager equation.	15



बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science B.Sc. (Chemistry) Programme

III	Second law of thermodynamics Limitations of the first law: Need for the second law, Spontaneous or irreversible processes, Cyclic process, Carnot cycle, The second law of thermodynamics, Carnot theorem, Concept of entropy, Entropy change in an isothermal expansion of an ideal gas, Entropy changes in reversible and irreversible processes, Entropy changes accompanying changes of phase, Calculation of entropy changes of an ideal gas with change in P, V and T, Entropy of mixing of ideal gases, Standard entropies, Physical significance of entropy, Work and free energy functions, Variation of free energy with T and P, Maxwell's relations, Criteria for reversible and irreversible processes, Gibbs-Helmholtz equation.	15
IV	Partial molar quantities Thermodynamics of open system, partial molar properties, chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature, variation of chemical potential with pressure, chemical potential in a system of ideal gases, determination of partial molar quantities, Clapeyron equation, Clapeyron-Clausius equation, application of Clausius-Clapeyron Equation, Numerical based on about topics.	15

Text Book(s)

Reference Books

1. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand & Co.
2. Physical Chemistry, 7th edition P. C. Rakshit
3. Elements of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan Pathania, Vishal Publishing Co. Jalandhar.
4. Physical Chemistry, Gordon M. Barrow
5. A Textbook of physical chemistry, O.P. Tandon, 1st edition
6. Advanced Physical chemistry Vol-1, Gurtu & Gurtu, 3rd edition
7. Advanced Physical chemistry Vol-2, Gurtu & Gurtu, 3rd edition
8. Physical Chemistry, W.J. Moore, 6/E, 1996, Mac-Graw Hill Publication
9. Essentials of Physical Chemistry, Bahl & Tuli, 22/E, S. Chand Publication, New Delhi.
10. Advanced Physical Chemistry by Gurdeep Raj, 19/E, Goel Publishing House Meerut
11. Atkins's Physical Chemistry by Peter Atkins, Julio De Paula and James Keeler, Global Edition, Wiley Publication



बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Mūṇḍā Drāyabala Yūnīvārsīṭī

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science B.Sc. (Chemistry) Programme

Web Resources	
1. Google books, INFLIBNET, Google Web	
Required Software(s) (if any)	
Practical(s) (if any)	

L:: Lecture, **T::** Tutorial, **P::** Practical

CCE:: Continuous and Comprehensive Evaluation

(CCE Theory includes Mid Semester Examination, Assignment, MCQ quizzes, Seminar, Reflective notes, class participation, case analysis and presentation, slip tests (announced/surprised), attendance etc. or any combination of these)

PWE:: Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)

SEE:: Semester End Evaluation