



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

M.Sc. (Chemistry) Programme

Subject Code & Name: - MS02CCHE02 & Physical Chemistry - II

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				Internal		External	
L	T	P	Total	TH	PWE	TH	PWE
4	-	-	4	50	-	50	-

Programme Name	M.Sc. Chemistry
Semester	II
Course Code	MS02CCHE02
Course Title	Physical Chemistry - II
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions+ Lab. Per Week	4
Total Teaching/Lab. Hours	60 Hours
* 2 Laboratory = 1 Session	

Learning Objectives

1. The principles are further studied and understood to comprehend the mechanical features of complex reactions through the course delivery and content. The theoretical foundation of the reaction mechanism is covered.
2. Group theory's foundations and concept-based elements It is taught to apply molecular symmetry to forecast some classical instances' spectroscopic and hybridization outcomes.

Prerequisites (if any)

Learning Outcomes

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

1. Discover the kinetic and mechanistic features of enzyme-catalyzed fast reactions, complex processes, opposing reactions, sequential reactions, parallel reactions, chain reactions, ionic reactions, and the salt effect.
2. Describe the ideas behind the energy transfer that occurs when molecules collide in situations that are gas-phase or condensed-phase.



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3. Learn how to calculate and comprehend aspects of the symmetry of molecules using mathematical techniques based on group theory.
4. Predict the molecular vibrations of symmetrical molecules, selection criteria for electronic transitions, infrared spectra, and Raman spectra by using group theory and symmetry.

Detailed Contents		
UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Group theory in Chemistry : Concepts of symmetry in molecule:- Symmetry elements, symmetry operations, definitions and theorems in group theory, examples of groups, subgroups and classes, Molecular Point groups :- Identification and classification, notation of point groups, Matrix representation of symmetry operations, Types of matrices, matrix notations for symmetry elements : E, C _n , i, σ , S _n . Matrix representation of point groups : product and square rule, inverse rule, matrices for C _{3v} , C _{4v} etc., Construction of character tables :-rules, reducible and irreducible representations, character of a representation, properties of a irreducible representations, orthogonality theorem, character tables for C _{2v} , C _{3v} , C _{4v} , D _{nh} , uses of character tables.	15
II	Chemical Applications of Group Theory : Molecular vibrations, molecular vibration of symmetrical AB ₂ (bent) molecule, symmetry of normal modes of ethylene, tetrahedral hybridization, Hybridization in Boron Trifluoride (trigonal planar geometry), Bonding in water molecule, Group theoretical selection rules for electronic transitions, infrared spectra and Raman spectra, Electronic spectra of carbonyl chromophore.	15
III	Chemical Kinetics – II : Complex reactions :- Opposing reactions, Consecutive reactions, Parallel reactions, Reactions in flow systems, Chain reactions, Ionic reactions and salt effect, enzyme catalyzed reactions, kinetics of fast reactions.	15



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IV	Chemical Dynamics : Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory ; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of uni-molecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogenbromine and hydrogen-chlorine reactions) and oscillatory reactions (BelousovZhabotinsky reaction).	15
Text Book(s)		
1. Basic concepts of Symmetry & Group Theory in chemistry, Satish Ghelani, bharat offset 2. Chemical Kinetics, K. J. Laidler, (McGraw Hill Publication) 3. Chemical Applications of Group Theory, F. A. Cotton, (Wiley Eastern Ltd., Third Edition)		
Reference Books		
1. Physical Chemistry, Ira N Levine (Tata McGraw-Hill Publishing Company, New Delhi, Fifth Edition). 2. Elements of Physical Chemistry, Peter Atkins, Julio De Paula, David Smith, (Oxford University Press, 6th Edition) 3. Group Theory and Its Chemical Applications, P. K. Bhattacharya (Himalya Publishing House, Mumbai, Second Revised Edition). 4. Group theory in Chemistry, M. S. Gopinathan, V. Ramakrishnan (Vishal Publishing Co. Second Edition).		
Web Resources		
1. www.nptel.ac.in 2. www.swayam.gov.in 3. www.epgp.inflibnet.ac.in (e-PG pathshala) 4. www.ndl.iitkgp.ac.in (National Digital Library)		
Required Software(s) (if any)		
Practical(s) (if any)		

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

PWE:: Practical Work Examination

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