Govt. T. R. S. (Autonomous) College Rewa (M.P.)

Department of Chemistry

Syllabus for B.Sc. Chemistry

(CBCS & NEP 2020)

Session 2022-23

Part A – Introduction			
Program: UG (Diploma)	**Class: B.Sc. Chemistry**	**Semester: III**	**Session: 2022-23**
Subject: Chemistry			

1	**Course code**	**CHCT-03**
2	**Course title**	**Physical Chemistry - I**
3	**Course type**	**Major/Minor**
4	**Pre-requisite (if any)**	**To study this course, a student must have had the subject Certificate.**
5	**Course Objective**	• To develop basic and advance concepts regarding the three states of matter. • To study the concept of ionization in aqueous solution, pH, buffers and various applications of ionization.
6	**Course Learning Outcomes (CLO)**	**By the end of the course, students will be able to:** • Derive mathematical expressions for different properties of gas, liquid and solids and understand their physical significance. • Explain the crystal structure and calculate related properties of cubic systems. • Explain the concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt. • Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses and everyday life.
7	**Credit Value**	**4**

8	Total Marks	Max. Marks (40+60): (CCE+ESE)	Min. Passing Marks: 35

Part B – Content of the course

Total No. of Lectures-Tutorials-Practical (4 hours per week):
L-T-P: 60-0-00

Unit	Topic	No.of Lectures
1	**Gaseous stat**e: **Behavior of real gases**: Deviations from ideal gas behavior, compressibility factor, and its variation with pressure for different gases. Causes of deviation from ideal behavior. van der Waals equation of state, its derivation and application in explaining real gas behaviour; van der Waals equation expressed in virial form, Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, critical and van der Waals constants, law of corresponding states. **Kinetic molecular model of a gas:** postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.	**20**
2	**Liquid state:** Structure and physical properties of liquids; vapour pressure, surface tension, viscosity, and their dependence on temperature, Effect of addition of various solutes on surface tension, cleansing action of detergents. Structure of water.	**10**
3	**Ionic equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di- and tri-protic acids. Salt hydrolysis, hydrolysis constants, degree of hydrolysis and pH for different salts. Buffer solutions; Henderson equation, buffer capacity, buffer range, buffer action, applications of buffers in analytical chemistry, Solubility and solubility product. Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.	**15**

	Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolytes.	
4	**Solid state:** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Various types of defects in crystals, Glasses and liquid crystals.	**15**

Part C – Learning Resources

Text Books, Reference Books, Other resources

Suggested Reading:

1.Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 8th Ed., Oxford University Press (2006).

2. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).

3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).

4. Mortimer, R. G. *Physical Chemistry* 3rd Ed. Elsevier: NOIDA, UP (2009).

5 G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

Suggested equivalent online:

Keywords:

States of matter, ideal/real gases, critical constants, viscosity, surface tension, symmetry, Crystal lattice/Systems, X-ray diffraction, Bragg's law, ionic equilibria, solubility product, pH, indicator.

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Part A – Introduction			
Program: UG (Diploma)	**Class: B.Sc. Chemistry**	**Semester: III**	**Session: 2022-23**
Subject: Chemistry			

1	**Course code**	**CHCP-03**	
2	**Course title**	**PHYSICAL CHEMISTRY I (PRACTICAL)**	
3	**Course type**	**Major/Minor**	
4	**Pre-requisite(if any)**	**To study this course, a student must have had the subject Certificate.**	
5	**Course Objective**	● To eliminating the fear associated with chemistry laboratory, ● To develop inquisitive nature about processes and phenomena happening during experiments. ● To attain knowledge about methods and techniques related to experiments in laboratory.	
6	**Course Learning Outcomes (CLO)**	**By the end of the course, students will be able to:** ● Determine the surface tension of aqueous solutions. ● ExplainViscosity by using Ostwald's viscometer. ● Determine molecular weight of a volatile compound using Victor Meyer's method ● Apply the concepts of buffer solution and pH value.	
7	**Credit Value**	**2**	
8	**Total Marks**	**Max. Marks (40+60): (CCE+ESE)**	**Min. Passing Marks: 35**

Part B – Content of the course		
Total No. of Lectures-Tutorials-Practical (4 hours per week): **L-T-P: 00-0-60**		
Unit	**Topic**	**No. of Lectures**
1	1 **Surface tension measurements.** a. Determine the surface tension by (i) drop number (ii) drop weight method. b. Study the variation of surface tension of detergent solutions with concentration. **2. Viscosity measurements using Ostwald's viscometer.** a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. c. Viscosity of sucrose solution with the concentration of solute. **3. pH metry** a. Effect on pH of addition of HCl/NaOH to solutions of acetic acid, Sodium acetate and their mixtures. b. Preparation of buffer solutions of different pH i. Sodium acetate-acetic acid ii. Ammonium chloride-ammonium hydroxide c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. d. Determination of dissociation constant of a weak acid.	**60**
Part C – Learning Resources		
Text Books, Reference Books, Other resources		
Suggested Reading: 1.Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011). 2.Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed*.; McGraw-Hill: New York (2003). 3 Halpern, A. M. &McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.:		

New York (2003).
4 Athawale V. D. amd Mathur P. Experimental Physical Chemistry,, New Age Intenational (2001)

Suggested equivalent online:
Part D – Assessment & Evaluation
Suggested Continuous Evaluation Method
Any remark / suggestion:
This course can be opted as an elective by the students of the following subjects:
Continuous & Comprehensive Evaluation shall be based on allotted Assignment and Class Test

Keywords:
Solution, pH values, buffer solutions, Ostwald's viscometer,cubic crystalline system, concentration, molar mass, CMC, surface tension.