Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Experiments in Physical Chemistry
Course Code: PCC-505
Number of Credits: 03   **Effective from AY:** 2019-20

Prerequisites for the course:	Students should have studied the laboratory course in Physical chemistry (PCC402), so as to have basic knowledge of instruments and practical experimental chemistry.	No. of lectures/hours 72
Course Objectives:	1. To introduce concepts of Kinetics and Thermodynamics 2. To introduce concepts of Surface science and Catalysis 3. To introduce various concepts of Electrochemistry 4. Introduction to use of computers and computational tools in chemistry	
Course Outcomes:	1. Student should be in a position to better understand the concepts of physical chemistry through practical experimental knowledge. 2. Students should be in a position to apply this knowledge to other practical chemistry applications.	
Content:	**Group - A. Instrumental** 1. To determine the energy of activation of reaction of $Zn + PbSO_4 ----> ZnSO_4 + Pb$ potentiometrically. 2. To determine the instability constant of the reaction $[Ag(NH_3)_2] ----> Ag + 2NH_3$ potentiometrically 3. To study the electro-kinetics of rapid reaction between SO_4^{2-} and I^- in an aqueous solution. 4. To verify Nernst equation and determine the standard oxidation potential of copper and zinc ion electrodes. 5. To study effect of ionic strength on activity coefficient of Ag^+ ions. 6. To study spectrophotometric titration of ferrous ammonium sulphate with potassium permanganate (or dichromate vs permanganate) 7. To investigate the reaction kinetics between potassium persulphate and potassium Iodide colorimetrically. 8. To determine the equivalent conductance of a strong electrolyte at several concentrations and verify Onsager's equation. 9. To estimate the concentration of sulphuric acid, acetic acid and copper sulphate in a given solution conductometrically. 10. To determine the concentration of Fe(II) ions by titrating with potassium dichromate conductometrically. 11. To study the kinetics of hydrolysis of tertiary butyl chloride by conductometry 14. To determine the half wave potential of $Cu^{2+}/Cd^{2+}/Zn^{2+}$ by using polarography **Group - B. Non-Instrumental**	24 hr 24 hr

1. To determine the partial molal volume of ethanol-water mixture at a given temperature 2. To study the phase rule for two component system 3. To determine the partial molal volume of sodium chloride-water, ethanol-water and methanol-water system (apparent molal volume method) 4. To determine the effect of salt on surface tension of water using by capillary rise method 5. To study effect of surfactants on surface tension of water using stalagmometer 6. To study the variation of viscosity with composition of mixtures and to verify the formation of compounds by Oswald's viscometer 7. To study the effect of pH on the kinetics of iodination of aniline 8. To study the kinetics of reaction between H_2O_2 and KI (clock reaction) 9. To study the kinetics of rapid reaction between bromine and iodine in aqueous media 10. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid. 11. To study the electroless deposition of Ni on non-conductor substrate and to determine the rate of deposition 12. To study the acid and alkaline corrosion susceptibility of metal and to determine the rate of corrosion 13. To study the catalytic activity of three different metal oxides in heterogeneous systems with H_2O_2 decomposition reaction 14. To determine the molecular weight of a polymer by intrinsic viscosity method. **Group - C. Computers in Chemistry** 1. To generate a mark sheet to learn various features of spreadsheets (revision) 2. To generate a plot for a given function (like solutions of 1D box, harmonic oscillator, H-like atom wave functions, Gaussians distributions etc) (revisions) 3. To write a computer program to obtain equivalence point in pH-metry and potentiometric experiments (derivative method) 4. To write a computer program to find percent composition for various atoms of a given molecular formula 5. To write a computer program to obtain slope and intercept for linear data using least square fit method 6. To write a computer program to obtain center of mass of a given molecule and moment of inertia, hence obtain	**24 hr**

	classification of the given molecule 7. To write a computer program to find out various parameters for data analysis viz. minimum, maximum, average, standard deviation, variance, covariance, correlation coefficient, frequency distribution etc. 8. To write a computer program to obtain thermodynamic probability. 9. To write a computer program to obtain degeneracy of a given energy level for a particle in a cube. *Note:* *A minimum of 4 experiments from each group A-C are to be carried out.*	
Pedagogy:	Practical / Hands on sessions will be conducted.	
Text Books / Reference Books	1. A. Finlay & J.A. Kitchener, *Practical Physical Chemistry, Longman Publisher,* 1963*.* 2. A. M. James, *Practical Physical Chemistry*, Longman Publisher, 1974. 3. D.P. Shoemaker & C.W. Garland, *Experimental Physical Chemistry,* McGraw-Hil,1981. 4. J. B. Yadav, *Advance Practical Physical Chemistry*, Krishna Educational Publishers, 2014.	