

Lecture Plan		
Name of the college: Government College of Arts, Science and Commerce, Sanquelim- Goa		
Name of Faculty: Ankita M. Vernekar	Subject: Chemistry	
Paper code: CHC-302	Program: T Y BSc	Division: A
Academic year: 2025 - 2026	Semester: V	Total Lectures: 30
Course Objectives: : To develop a strong foundation in electrochemistry and quantum mechanics by understanding fundamental concepts, applyi mathematical models, and performing related problem-solving and experimental analysis.		
Expected Course Outcome: 1. Explain and apply concepts of conductivity, ionic mobility, transference number, and EMF in electrochemical systems. 2. Analyze and solve numerical problems related to conductometric titrations, solubility product, and concentration cells. 3. Interpret quantum mechanical principles including de Broglie hypothesis, uncertainty principle, and Schrödinger equation. 4. Apply quantum mechanical models to simple systems such as free particles and particles in a box to determine energy quantisation.		
Student Learning Outcome: 1. Explain and apply concepts of conductivity, ionic mobility, transference number, and EMF in electrochemical systems. 2. Analyze and solve numerical problems related to conductometric titrations, solubility product, and concentration cells. 3. Interpret quantum mechanical principles including de Broglie hypothesis, uncertainty principle, and Schrödinger equation. 4. Apply quantum mechanical models to simple systems such as free particles and particles in a box to determine energy quantisation.		

Month	Lecture From	Lecture To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/ Assignment	ICT Tools	Reference books
June	20/06/2025	28/06/2025	1	ELECTROCHEMISTRY Conductivity: Equivalent and molar conductivity and the effect of dilution for weak and strong electrolytes,	Define equivalent and molar conductivity; calculate both for given electrolyte concentrations.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
July	30/06/2025	05/07/2025	2	Arrhenius theory of ionisation, Ostwald dilution law,	Derive the law; calculate dissociation constant for a weak acid from given data.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
July	07/07/2025	12/07/2025	2	Debye-Hückel theory and its limitation, Debye Hückel-Onsager equation	Discuss assumptions; solve a conceptual question on ionic strength effect.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
July	14/07/2025	19/07/2025	2	Kohlrausch's law of independent migration of ions	Derive the equation; numerical on limiting molar conductivity. State and explain the law; determine Λ° for a salt using given ionic values	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan

July	21/07/2025	26/07/2025	2	Ionic mobility and factors affecting ionic mobility, Transference number – Moving boundary method	Explain factors (viscosity, temperature); numerical on mobility calculation. Draw experimental setup; calculate transference number from given data.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
July/ August	28/07/2025	02/08/2025	2	Transference number – Hittorf method, Applications: hydrolysis and hydrolysis constan	Calculate hydrolysis constant (Kh) and pH of a salt solution	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
August	04/08/2025	09/08/2025	2	Applications: solubility and solubility products of sparingly soluble salts, Ionic product of water, conductometric titrations (only acid-base)	Plot titration curve for strong acid vs. strong base; calculate Kw.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
August	11/08/2025	16/08/2025	2	EMF of a cell and its measurements, reversible and irreversible cell	Write the Nernst equation; numerical on EMF calculation.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition.

							2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
August	18/08/2025	23/08/2025	2	Concentration cells (with and without transference), liquid junction potential and its measurements	Solve a numerical on EMF of a concentration cell; explain liquid junction potential.	Power point presentation/ Smart board	1. J.N. Gurtu, Physical Chemistry Vol-III, A pragati edition. 2. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan
August	25/08/2025	30/08/2025	CHATURTHI BREAK				
September	01/09/2025	06/09/2025	2	QUANTUM CHEMISTRY De-Broglie hypothesis, Experimental verification of De Broglie Hypothesis	Derive the principle using wave packet approach; conceptual question on its limitations	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.
September	08/09/2025	13/09/2025		Heisenberg uncertainty principle, Derivation of Heisenberg's uncertainty principle		Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.
September	15/09/2025	20/09/2025	2	Sinusoidal wave function, eigen value and eigen functions	Identify eigenfunctions and their corresponding eigenvalues for a simple operator.	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.

September	22/09/2025	27/09/2025	2	Physical significance of wave function Terms involved: Normalisation, orthogonality, observables	Perform normalisation of a simple wave function; define orthogonality condition.	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.
September/ October	29/09/2025	04/10/2025	2	Operators: linear, non-linear, Hermitian, non-Hermitian, Hamiltonian Operator, Commutation rule	Solve a commutator problem for position and momentum operators.	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.
October	06/10/2025	11/10/2025	2	Postulates of quantum mechanics Schrödinger equation	State postulates of quantum mechanics.	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.
October	13/10/2025	18/10/2025	2	Schrödinger equation application to free particle,	Derive energy levels for a particle in a 1D box; calculate zero-point energy for given dimensions.	Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.

				Schrödinger equation application to particle in a box, quantisation of energy levels, zero-point energy			
October	21/10/2024	21/10/2024	2			Power point presentation/ Smart board	Chandra, A.K., Introductory Quantum Chemistry, Tata McGraw –Hill (2001), New Delhi, 4 th edition.

Practical Plan		
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Name of the college: Government college of Arts Science and commerce Sanquelim Goa.		
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Name of Faculty: Ms. Ankita M. Vernekar	Subject: Chemistry	
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Paper code: CHC-302	Program: T.Y.B.Sc	Division: A
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Academic year: 2025- 2026	Semester: V	Total Practicals/Labs: 16 (60 hours)
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Credits: 2

Course Objectives:- To develop practical skills in electrochemistry, quantum mechanics, and spectroscopy by determining physicochemical constants, verifying laws, and interpreting experimental data.
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Expected Course Outcome:

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| <ul style="list-style-type: none">1) Determine physicochemical parameters using conductometric and potentiometric techniques.2) Verify laws and titration principles in physical chemistry experimentally.3) Analyze vibrational-rotational spectra to calculate molecular constants.4) Plot quantum mechanical wavefunctions for a particle in a one-dimensional box. |
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Student Learning Outcome:

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| <ul style="list-style-type: none">1) Determine physicochemical parameters using conductometric and potentiometric techniques.2) Verify laws and titration principles in physical chemistry experimentally.3) Analyze vibrational-rotational spectra to calculate molecular constants.4) Plot quantum mechanical wavefunctions for a particle in a one-dimensional box. |
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Month	Practicals/Labs Scheduled Date	No. of Practical's/Labs planned	List of Experiments	Reference books
June	23/06/2025-28/06/2025			
June/July	30/06/2025-05/07/2025	2	To determine the cell constant using 0.1N and 0.02N KCl solution.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
July	07/07/2025-12/07/2025	2	To verify Ostwald's dilution law using acetic acid.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
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July	21/07/2025-26/07/2025	2	To determine the percentage composition of acid mixture (strong acid and weak acid) by titrating against standard 0.1N NaOH.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
July/August	28/07/2025-02/08/2025	2	To determine the percentage composition of acid mixture (strong acid and weak acid) by titrating against standard 0.1N NaOH.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
August	04/08/2025-09/08/2025	2	To determine standard oxidation potential of Cu/Cu ⁺² and Zn/Zn ⁺²	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication.

August	11/08/2025-16/08/2025	2	To determine standard oxidation potential of Cu/Cu ⁺² and Zn/Zn ⁺²	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
August	18/08/2025-23/08/2025	2	To determine solubility product of AgCl using potentiometer.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
August	25/08/2025-30/08/2025	2	GANESH CHATURTHI HOLIDAY	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
September	01/09/2025-06/09/2025	2	To determine solubility product of AgCl using potentiometer.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
September	08/09/2025-13/09/2025	2	To determine formal redox potential of Fe ⁺² /Fe ⁺³ system using 0.1N K ₂ Cr ₂ O ₇ .	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
September	15/09/2025-20/09/2025	2	To determine formal redox potential of Fe ⁺² /Fe ⁺³ system using 0.1N K ₂ Cr ₂ O ₇ .	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
September	22/09/2025-27/09/2025	2	To plot the orthonormal wavefunctions of a particle in a one-dimensional box.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
September/October	29/09/2025-04/10/2025	2	To plot the orthonormal wavefunctions of a particle in a one-dimensional box.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co

October	06/10/2025-11/10/2025	2	Using vibrational-rotational spectra of HCl and HBr molecules a) Assign the rotational lines to various transitions. b) Calculate: i) The value of B_0 and B_1 , for R and P branches of spectra ii) Vibrational frequency and iii) Internuclear distance.	1)Systematic experimental Physical Chemistry by W. Rajbhoj, T.K. Chondhekar, Anjali publication. 2)Senior Practical Physical chemistry by B.D. Khosla, V.C. Garg, Adarsh Gulati, published by R. Chand and Co
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Assessment Rubrics

Component	Max Marks
ISA 1	7.5
ISA 2	7.5
Practical	25
Project	-
Semester End Exam	45

