



Devrukh Shikshan Prasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S.R. Sapre Commerce and
Vid. Dadasaheb Pitre Science College
(Autonomous)

Late Kakasaheb Pandit Educational Campus,
Devrukh, Dist: Ratnagiri- 415 804, Maharashtra

NAAC Accredited 'A' Grade (Third Cycle), Mumbai University Best College Award 2009-10

Syllabus

Programme: T. Y. B. Sc.

Course- Physical Chemistry

w.e.f. Academic Year 2021-22

Choice Based Credit System
T. Y. B. Sc.
Chemistry Syllabus
To be implemented from the Academic year 2021-22

Course Content
Semester V

Course Code	Unit	Topics	Credits	L/Week
USCHT51	I	Molecular Spectroscopy		
	II	Electrochemistry		
	III	Nuclear Chemistry		
	IV	Surface Chemistry & Colloidal State		
USCHT52	I	Molecular Symmetry and Chemical Bonding		
	II	Solid State Chemistry		
	III	Chemistry of Inner Transition Elements		
	IV	Some Selected Topics		
USCHT53	I	Mechanism of Organic Reactions; Pericyclic Reactions & Photochemistry		
	II	Stereochemistry & Heterocyclic Chemistry		
	III	IUPAC & Synthesis of Organic Compounds		
	IV	Spectroscopy-I & Natural Products		
USCHT54	I	Statistical Treatment of Analytical Data-II		
	II	Classical Methods of Analysis (Titrimetry)		
	III	Optical Methods		
	IV	Methods of Separation-I		
USCHP51		Chemistry Practicals I		
USCHP52		Chemistry Practicals II		
USCHP53		Chemistry Practicals III		
USCHP54		Chemistry Practicals IV		

T.Y.B.Sc. Syllabus Chemistry Paper-I
Physical Chemistry

Semester V

Unit I: MOLECULAR SPECTROSCOPY (15L)

1.1 Rotational Spectrum: Introduction to dipole moment, polarization of a bond, bond moment, molecular structure, Rotational spectrum of a diatomic molecule, rigid rotor, moment of inertia, energy levels, conditions for obtaining pure rotational spectrum, selection rule, nature of spectrum, determination of internuclear distance and isotopic shift.

1.2 Vibrational spectrum: Vibrational motion, degrees of freedom, modes of vibration, vibrational spectrum of a diatomic molecule, simple harmonic oscillator, energy levels, zero-point energy, conditions for obtaining vibrational spectrum, selection rule, nature of spectrum.

1.3 Vibrational-Rotational spectrum of diatomic molecule: Energy levels, selection rule, nature of spectrum, P and R branch lines. Anharmonic oscillator - energy levels, selection rule, fundamental band, overtones. Application of vibrational-rotational spectrum in determination of force constant and its significance. Infrared spectra of simple molecules like H₂O and CO₂.

1.4 Raman Spectroscopy: Scattering of electromagnetic radiation, Rayleigh scattering, Raman scattering, nature of Raman spectrum, Stoke's lines, Anti-Stoke's lines, Raman shift, quantum theory of Raman spectrum, comparative study of IR and Raman spectra, rule of mutual exclusion- CO₂ molecule. Number of modes of vibrations for linear and non-linear molecules.

Unit-II: ELECTROCHEMISTRY (15L)

2.1 Activity and Activity Coefficient: Lewis concept, Ionic Strength, Mean Ionic Activity and Mean Ionic Activity Coefficient of an electrolyte, expression for activities of electrolytes. Debye-Huckel limiting law (No derivation).

2.2 Classification of Galvanic cells: Chemical cells and Concentration cells, Chemical cells with and without transference, Electrode Concentration cells, Electrolyte concentration cells with and without transference (Derivations are expected)

2.3 Origin of Liquid Junction Potential and its elimination.

2.4 Determination of solubility product and solubility of a sparingly soluble salt: By Chemical cell and By Concentration cell.

2.5 Determination of Liquid Junction Potential

Unit III: NUCLEAR CHEMISTRY (15L)

3.1. Introduction: Basic terms-radioactive constants (decay constant, half-life and average life) and units of radioactivity

3.2 Detection and Measurement of Radioactivity: Types and characteristics of nuclear radiations, behavior of ion pairs in electric field, detection and measurement of nuclear radiations using G. M. Counter and Scintillation Counter.

3.3 Application of use of radioisotopes as Tracers: Chemical reaction mechanism, Age Determination - Dating by C₁₄.

3.4 Nuclear reactions: nuclear transmutation (one example for each projectile), artificial radioactivity, Q - value of nuclear reaction, threshold energy.

3.5 Fission Process: Fissile and fertile material, nuclear fission, chain reaction, factor

controlling fission process, multiplication factor and critical size or mass of fissionable material, nuclear power reactor and breeder reactor.

Unit IV: SURFACE CHEMISTRY & COLLOIDAL STATE (15L)

4.1 Surface Chemistry (6L)

4.1.1 Adsorption: Physical and Chemical Adsorption, types of adsorption isotherms. Langmuir's adsorption isotherm (Postulates and Derivation expected).

4.2.2 B.E.T. equation for multilayer adsorption (Derivation not expected), Determination of surface area of an adsorbent using B.E.T. equation.

4.2 Colloidal State (9L)

4.2.1 Introduction to colloids: Emulsions, Gels and Sols

4.2.2 Electrical Properties: Origin of charges on colloidal particles, Concept of electrical double layer, zeta potential, Helmholtz and Stern model.

4.2.3 Electro-kinetic Phenomena: Electrophoresis, Electro-Osmosis, Streaming Potential, Sedimentation Potential, Donnan Membrane Equilibrium.

4.2.3 Colloidal Electrolytes: Introduction, micelle formation,

4.2.4 Surfactants: Classification and applications of surfactants in detergents and food industry.

(Numericals are expected from All Units)

Reference Books:

Physical Chemistry

1. Physical Chemistry, Ira Levine, 5th Edition, 2002 Tata McGraw Hill Publishing Co.Ltd.
2. The Elements of Physical Chemistry, P.W. Atkins, Oxford University Press, Oxford..
3. Modern Electrochemistry, J.O.M Bockris& A.K.N. Reddy, Maria Gamboa – Aldeco 2nd Edition, 1st Indian reprint,2006 Springer
4. Physical Chemistry, G.M. Barrow, 6th Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
5. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford University Press Oxford
6. Physical Chemistry, G.K. Vemullapallie, 1997, Prentice Hall of India, Pvt.Ltd. New Delhi.