Gondwana University, Gadchiroli
Semester Pattern Syllabus for
B. Sc. III year, Semester VI
CHEMISTRY
UNIT-I

A) Metal Ligand Bonding In Transition Metal Complexes:
Limitations of Valency bond theory, Crystal field theory: Splitting of d-orbital in octahedral, tetrahedral and square planar complexes. Factors affecting the Magnitude of 10Dq, Crystal field Stabilisation Energy of Octahedral and Tetrahedral complexes (Numericals) 
[8 L]

B) Electronic Spectra Of Transition Metal Complexes:

UNIT-II

A) Magnetic Properties Of Transition Metal Complexes:
Method of determining of Magnetic Susceptibility by Gouy’s Method. Spin only formula and orbital contribution to magnetic moment. Magnetic properties of Octahedral and Tetrahedral complexes with respect to CFT. Numericals on magnetic moments. [6 L]

B) Thermodynamic And Kinetic Aspect Of Metal Complexes:
UNIT-III

A) Colorimetry And Spectrophotometry:


[6 L]

B) Separation Techniques:

a) Chromatography: Classification, Principle, Technique and Application of Paper and Column Chromatography.

b) Ion-Exchange: Types of ion exchange resins, Equilibria and ion exchange capacity, Application in separation of binary mixtures.

c) Solvent Extraction: Principle and Classification, Factors influencing extraction and application in chemistry.  

[6 L]

UNIT-IV

A) Organometallic Chemistry :-

Definition, Nomenclature and Classification of Organometallic compounds. Preparation properties and application of Alkyl and Aryls of Al, Hg and Sn. A brief account of metal ethylenic complexes (Structure only). Homogeneous Hydrogenation (Wilkinson’s Catalyst reaction).  

[4 L]

B) Bioinorganic Chemistry:


[4 L]

A) Basic Principal Of Soil Chemistry :-


[4 L]
A) Quantum Chemistry :- Schrodinger wave equation for hydrogen atom, separation in to three equations (without derivation, in terms of r, and Φ), Total wave function for hydrogen atom in terms of radial and angular wave functions, energy of hydrogen atom (no derivation). Hydrogen like wave functions, radial wave functions and angular wave functions. Interpretation of quantum, numbers. Concept of orbital and radial probability distribution curves for 1s, 2s, 2p, 3p and 3d orbitals. [6 L]

B) Molecular Orbital Theory : Criteria for forming M. O. from A. O., LCAO-MO method for H₂⁺ molecule, expression for energy levels for bonding and antibonding wave functions. Normalized wave functions for bonding and antibonding (no derivation). Physical pictures of bonding and antibonding wave functions. Introduction to M. O. theory for H₂ molecule (Qualitative treatment, without derivation). Introduction to Valance bond theory for H₂ molecule. [6 L]

UNIT-II

A) Photochemistry :-
Interaction of radiation with matter, difference between thermal and photochemical process, Beer–Lamberts, laws of photochemistry : Grothus–Draper law, Stark–Einstein law, Jablonski diagram depicting various processes (nonradiative and radiative) fluorescence, phosphorescence, chemiluminescence, quantum yield, determination of quantum yield of reactions, causes for low and high quantum yields. Some examples of photochemical reactions (e.g. Photochemical decomposition of Hydrogen iodide, Photosynthesis of HBr from H₂ and Br₂ and photosynthesis of HCl from H₂ and Cl₂, Photosensitized reactions. Energy transfer processes. [8 L]

B) Dipole Moment :-
Electrical dipole moment, polarizatrition of molecules (Clasius Mosotti equation), orientation of dipoles in an electric field. Determination of dipole moment. Bond moments. Group moments for benzene derivatives. Application of dipole moment to (i) % ionic character (ii) Shape of molecules, (iii) study of geometrical isomers and (iv) substituted benzene molecules. [4 L]
UNIT-III

Spectroscopy

A) Rotational Spectroscopy :
Introduction to spectroscopy, Dipole moment and Rotational Spectra. Rotational spectra of diatomic molecules, Energy levels of rigid rotor. Selection rule for transition between energy levels. Expression for wave number (cm$^{-1}$) of spectral lines in terms of rotational constant (B) and rotational quantum number (J). Intensity of spectral lines. Application of rotational spectra for determination of bond length of diatomic molecules. Introduction to non-rigid rotor.

B) Vibrational Spectroscopy :
Energy levels of simple harmonic oscillator, Energy level diagram, relative populations of energy levels. Selection rule for pure vibrational spectra (harmonic oscillations), Force constant. Anharmonic oscillator, Morse equation, selection rules, idea of overtones. Degrees of freedom and normal modes of vibration for polyatomic molecules. Idea of vibrational frequencies of different functional groups.

UNIT-IV

A) Surface Chemistry :-
Adsorption, Chemisorptions, Application of adsorption, adsorption of gases by solid, freundlich adsorption isotherm , Langmuirs theory of adsorption, Adsorption from solution , Adsorption chromatography.

B) Colloidal Chemistry:-
Type of colloidal system , its classification, lyophilic and lyophobic sol, partical size range, preparation of colloidal solution by condensation method , ultra filtration, properties of colloidal system, charge on colloidal particles, gold number, electrical properties: electrophoresis and electro Osmosis, Surfactant definition, types , miscelle concentration, effect of temperature on CMC.
Semester - VI
Chemistry Practicals

Time 4-5 hrs Total Marks 30

➢ Inorganic Chemistry

Group A) Preparation of following complexes:
i) Potassium trioxalato ferrate (III) $K_3[Fe(C_2O_4)_3].H_2O$
ii) Copper tetramine complex $[Cu(NH_3)_4].2H_2O$

Group B) Colorimetry:
i) Jobs method of determination of composition of Fe- SSA complex
ii) Mole Ratio Method of determination of composition of Fe- SSA complex

Group C) i) Ion exchange method, separation and estimation of Mg (II) and Zn (II).
ii) Chromatographic separation of binary mixtures(at least Two) containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of Rf values.

Note: Any two experiment from group A, B and C (One from each group) are compulsory in examination.

➢ Physical Chemistry

1) To verify Beer-Lambert law for $KMnO_4/ K_2Cr_2O_7$ and determine the concentration of the given solution of $KMnO_4/ K_2Cr_2O_7$.
2) To verify law of refraction for mixture (glycerol-water) using Abbe’s refracto meter.
3) To determine the specific rotation of a given optically active compound by polarimeter. (D-glucose, D / L Lactic acid).
4) To determine molecular mass of a non-volatile solute by Rast method.
5) To verify the freundlich adsorption isotherm by acetic acid on activated charcoal.

Distribution Of Marks For Practical Examination
Time 4-5 hours (One Day Examination) Marks 30
Organic Chemistry (Experiment) ....................... 12
Physical Chemistry (Experiment) ....................... 12
References:
6. Concise Inorganic Chemistry by J. D. Lee, ELBS.
10. Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, ELBS.
12. Inorganic complex compounds by Murmann, Chapman and Hall.
18. Instrumental Methods of Chemical Analysis _ B.K. Sharma – Goel Publication
19. Robert de Lavie, A spreadsheet workbook for Quantitative Chemical Analysis, Mcgraw-
22. Principles of Physical Chemistry: Maron and Prutton
26. Practical Physical Chemistry: Palit and De.
27. Practical Physical Chemistry: Yadao.