Gondwana University, Gadchiroli

Semester Pattern Syllabus for

B. Sc. III year, Semester VI

CHEMISTRY

GONDWANA UNIVERSITY, GADCHIROLI

CHEMISTRY SYLLABUS

B.Sc. Part III (Semester-VI)

(Effective from 2014-15)

Paper –I (Inorganic Chemistry)

Total Lectures : 48 Marks : 50

Note:- Figure to right hand side indicates number of lectures.

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 Stabilisatation Energy of Octahedral and Tetrahedral complexes (Numericals)

[8 L]

B) Electronic Spectra Of Transition Metal Complexes :

Jahn Teller Effect, Selection Rules (Laporte and Spin selection Rules).Hole Formalism Principle. Electronic spectrum of $[Ti(H_2O)_6]^{3+}$ and $[Cu(H_2O)_6]^{2+}$ complex ions [4L]

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 :

Thermodynamic and Kinetic stability of metal complexes, their relation. Stepwise stability and overall stability constant and their relationship, Factors affecting the Stability of complexes. Determination of composition of Fe(III)-SSA complex by Mole Ratio and Job's Method.

[6 L]

UNIT-III

A) Colorimetery And Spectrophotometery:

Principles of photometery: Beer-Lamberts Law, And its deviation. Types of colorimeter and spectrophotometer with simple schematic diagrams. Application of colorimeter and spectrophotometer in quantitative analysis with reference to estimation of Cu(II) as Cu-ammonia complex. [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:

Essential and Trace elements in biological processes, Metallo porphyrins with special reference to structure and role of Hemoglobin and Myoglobin in transport of Oxygen. Biological role of Na^+ and K^+ and Ca^{2+} metal ions. [4 L]

A) Basic Principal Of Soil Chemistry :-

Introduction of soil and its type, Chemical Analysis of soil, Collection of soil Sample, Method of analysis, Soil pH, Soil Salinity, Organic carbon, available phosphorous and potassium. Lime requirements. [4 L]

Semester VI

Paper II : Physical Chemistry

UNIT-I

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 H_2^+ 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 H_2 molecule (Qualitative treatment, without derivation). Introduction to Valance bond theory for H_2 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, chemiluminesence, 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 H_2 and Br_2 and photosynthesis of HCI from H_2 and Cl_2 Photosensitized reactions. Energy transfer processes.

[8 L]

B) Dipole Moment :-

Electrical dipole moment, polarizatrion 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.

[6 L]

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.

[6 L]

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. [6 L]

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.[6 L]

Semister - VI

Chemistry Practicals

Time 4-5 hrs Total Marks 30

- **Inorganic Chemistry**

Group A) Preparation of following complexes :

i)Potasium trioxalato ferrate (III) $K_3[Fe(C_2O_4)_3].H_2O$

ii)Copper tetramine complex $[Cu(NH_3)_4] . 2H_2O$

Group B) Colorimetery :

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 frendlich adsoption 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

Viva-Voce …… 03
Record …… 03

Total : 30 marks

References :

1. Principles of Inorganic Chemistry by Puri. Sharma and Kalia – S. Naginchand & Co. Delhi.
2. Text book of Inorganic Chemistry by A. K. De. Wiley East Ltd.,
3. Selected Topies in Inorganic Chemistry by Malik, Tuli and Madan – S. Chand and Co.
4. Modern Inorganic Chemistry by R. c. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J. D. Lee, ELBS.
7. Inorganic Chemistry by J. E. Hoheey – Harper and Row.
8. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W. L. McGraw Hill Int.
10. Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman and Hall.
13. Text book of Inorganic Chemistry by K. N. Upadhayaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj. Goel Publishing House, Meerut.
15. Co-Ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorgnaic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Physico Chemical Techniques of Analysis – P.B. Janarthanam Vol – I & II- Asian Publication
18. Instrumental Methods of Chemical Analysis _ B.K. Sharma – Goel Publication
19. Robert de Lavie, A spreadsheet workbook for Quantitative ChemicalAnalysis, Mcgraw-
20. Physical Chemistry: Walter, J. Moore, 5^{th} edn., New Delhi.
21. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.

22. Principles of Physical Chemistry: Maron and Prutton

23. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.

24. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.

25. Physical Chemistry: Levine.

26. Practical Physical Chemistry: Palit and De.

27. Practical Physical Chemistry: Yadao.

28. Practical Physical Chemistry: Khosla.

29. Laboratory Mannual of Physical Chemistry W.J. Popiel.

30. Principles of Soil Science : M. M. Rai (4^{th} addition) McMillan publication.

31. Advance physical chemistry : J. N. Gurtu & A. Gurtu, Pragati prakashan, Meerut.

32. T.Y. B.Sc. Inorganic Chemistry: Semester-VI by – *Shell Publication, Nagpur.(Proposed)*

33. T.Y. B.Sc. Physical Chemistry : Semester-VI by – *Shell Publication, Nagpur.(Proposed)*

34. T.Y. B.Sc. Practical Chemistry : Semester-VI by – *Shell Publication, Nagpur.(Proposed)*