

Department of Chemistry

B.Sc III- Year Semester 5th Syllabus & Pattern of Chemistry

B.Sc- III Semester-V

(Effective from session 2015-16)

5S Chemistry

Total Lectures: 84 Marks: 80

- The examination in Chemistry of Fifth semester shall comprise of one theory paper, internal assessment and practical examination.
- Theory paper will be of 3 Hrs. duration and carry 80 marks.
- The internal assessment will carry 20 marks.
- The practical examination will be of 6 hours duration and carry 50 marks.
- The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week.
- Each theory paper has been divided into 6 units.
- There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

Unit I

14L

A] Coordination Compounds: Important terms

namely molecular or addition compounds, double salts, complex salts, complex ion, ligand, coordination number, central metal ion, etc. Werner's theory of coordination and its experimental verification on the basis of conductance data and formation of AgCl precipitate in case of cobaltammines. Sidgwick's electronic interpretation and its drawbacks, effective atomic number. IUPAC rules for nomenclature of coordination compounds. Structural isomerism-ionization, linkage and coordination in complexes. Geometrical isomerism in octahedral complexes of the type Ma_4b_2 , Ma_3b_3 , $Ma_2b_2c_2$, Ma_4bc , $M(AA)_2b_2$. Square planar complexes of the type Ma_2b_2 and Ma_2bc . Optical isomerism in octahedral complexes of type $Ma_2b_2c_2$, $Mabcdef$, $M(AA)_3$, $M(AA)_2b_2$ and tetrahedral complexes of the type $Mabcd$ and $M(AA)_2$. Optical isomerism in square planar complexes. Valence bond theory as applied to structure and bonding in complexes of 3d-series elements (Only 4 and 6 coordinates complexes). Inner and outer

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orbital complexes. Magnetic properties of complexes of 3d series elements. Limitations of VB theory.

B] Chelates :

Definition, classification and applications of chelates in analytical chemistry. Stability of chelate with special reference to chelate effect.

Unit II

14L

A] Crystal Field Theory (CFT): Postulates of CFT, Crystal field splitting in octahedral, distorted octahedral, square planar tetrahedral complexes, concept of CFSE, high spin and low spin complexes on the basis of Δ_0 and pairing energy, distribution of electrons in t_{2g} and e_g orbitals in high spin and low spin octahedral complexes. Factor affecting magnitude of crystal field splitting in octahedral complexes.

B] Electronic Spectra of Transition Metal Complexes : Introduction to spectra, selection rules for d-d transitions, spectroscopic terms-determination of ground term symbols for d_1 to d_{10} , spectra of d_1 and d_9 octahedral complexes, Orgel diagram for d_1 and d_9 states, electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion. Spectrochemical series.

Unit III

14L

A] Heterocyclic compounds: Nomenclature, Pyrrole: Synthesis from acetylene, succinimide and furan, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, acetylation and halogenation, Molecular orbital structure. [4] Pyridine: Synthesis from acetylene and pentamethylene diamine hydrochloride, Basicity, Electrophilic substitution reactions (orientation) – nitration, sulphonation, Nucleophilic substitution reactions (orientation)- with NaNH_2 , $\text{C}_6\text{H}_5\text{Li}$ and KOH .

B] Organometallic compounds: Grignard reagents: Methyl magnesium bromide- Synthesis from methyl bromide (only reaction) Synthetic applications: Electrophilic substitution reactions- formation of alkanes, alkenes, higher alkynes and other organometallic compounds, Nucleophilic substitution reactions- Reaction with aldehydes and ketones, ethylene oxide, acetyl chloride, methyl cyanide and CO_2 . Methyl lithium-Synthesis and reaction with water, formaldehyde, acetaldehyde, acetone, ethylene oxide and CO_2

Unit IV

14L

A] Dyes: Classification on the basis of structure and mode of application, Preparation and uses of Methyl orange, Crystal violet, Phenolphthalein, Alizarin and Indigo.

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B] Drugs: Analgesic and antipyretics: Synthesis and uses of phenylbutazone. Sulpha drugs: Synthesis and uses of sulphanilamide and sulphadiazine. Antimalarials: Synthesis of chloroquine from 4,7-dichloroquinoline and its uses.

C] Pesticides: Insecticides: Synthesis and uses of malathion. Herbicides: Synthesis and uses of 2,4-dichloro phenoxy acetic acid (2,4-D). Fungicides: Synthesis and uses of thiram (tetramethyl thiuram disulphide).

Unit V-

14L

Photochemistry (i) Photochemical and thermal reactions. (ii) Lambert's law - Statement and derivation. Beer's law - Statement and derivation. Reasons for deviation from Beer's law. (iii) Laws of photochemistry. (iv) Quantum yield of photochemical reaction. Reasons for high and low quantum yield. Experimental determination of quantum yield. Photosensitized reaction. (v) Kinetics of photochemical decomposition of HI. (vi) Fluorescence and Phosphorescence. Selection rule for electronic transition. Internal conversion and inter-system crossing. Explanation of fluorescence and phosphorescence on the basis of Jablonski diagram. (vii) Chemiluminescence and Bioluminescence with examples. (viii) Numericals.

Unit VI-

14L

Molecular Spectroscopy (i) Electromagnetic radiation, characteristics of electromagnetic radiation in terms of wavelength, wave number, frequency and energy of photon. Spectrum of electromagnetic radiation. (ii) Types of spectra - Emission and absorption spectra, atomic and molecular spectra, line and band spectra (iii) Translational, vibrational, rotational and electronic motion. The degree of freedom in each motion. (iv) Energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. (v) Condition for pure rotational spectrum (i.e. microwave active molecules), selection rule for rotational transition. Derivation of expression for moment of inertia of a diatomic rigid rotor. Isotope effect. Applications of microwave spectroscopy for the determination of moment of inertia and bonding. (vi) Condition for exhibiting vibrational spectra (i.e. IR active molecule), selection rule for vibrational transition. Vibrational energy levels of a simple harmonic oscillator. Zero point energy, position of a spectral line. Determination of force constant of a covalent bond. (v) Raman effect - Raman's spectrum of a molecule. Condition for exhibiting Raman spectrum (i.e. Raman active molecule), selection rule for rotational transitions. Pure rotational spectrum of diatomic molecule, vibrational Raman spectrum of a diatomic molecule. (vii) Numericals.

Semester- V

5S Chemistry Practicals

Total Laboratory sessions: 26 Marks: 50

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Exercise 1:

Inorganic Preparations 12 Laboratory sessions

1. Preparation of tetraamminecopper(II)sulphate.
2. Preparation of hexaamminenickel(II)chloride.
3. Preparation of potassiumtrioxalate aluminate(III).
4. Preparation of Prussian blue.
5. Preparation of chrome alum.
6. Preparation of sodium thiosulphate and dithionite. (Comment on VB structure, magnetic properties and color of 1, 2 and 3 complexes)

Exercise II:

Physical Chemistry experiments 14 Laboratory sessions (Standard oxalic acid solution should be prepared by the students)

1. To determine strength of given HCl solution conductometrically.
2. To determine strength of given CH₃ COOH solution conductometrically.
3. To determine strength of given HCl solution potentiometrically.
4. To determine strength of HCl and CH₃ COOH in a given mixture conductometrically.
5. To determine redox potential of Fe⁺²/Fe⁺³ system potentiometrically.
6. To determine molecular weight by Rast's method.
7. To determine specific rotation of optically active compound by Polarimeter.

Distribution of Marks for Practical Examination

Time: 6 hours (One Day Examination) Marks: 50

Exercise-I	18
Exercise-II	18
Viva-Voce	07
Record	07

Total: 50

Books Recommended: (Common for Semester V and Semester VI)

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S.

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Naginchand & Co., Delhi.

2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & 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. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.

Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.

12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by B.J. Joshi, P.J. Bahad, P.R. Mandlik, R.M. Kedar, C.B. Deshpande, V.V. Parhate published by Amravati University Chemistry Teachers Association with Bokey Prakashan, Amravati.
17. Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.
18. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.
19. Organic Chemistry by Pine, 5th edition.
20. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
21. Organic Chemistry by S.K. Ghosh.
22. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
23. Spectroscopy of Organic Compounds by P.S. Kalsi.
24. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
25. Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
26. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
27. Text book of Practical Organic Chemistry by A. I. Vogel.
28. Text book of Organic Chemistry by P.R. Rajput, S.N. Bhosale, Y.K. Meshram, V.G. Thakre, Dr. S.P. Deshmukh, A.R. Mankar, published by Amravati University Chemistry Teachers Association with Bokey

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Prakashan, Amravati.

29. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
30. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
31. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
32. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
33. Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
34. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
35. Principles of Physical Chemistry: Maron and Prutton.
36. Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
37. Physical Chemistry: P.W. Atkins, 4th Edn.
38. Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.
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39. Physical Chemistry: Levine.
40. Practical Physical Chemistry: Palit and De.
41. Practical Physical Chemistry: Yadao.
42. Practical Physical Chemistry: Khosla.
43. Laboratory Manual of Physical Chemistry: W.J. Popiel.
44. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
45. Text book of Physical Chemistry by S.B. Phadke, G.N. Chaudhari, S.S. Kabra, R.G. Bhangale, A.B. Patil, S.K. Rithe published by Amravati University Chemistry Teachers Association with Bokey Prakashan, Amravati.