

Credit Based Semester and Grading System (CBSGS) with effect from the
academic year 2021-22
Semester I

Program: M.Sc. in Chemistry
Course: Inorganic Chemistry I

University of Mumbai
Affiliated to

"A" Road, Churhgate, Mumbai - 400 020, India.

J.T. LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)
&

BASANTSING INSTITUTE OF SCIENCE
JAI HIND COLLEGE



M.Sc. Chemistry Syllabus

Semester I			
Course Code	Course Title	Credits	Lectures/Week
PSCHE102	Inorganic Chemistry I	04	04




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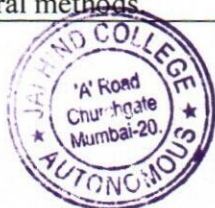
Semester I – Theory

Course Code: PSCHE102	Course Title: Inorganic Chemistry I	Credits: 04 Lectures/Week: 04
Course description: Chemical Bonding, Symmetry & group theory, Environmental Chemistry, Coordination Chemistry		
Objectives: <ol style="list-style-type: none"> 1. To develop the ability to link symmetry to the shapes of molecules and understand bonding, to study reaction mechanism of complexes. 2. To understand Coordination Chemistry of complexes. 3. To create awareness for various environmental issues. Outcomes: <ol style="list-style-type: none"> 1. The students will be able to understand the substitution reactions in various complexes and relate it to the stability of complexes. 2. To explain Coordination Chemistry of complexes. 3. To discuss the various environmental issues. 		
Unit I	Chemical Bonding: <ol style="list-style-type: none"> 1.1 Recapitulation of hybridization Derivation of wave functions for sp, sp^2, sp^3 orbital hybridization types considering only sigma bonding. 1.2 Discussion of involvement of d orbitals in various types of hybridizations. Concept of resonance, resonance energy derivation expected. Formal charge with examples. 1.3 Critical analysis of VBT. 1.4 Molecular Orbital Theory for diatomic species of First transition Series. 1.5 Molecular Orbital Theory for Polyatomic species considering σ bonding for SF_6, CO_2, B_2H_6, I_3^- molecular species. 1.6 Weak forces of attraction: Hydrogen bonding – concept, types, properties, methods of detection and importance. Van der Waal's forces, ion-dipole, dipole-dipole, London forces. 	15L
Unit II	Molecular Symmetry and Group Theory: <ol style="list-style-type: none"> 2.1 Symmetry criterion of optical activity, symmetry restrictions on dipole moment. A systematic procedure for symmetry classification of molecules. 2.2 Concepts of Groups, Sub-groups, Classes of Symmetry operations, Group Multiplication Tables. Abelian and non-Abelian point groups. 	15L




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	<p>2.3 Representation of Groups: Matrix representation of symmetry operations, reducible and irreducible representations. The Great Orthogonality Theorem and its application in construction of character tables for point groups C_{2v}, C_{3v} and D_{2h}, structure of character tables.</p> <p>2.4 Applications of Group Theory</p> <ol style="list-style-type: none"> Symmetry adapted linear combinations (SALC), symmetry aspects of MO theory, sigma bonding in AB_n (Ammonia, CH_4) molecule. Determination of symmetry species for translations and rotations. Mulliken's notations for irreducible representations. Reduction of reducible representations using reduction formula. Group-subgroup relationships. Descent and ascent in symmetry correlation diagrams showing relationship between different groups. 	
Unit III	<p>Environmental Chemistry</p> <p>3.1 Chemical Toxicology: Toxic chemicals in environment, Impact, Toxicity of heavy metals (As, Cd, Pb, Hg, Cu), Antidotes for metal poisoning. (5L)</p> <p>3.2 Case study of Itai Itai & As poisoning in Indo-Bangladesh region. Bhopal gas tragedy, Chernobyl disaster, three-mile island. (3L)</p> <p>3.3 Biochemical effects of NO_x, SO_2, O_3, PAN, Cyanides. (2L)</p> <p>3.4 Waste treatment and Recycling: Waste classification, Solid waste disposal & management, Waste water treatment. (3L)</p> <p>3.5 Environmental compliance for chemical industries- Policies and laws (2L)</p>	15L
Unit IV	<p>Characterisation of Coordination compounds</p> <p>4.1 Formation, thermal studies, Conductivity measurements, electronic spectral and magnetic measurements, IR, NMR and ESR spectroscopic methods.</p> <p>4.2 Spectral calculations using Orgel and Tanabe-Sugano diagram, calculation of electronic parameters such as Δ, B, C, Nephelauxetic ratio.</p> <p>4.3 Determination of formation constants of metal complexes (Overall and Stepwise): Comparative studies of Potentiometric and spectral methods.</p>	15L




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Standard References:

Unit I

1. J. Huheey, F. A. Keiter and R. I. Keiter, *Inorganic Chemistry—Principles of Structure and Reactivity*, 4th Ed.
2. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers, 2013-2014.
3. Catherine E. Housecroft And Alan G. Sharpe, *Inorganic Chemistry*, 2nd Edition
4. Gary Miessler, Paul Fischer, Donald Tarr, *Inorganic Chemistry*, 5th Edition

Unit II

5. A. Salahuddin Kunju and G. Krishnan, *Group Theory and its Applications in Chemistry*. (for 2.2,2.3,2.4)
6. K. V. Reddy. *Symmetry and Spectroscopy of Molecules*, 2nd Edition, New Age International Publishers, New Delhi, 2009. (for 2.1,2.4 (a),(b),(c))
7. R. L. Carter, *Molecular Symmetry and Group Theory*, John Wiley & Sons, New York, 1998. (for 2.3, 2.4f)

Unit III

8. Anil K De, Arnab K. De, *Environmental chemistry*, 9th Edition, New Age International Publishers, New Delhi. ISBN: 978-93-87477-24-7.
9. *Fundamentals of Environmental and Toxicological Chemistry* 4th edition, Stanley E. Manahan, ISBN: 978-1-4665-5317-0, CRC Press Taylor & Francis Group, 2013.
10. *Environmental Chemistry*, 5th edition, Colin Baird Michael Cann, W. H. Freeman and Company, New York, 2012

Unit IV

11. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann; *Advanced Inorganic Chemistry*, 6th ed. Wiley, 1999
12. Gary Miessler, Paul Fischer, Donald Tarr, *Inorganic Chemistry*, 5th Edition.
13. James E House, *Inorganic Chemistry*, Elsevier Publication 2008.
14. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers, 2013-2014.

Additional References:

15. W. W. Porterfield, *Inorganic Chemistry—A Unified Approach*, 2nd Ed., Academic Press, 1993.
16. B. W. Pfennig, *Principles of Inorganic Chemistry*, Wiley, 2015.
17. C. E. Housecroft and A. G. Sharpe, *Inorganic Chemistry*, Pearson Education Limited, 2nd Edition 2005
18. P. J. Durrant and B. Durrant, *Introduction to Advanced Inorganic Chemistry*, Oxford University Press, 1967.
19. R. L. Dekock and H.B.Gray, *Chemical Structure and Bonding*, The Benjamin Cummings Publishing Company, 1989.
20. R. Sarkar, *General Inorganic Chemistry*, Books & Allied (P) Ltd., 2001.
21. C. M. Day and J. Selbin, *Theoretical Inorganic Chemistry*, Affiliated East West Press Pvt. Ltd., 1985.
22. J. N. Murrell, S. F. A. Kettle and J. M. Tedder, *The Chemical Bond*, Wiley, 1978.
23. G. A. Jeffrey, *An Introduction to Hydrogen Bonding*, Oxford University Press, Inc., 1997.



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24. H. H. Jaffe and M. Orchin, *Symmetry in Chemistry*, John Wiley & Sons, New York, 1996.
25. P. K. Bhattacharya, *Group Theory and its Chemical Applications*, Himalaya Publishing House. 2014.
26. S. Swarnalakshmi, T. Saroja and R. M. Ezhilarasi, *A Simple Approach to Group Theory in Chemistry*, Universities Press, 2008.
27. D. Banerjea, *Coordination Chemistry*
28. Geary *Coordination reviews*
29. P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong; Shriver & Atkins: *Inorganic Chemistry*, 4th ed. Oxford University Press, 2006.
30. B. Douglas, D. McDaniel and J. Alexander. *Concepts and Models of Inorganic Chemistry* (3rd edn.), John Wiley & Sons (1994).

Evaluation Scheme

- **Continuous Assessment (CA) – 40 Marks**
 - Knowledge and Application based: Objective test of 20 Marks
 - Skill based (20 marks): Learner will be assessed on relevant skills pertaining to the course content of a particular paper which could involve but not limited to
 - Oral Presentations on relevant topics
 - Review writing/Worksheets etc.
- **Semester End Examination (SEE)- 60 Marks**



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"A" Road, Churchgate, Mumbai - 400 020, India.

**Affiliated to
University of Mumbai**

Program: M.Sc. in Chemistry

Course: Inorganic Chemistry Practical I

Semester I

**Credit Based Semester and Grading System (CBSGS) with effect from the
academic year 2021-22**



Principal
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M.Sc. Chemistry Practical Syllabus

Semester I			
Course Code	Course Title	Credits	Practical/Week
PSCHEPR102	Inorganic Chemistry Practical I	02	01




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Semester I – Practical

Course Code: PSCHEPR102	Course Title: Inorganic Chemistry Practical I	Credits: 02, Practical/Week: 01
Objectives: <ol style="list-style-type: none">1. To understand the procedure to synthesize and characterize Complexes.2. To apply the theoretical concept of equilibrium constant. Outcomes: <ol style="list-style-type: none">1. To explain the reactivity of the same ligand with different Metals.2. To determine equilibrium constant Fe^{+3}/SCN^- system by slope intercept methods3. To determine Electrolytic nature of inorganic compounds by Conductance measurement.		
Inorganic Preparations (Synthesis & Characterization) <ol style="list-style-type: none">1. Bis-(tetraethylammonium) tetrachloro Cuprate (II) $(Et_4N)_2[CuCl_4]$2. Bis-(tetraethylammonium) tetrachloro Nickelate (II) $(Et_4N)_2[NiCl_4]$3. Bis-(tetraethylammonium) tetrachloro Cobaltate (II) $(Et_4N)_2[CoCl_4]$ (Any two from above preparations)4. Tetrammine monocarbonato Cobalt (III) Nitrate $[Co(NH_3)_4(CO_3)]NO_3$5. Bis (ethylenediammine) Copper (II) Sulphate $[Cu(en)_2]SO_4$6. Hydronium dichloro bis(dimethylglyoximato) Cobaltate(III) $H[Co(dmgH)_2Cl_2]$ Instrumental <ol style="list-style-type: none">1. Determination of equilibrium constant by Slope intercept method for Fe^{+3}/SCN^- system2. Determination of Electrolytic nature of inorganic compounds by Conductance measurement.		
REFERENCES		
<ol style="list-style-type: none">1. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd2. The Synthesis and Characterization of Inorganic Compounds by <u>William L. Jolly</u>3. Inorganic Chemistry Practical Under UGC Syllabus for M.Sc. in all India Universities By: <u>Dr Deepak Pant</u>		




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Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks




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