



**JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)**

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

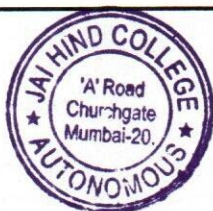
**Affiliated to
University of Mumbai**

Program: M.Sc. in Chemistry

Course: Inorganic Chemistry II

Semester II

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



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M.Sc. Chemistry Syllabus

| Semester II | | | |
|-------------|------------------------|---------|---------------|
| Course Code | Course Title | Credits | Lectures/Week |
| PSCHE202 | Inorganic Chemistry II | 04 | 04 |



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Semester II – Theory

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| Course Code: PSCHE202 | Course Title: Inorganic Chemistry II | Credits: 04 Lectures/Week: 04 |
| | Course description: Chemical Reaction Mechanisms in Inorganic Chemistry, Nanomaterials & Nanotechnology, Organometallic & Bioinorganic Chemistry | |
| | <p>Objectives:</p> <ol style="list-style-type: none"> 1. To understand inorganic reaction mechanism. 2. To understand Organometallic Chemistry of Transition Metals. 3. To introduce the concept of Nanomaterials & Nanotechnology and Bioinorganic Chemistry. <p>Outcomes:</p> <ol style="list-style-type: none"> 1. To identify and explain the inorganic Reaction Mechanism. 2. To discuss the concept of Nanomaterials & Nanotechnology and Bioinorganic Chemistry. 3. To explain the concept of Organometallic Chemistry of Transition Metals. | |
| Unit I | <p>Inorganic Reaction Mechanism:</p> <p>1.1 Rate of reactions, factors affecting the rate of reactions, techniques for determination of rate of reaction (Direct chemical analysis, spectrophotometric method, electrochemical and flow methods).</p> <p>1.2 Ligand Substitution Reactions of:</p> <ol style="list-style-type: none"> a. Octahedral complexes without breaking of metal-ligand bond (Use of isotopic labelling method) b. Square planar complexes, trans-effect, its theories and applications; trans effect v/s trans influence in square planar complexes; mechanism and factors affecting these substitution reactions. <p>1.3 Redox reactions: inner and outer sphere mechanisms, complimentary and non-complimentary reactions.</p> <p>1.4 Stereochemistry of substitution reactions of octahedral complexes. (Isomerization and racemization reactions and applications.)</p> | 15L |



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| <p>Unit II</p> | <p>Organometallic Chemistry of Transition Metals</p> <p>2.1 Eighteen and sixteen electron rule and electron counting with examples.</p> <p>2.2 Ligand Substitution Reactions(CO,Phosphine,CS,NO)</p> <p>2.3 Preparation, reactions& properties of:</p> <ol style="list-style-type: none"> Metal carbonyls Metal alkyls Metal carbenes & carbynes Metal complexes with alkenes & alkynes Allyl complexes of transition metals Group-subgroup relationships. <p>2.4 Homogeneous & heterogeneous catalysis</p> <p>2.5 Structure and bonding on the basis of VBT and MOT in the following organometallic compounds:</p> <ol style="list-style-type: none"> Zeise's salt Bis(triphenylphosphine)diphenylacetylene platinum (0) [Pt(PPh₃)₂(HC≡CPh₂)] Diallylnickel (II) Ferrocene Bis(arene)chromium (0) | <p>15L</p> |
| <p>Unit III</p> | <p>Introduction to Nanomaterials & Nanotechnology:</p> <p>3.1 Introduction to Nanomaterials and Nanotechnology: Definitions, Historical development, Classification, Types of nanomaterials(2L)</p> <p>3.2 Fundamentals: Size effect (grain boundaries, surface area), Properties of nanomaterials: Optical and mechanical properties with applications (in brief). (3L)</p> <p>3.3 Special Nanostructures: Carbon nanostructures (Fullerenes, CNT, Graphene), Quantum dots, porous silica, Core-shell structures and Nanocomposites. (3L)</p> <p>3.4 Synthesis of nanomaterials: Top down & Bottom-up approach(7L)</p> <ol style="list-style-type: none"> Chemical methods: Role of surfactant, Reduction, Colloidal method, Sol-gel methods, Hydrothermal, Microwave, Langmuir-Blodgett Method Physical methods: CVD, Laser Ablation, Arc discharge and Electrochemical methods. | <p>15L</p> |



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| Unit IV | <p>Bioinorganic Chemistry</p> <p>4.1 Biological oxygen carriers; hemoglobin, hemerythrin and hemocyanin- structure of metal active center and differences in mechanism of oxygen binding, Differences between hemoglobin and myoglobin: Cooperativity of oxygen binding in hemoglobin and Hill equation, pH dependence of oxygen affinity in hemoglobin and myoglobin and its implications.</p> <p>4.2 Activation of oxygen in biological system with examples of mono-oxygenases, and oxidases- structure of the metal center and mechanism of oxygen activation by these enzymes.</p> <p>4.3 Copper containing enzymes- superoxide dismutase, tyrosinase and laccase: catalytic reactions and the structures of the metal binding site.</p> <p>4.4 Nitrogen fixation-nitrogenases, hydrogenases</p> <p>4.5 Metal ion transport and storage: Ionophores, transferrin, ferritin and metallothionins</p> <p>4.6 Medicinal applications of cis-platin and related compounds</p> | 15L |
| <p>Standard References:</p> <p>Unit I</p> <ol style="list-style-type: none"> 1. F. Basalo and R. G. Pearson, Mechanism of Inorganic Reactions, 2nd Ed., Wiley, 1967. 2. Selected topics in Inorganic Chemistry, Wahid U Malik, G.D Tuli, R.D Madan. S.Chand and company. 12th edition. 3. Fundamental concepts of Inorganic Chemistry. Vol 5. Asim K. Das. CBS Publishers and distributors Pvt Ltd. <p>Unit II</p> <ol style="list-style-type: none"> 4. Organometallic Chemistry of Transition metals, Robert Crabtree, John Wiley & Sons publications, 4th edition. 5. Basic Organometallic Chemistry, B.D. Gupta & A. Elias, Universities Press, 2nd Edition 6. R.C Mehrotra and A. Singh, Organometallic Chemistry- A unified Approach, 2nd ed. New Age International Pvt Ltd, 2000. <p>Unit III</p> <ol style="list-style-type: none"> 7. Kulkarni, S. K. Nanotechnology: Principles and Practices, Capitol Publishing Company (2007) 8. Goyal, R.K. Nanomaterials and Nanocomposites: Synthesis, Properties, Characterization Techniques and Applications, CRC press, Taylor & Francis (2018) 9. Rao, C.N.R., Müller & Cheetham, A.K., Eds. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim (2004). <p>Unit IV</p> <ol style="list-style-type: none"> 10. I. Bertini, H.B. Gray, S. J. Lippard and J.S. Valentine, Bioinorganic Chemistry, First South Indian Edition, Viva Books, New Delhi, 1998. | | |



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11. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, University Science Publications, Mill Valley, California, 1994.

Additional References:

12. P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Inorganic Chemistry, 5th Ed., Oxford University Press, 2010.
13. D. Banerjee, Coordination Chemistry, Tata McGraw Hill, 1993.
14. M. L. Tobe and J. Burgess, Inorganic Reaction Mechanism, Longman, 1999.
15. S. Asperger, Chemical kinetics and Inorganic Reaction Mechanism, 2nd Ed., Kluwer Academic/ Plenum Publishers, 2002
16. Gurdeep Raj, Advanced Inorganic Chemistry-Vol.II, 12th Edition, Goel publishing house, 2012.
17. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2013-2014.
18. R. Gopalan and V. Ramlingam, Concise Coordination chemistry, Vikas Publishing house Pvt Ltd., 2001.
19. Robert B. Jordan, Reaction Mechanisms of Inorganic and Organometallic Systems, 3rd Ed., Oxford University Press 2008.
20. D. Banerjee, Coordination chemistry. Tata McGraw Hill, New Delhi, 1993.
21. B. Douglas, D.H. McDaniel and J.J. Alexander. Concepts and Models of Inorganic Chemistry, 2nd edition, John Wiley and Sons. 1983.
22. Organometallic Chemistry by G.S. Sodhi. Ane Books Pvt Ltd.
23. R. W. Hay, Bioinorganic Chemistry, Ellis Harwood, England, 1984.
24. J. A. Cowan, Inorganic Biochemistry-An introduction, VCH Publication, 1993.
25. G.N. Mukherjee and A. Das, Elements of Bioinorganic Chemistry, Dhuri & Sons, Calcutta, 1988.
26. J.Chem. Educ. (Special issue), Nov, 1985.
27. E.Frienden, J.Chem. Educ., 1985, 62.
28. Robert R. Creighton, Biological Inorganic Chemistry – An Introduction, Elsevier
29. J. R. Frausto da Silva and R. J. P. Williams The Biological Chemistry of the Elements, Clarendon Press, Oxford, 1991.
30. J.M. D. Yudkin and R. E. Offord A Guidebook to Biochemistry, Cambridge University Press, 1980.




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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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University of Mumbai**

Program: M.Sc. in Chemistry

Course: Inorganic Chemistry Practical II

Semester II

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





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M.Sc. Chemistry Practical Syllabus

| Semester II | | | |
|-------------|----------------------------------|---------|----------------|
| Course Code | Course Title | Credits | Practical/Week |
| PSCHEPR202 | Inorganic Chemistry Practical II | 02 | 01 |




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Semester II – Practical

| | | |
|---|---|--|
| Course: PSCHEPR202 | Course Title: Inorganic Chemistry Practical II | Credits: 02, Practical/Week: 01 |
| Objectives: <ol style="list-style-type: none">1. To understand analysis of ores and alloys.2. To understand the estimation of copper and Fe^{+3} potentiometrically Outcomes: <ol style="list-style-type: none">1. To determine the content of ores and alloys.2. To estimate copper and Fe^{+3} potentiometrically | | |
| Ores and Alloys <ol style="list-style-type: none">1. Analysis of Devarda's alloy2. Analysis of Cu – Ni alloy3. Analysis of Tin Solder alloy4. Analysis of Limestone. | | |
| Instrumental <ol style="list-style-type: none">1. Estimation of Copper using Iodometric method Potentiometrically.2. Estimation of Fe^{+3} solution using Ce(IV) ions Potentiometrically | | |
| 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> | | |

Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks



Dr. Deepak Pant
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