
# JAI HIND COLLEGE

Basantsing Institute of Science & J. T. Lalvani College of Commerce.

And Sheila Gopal Raheja College of Management

**Affiliated to University of Mumbai**

**Autonomous**

**Masters of Science (M.Sc in Inorganic Chemistry)**

## Semester I

| Course Code: PSCHE102 | Course Title: Inorganic Chemistry I |
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**Learning Objectives:**

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.

**Learning Outcomes:**

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.

## Semester I

| Course Code: PSCHEPR102 | Course Title: Inorganic Chemistry Practical I |
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**Learning Objectives:**

1. To understand the procedure to synthesize and characterize Complexes.
2. To apply the theoretical concept of equilibrium constant.
3. To explain conductance of electrolytic inorganic compounds

**Learning Outcomes:**

1. To explain the reactivity of the same ligand with different Metals.
2. To determine equilibrium constant $Fe^{+3}$/ $SCN^{-}$system by slope intercept methods
3. To determine Electrolytic nature of inorganic compounds by Conductance measurement.

## Semester II

| Course Code: PSCHE202 | Course Title: Inorganic Chemistry II |
|---|---|

**Learning Objectives:**

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.

**Learning Outcomes:**

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.

## Semester II

| Course Code: PSCHEPR202 | Course Title: Inorganic Chemistry Practical II |
|---|---|

**Learning Objectives:**

1. To understand analysis of ores.
2. To explain analysis of inorganic alloys
3. To understand the estimation of copper and $Fe^{+3}$ potentiometrically

**Learning Outcomes:**

1. To determine the content of ores
2. To determine the content of inorganic alloys.
3. To estimate copper and $Fe^{+3}$ potentiometrically

## Semester III

| Course Code: PSCHE2301 | Coordination and Bioinorganic Chemistry |
|---|---|

**Learning Objectives:**

1) To understand Structure, Bonding & Stereochemistry of coordination Compounds.
2) To introduce the electronic spectra and magnetic properties of complexes.
3) To describe the concept of Advanced Bioinorganic Chemistry& reactivity of chemical species.

**Learning Outcomes:**

1) To explain MOT stereochemistry of coordination complexes.
2) To calculate magnetic moment and magnetic susceptibility.
3) To summarise the role of metal ions in biological electron transfer processes.

## Semester III

| Course Code: PSCHEP2301 | Course Code: Practical Coursework I |
|---|---|

**Learning Objectives:**

1. To train students in calibration of instruments
2.To equip the students with practical skills in instrumental & non-instrumental methods.
3. To train them with analysis of different experimental approaches.

**Learning Outcomes:**

1. To learn handling of instruments in the lab and perform chemical assays
2. To calibrate glasswares and laboratory instruments
3. To design experiments for instrumental and non-instrumental assays.

## Semester III

| Course Code: PSCHE2302 | Course Title: Atomic, Molecular Structure & Spectroscopy |
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**Learning Objectives:**

1. To understand the advantages of approximation methods for solving complex problems.
2. To explain bonding in simple molecules with Valence bond theory, Molecular orbital theory
3. To understand the principles and theories of rotational, vibrational Raman, ESR, Mossbauer and NQR spectroscopy.

**Learning Outcomes:**

1. To apply approximation methods for solving complex problems.
2. To describe bonding in simple molecules using MOT and VBT.
3. To interpret rotational, vibrational Raman, ESR, Mossbauer and NQR spectra of different molecules.

## Semester III

| Course Code: PSCHEP2302 | Course Title: Practical Coursework II |
|---|---|

**Learning Objectives:**

1. To equip the students with practical skills in synthesis of coordination compounds.
2. To explain the characterisation of coordination compounds
3. To understand the instrumental methods used for coordination complexes

**Learning Outcomes:**

1. To acquire laboratory skills in the synthesis of coordination complexes
2. To characterize coordination compounds
3. To measure using instrumental methods.

## Semester III

| Course Code: PSCHE2303 | Course Title: Nanochemistry and Nanotechnology |
|---|---|

**Learning Objectives:**

1) To understand various chemical and physical methods for the synthesis of diverse types of nanomaterials (0D, 1D and 2D).
2) To establish various characterization techniques for nanomaterials
3) To introduce different application of nanotechnology in the field of energy.

**Learning Outcomes:**

1) To explain the synthesis of metal nanoparticles.
2) To assess physical properties of materials and make decision on their application in energy conversion devices.
3) To describe the principles of Scanning Electron Microscope (SEM) and its use in characterizing nanoparticles.

## Semester III

| Course Code: PSCHEP2303 | Course Title: Research Methodology |
|---|---|

**Learning Objectives:**

1) To understand a general definition of research design.
2) To familiarize with how to write a good introduction to educational research study and the components that comprise such an introduction.
3) To understand the research objectives stated in the study.

**Learning Outcomes:**

1) To identify a research problem stated in a study.
2) To distinguish a purpose statement and research question
3) To identify and state research hypothesis and research objective

## Semester III

| Course Code: PSCHE2304 | Course Title: Application of Materials & Nuclear Chemistry |
|---|---|

**Learning Objectives:**

1) To understand advanced concept of Metals and alloys.
2) To introduce the mechanical properties of solid materials.
3) To introduce the concept, working and application of lasers.

**Learning Outcomes:**

1) To explain the growth of single crystal, defect and atomic diffusion in solids.
2) To identify mechanical properties of solid materials.
3) To classify different laser and its application in Chemistry.

## Semester III

| Course Code: PSCHEP2304 | Course Title: Literature Review |
|---|---|

**Learning Objectives:**

1. To understand the importance of literature review
2.To understand the existing research and debates relevant to a particular topic or area of study
3. To make them present the knowledge in the form of a written report.

**Learning Outcomes:**

1. To utilize tools for literature review
2. To critically write review and conclude its finding.
3. To write a knowledge report

## Semester IV

| Course Code: PSCHE2401 | Course Title: Organometallics and Inorganic Polymers |
|---|---|

**Learning Objectives:**

1. To explain the metal-metal bonding in inorganic clusters and cage compounds.
2. To explain the application of organic compounds in coupling reactions.
3. To introduce the preparation, properties and application inorganic polymers.

**Learning Outcomes:**

1. To describe the bonding in boranes, heteroboranes, carboranes and cluster compounds.
2. To identify the application of organic compounds in coupling reactions.
3. To define the different preparative methods, various properties and applications of inorganic polymers.

## Semester IV

| Course Code: PSCHEP2401 | Course Title: Practical Coursework III |
|---|---|

**Learning Objectives:**

1.To solve problems in chemistry through experiments.
2. To understand designing of experiments
3. To familiarize with standardization protocols

**Learning Outcomes:**

1. To design experiments
2. To gain experimental skills to solve problems in chemistry
3. To perform standardization protocols

## Semester IV

| Course Code: PSCHE2402 | Course Title: Solid State Chemistry |
|---|---|

**Learning Objectives:**

1. To understand the Structure, properties and Synthesis of solids.
2. To understand the crystal defects and non-stoichiometry.
3. To introduce the Electrical and Magnetic Properties of solids.

**Learning Outcomes:**

1. To distinguish between different structures of solids and various methods to synthesize it.
2. To identify different types of defects and its applications.
3. To describe the electrical, magnetic, thermal and optical properties of solid.

## Semester IV

| Course Code: PSCHEP2402 | Course Title: Practical Coursework IV |
|---|---|

**Learning Objectives:**

1. To understand quality control procedures
2. To evaluate commercial samples, ores and alloys for their percentage assay.
3. To familiarize with errors in measurement

**Learning Outcomes:**

1. To learn quality control procedures,
2. To calculate errors in measurement and comparison against standards.
3. To measure commercial samples, ores and alloys.

## Semester IV

| Course Code: PSCHE2403 | Course Title: Photochemistry and Advanced Spectroscopy |
|---|---|

**Learning Objectives:**

1. To introduce the concept of Photochemistry & Photocatalysis.
2. To understand the principal and application of fluorescence phenomena.
3. To describe the principal, instrumentation and applications of advanced Spectroscopic Techniques-I& II.

**Learning Outcomes:**

1. To apply the principles of Photochemistry & Photocatalysis in water splitting, $CO_2$ reductions etc.
2. To describe the phenomena and mechanism of fluorescence quenching.
3. To elucidate the structure of molecules applying advanced Spectroscopic Techniques-I & II.

## Semester IV

| Course Code: PSCHEP2403 | Course Title: Spectral Interpretation |
|---|---|

**Learning Objectives:**

1. To understand the principle of instruments
2. To elucidate structural information about molecules from their spectral data.
3. To learn interpretation of Spectral data obtained from UV/IR/NMR/Mass/XRD

**Learning Outcomes:**

1. To use UV/IR/NMR/Mass/XRD instruments.
2. To deduce structure of molecules from spectral data
3. To interpret UV/IR/NMR/Mass/XRD spectra and its analysis.

## Semester IV

| Course Code: PSCHE2404 | Course Title: Materials, Devices and Computational Chemistry |
|---|---|

**Learning Objectives:**

1. To describe different photovoltaic cells and its applications in batteries and supercapacitors.
2. To introduce the concept of organic semiconductors, optoelectronic devices.
3. To introduce the of Intellectual Property Rights & Cheminformatics.

**Learning Outcomes:**

1. To identify different type photovoltaic cells and its applications in batteries and supercapacitors.
2. To explain the working of organic semiconductors, optoelectronic devices.
3. To describe Intellectual Property Rights & Cheminformatics

## Semester IV

| Course Code: PSCHEP2404 | Course Title: Research Project |
|---|---|

**Learning Objectives:**

1. To understand and create a research problem
2. To make them learn designing of a research problem
3. To make them investigate the research problem experimentally through a project.

**Learning Outcomes:**

1. To state a proper research problem

2. To create a research design and understand research workflow- literature review,

3. To identify research problem and investigation