SYLLABUS

M. Phil. (Chemistry)

DEPARTMENT OF CHEMISTRY
PONDICHERRY UNIVERSITY
PONDICHERRY – 605 014
The Department of Chemistry belongs to the School of Physical, Chemical and Applied Sciences and it offers different programs leading to M. Sc. Integrated Program in Chemistry, M. Sc. Chemical Sciences, M. Phil. Chemistry and Ph.D. degrees. Students are admitted to M.Sc. Integrated program in Chemistry after 10+2 system of schooling, M.Sc. Chemical Science after three year under-graduation, M.Phil. Chemistry and Ph.D. after two year post-graduation. Details of eligibility criteria are available in the information brochure. Normally students are expected to take 10 semesters for M.Sc. Integrated program, 4 semesters for M.Sc. and 2/3 semesters for M.Phil. to complete requirements for the degree. The department follows Choice Based Credit System (CBCS). The students are expected to earn at least 192 credits for M.Sc. integrated program, 72 credits for M.Sc. and 36 credits for M.Phil. It is mandatory for the students to clear all the hard core courses and exercise selection from among the soft-core courses offered by the Department. Apart from the courses taken within the department, students are expected to take optional courses from among the breadth courses offered by sister departments in the University.

M.Sc. integrated and M.Sc. Chemical Sciences students are expected to do project work spanning one semester in the final year. In addition, the students also do advanced practical. Both the advanced practical and the project courses are faculty oriented. Students are tuned to research in chemistry under the guidance of the selected faculty member.

The Department strives to provide broad based education in Chemistry at graduate, post-graduate and research levels. The students are expected to evolve interdisciplinary attitudes while going through various programs of the Department and the University.
M. Phil. Chemistry
Course Structure

1\textsuperscript{st} Semester:

1. Chemical Bonding And Reactivity - CHEM 660; 6 Credits; HC
2. Physical Methods in Inorganic Chemistry - CHEM 602; 6 Credits; SC
3. Advanced Topics in Organic Chemistry - CHEM 622; 6 Credits; SC
4. Theoretical and Computational Chemistry - CHEM 662; 6 Credits; SC

Any Two of the following Three Courses:

Number of Credits for the Semester = 18

2\textsuperscript{nd} and 3\textsuperscript{rd} Semesters:

1. Dissertation - CHEM 702; 15 Credits; HC
2. Viva – Voce - CHEM 703; 3 Credits; HC

Number of Credits for the Semester = 18
M.PHIL COURSES

CHEM 660 CHEMICAL BONDING AND REACTIVITY
Pre-requisite: M. Sc. Chemistry / Chemical Sciences; HC
Credits: 6

UNIT – I
Elements of Quantum Chemistry

UNIT – II
Bonding & reactivity of Transition metal complexes:
CFT, LFT, angular overlap model, electronic spectra and magnetic properties, exchange interactions, EPR – reactions of coordination compounds – electron transfer reactions

UNIT – III
Reactivity of Organic Molecules. Pericyclic Reactions:

Recommended Books:
1. M. Karplus and Porter, Atoms & Molecules
3. P. W. Atkins, Molecular Quantum Mechanics
6. B. N. Figgis, Ligand Field Theory, Wiley Eastern

CHEM 602 PHYSICAL METHODS IN INORGANIC CHEMISTRY
Pre-requisite: M. Sc. Chemistry / Chemical Sciences; SC
Credits: 6

UNIT – I
Magnetic Susceptibility:
Basic Theory, spin only moments, spin orbital interactions, temperature dependence of magnetic susceptibility – methodology: Guoy, Faraday, VSM, SQUID.

UNIT – II
Spectral Techniques:
NMR of paramagnetic molecules, contact and dipolar shifts, $^{15}$N, $^{19}$F, $^{91}$P NMR, NMR of heavy nuclei – Mossabauer spectroscopy: basic principles, instrumentation and applications – ESCA – Auger – EXAFS – XANES.

UNIT – III
EPR of Transition metal ions:
Spin Hamiltonian, spin-orbital coupling, g and A matrices, solutions to S=1/2 systems in various ligand fields, $d^9$, $d^1$, $d^5$ systems, S>1/2 systems, zero-field splitting – single crystal and powder spectra – spin-lattice and spin-spin relaxation.

Recommended Books:
1. A. Abragam and B. Bleaney, Electron Paramagnetic Resonance, Dover, 1986

CHEM 622 ADVANCED TOPICS IN ORGANIC CHEMISTRY
Pre-requisite: M. Sc. Chemistry/Chemical Sciences; SC
Credits: 6

UNIT – I
Recent Advances in Structure Determination of Organic Molecules:
Spectrometric methods in organic molecules – pulsed NMR techniques ($^1$H and $^{13}$C) – application of 2-D NMR – mass spectrometric techniques, parent and daughter ion analysis – problem solving exercises

UNIT – II
Molecular Recognition:
Designed Host-Guest relationships ( based on oxygen, nitrogen and aromatic macrocycles) – molecular recognition in biochemical process – Thermodynamics, kinetics and stereochemistry in molecular recognition
UNIT – III
Topics in Stereochemistry:
Conformational flexibility in large rings (seven to eleven) – asymmetric synthesis – application of chiral auxiliaries in asymmetric synthesis

Recommended Books:

UNIT – I
Extended Huckel Theory:

UNIT – II
Potential Energy & Surfaces:

CHEM 662 THEORETICAL AND COMPUTATIONAL CHEMISTRY
Pre-requisite: M. Sc. Chemistry/Chemical Sciences; SC Credits: 6

UNIT – IV
Molecular Mechanics:
Quantum Mechanical and Molecular Mechanics potential functions. MM force fields. Parameterization. Steric energies, Heats of formation and strain.

UNIT – V
Laboratory Sessions:

Recommended Books:
5. PCMODEL Manual and Computer program, Serena Software

CHEM 646 Advances in Nanomaterials and Photo catalysis
Pre-requisites: M.Sc Chem./Chemical Sciences; SC Credits: 6

UNIT – I

UNIT – II
Investigation and Manipulation of Nanomaterials

UNIT – III
Photocatalysis: Semiconductors, metal-

**Recommended books**


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**CHEM 702 DISSERTATION**

*Pre-requisite: Consent of Teacher*

*HC; Credits: 15*

Students are selected on the basis of their performance in the M. Phil entrance examination. They are allotted to various faculties of the department according to their choices and availability of position. Selected students will work independently on specialized problems related to the research interests of the respective guides. They will also submit a report on completion of the project which will be evaluated by the guide and an external examiner.

**CHEM 703 VIVA – VOCE**

*Pre-requisite: CHEM 702; HC; Credits: 3*

Students who have completed CHEM 702 will defend their work in a viva-voce in presence of examiners.