University of Pune
Department of Chemistry

Syllabus for M.Phil. / Ph.D. course in Chemistry
(to be implemented from academic year 2010 – 11)

Course Structure

Course I : Research methodology 100 marks ( 05 credits)
Course II : Advances in Chemistry 200 marks ( 10 credits)
Course III : Seminar, Field work & Review Writing 100 marks ( 05 credits)
Syllabus for M.Phil. / Ph.D. course in Chemistry to be implemented from academic year 2010 - 11

Course I : Research methodology 100 marks ( 05 credits)

Fundamental Laboratory Techniques : Basic principles, Health and safety, working with liquids, Basic laboratory procedures I, Basic laboratory procedures II, Principles of solution chemistry, pH and buffer solutions (Ref. 1. Chapters 1 to 7 : pages 03 to 62)

The investigative approach : Making and recording measurements, SI units and their use, Scientific method and design of experiments, Project work (Ref. 1. Chapters 8 to 11 : pages 65 to 83)

Analysis and presentation data : Using graphs, Presenting data in tables, Hints for solving numerical problems, Descriptive statistics, choosing and using statistical tests, drawing chemical structures, chemometrics, computational chemistry (Ref. 1. Chapters 37 to 44 : pages 251 to 295)

Information technology and library resources : The Internet and World Wide Web, internet resources for chemistry, using spreadsheets, word processors, databases and other packages, finding and citing information (Ref. 1. Chapters 45 to 49 : pages 299 to 321)

Communicating information : General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation examinations (Ref. 1. Chapters 50 to 56 : pages 325 to 354)

Chemical safety and Disaster Management :

(a) Emergency response : chemical spills, radiation spills, biohazard spills, leaking compressed gas cylinders, fires, medical emergency accident reporting
(b) **General safety** : General safety and operational rules, safety equipments, personal protective equipments, compressed gas safety, safety practices for disposal of broken glass wares, centrifuge safety, treated biomedical wastes and scientific ethics.

**Research problem** : meaning of research problems, sources of research problems, criteria / characteristics of a good research problem, errors in selecting a research problem.

**Hypothesis** : Meaning, types of hypothesis.

**Developing a Research Proposal** : Format of research proposal, individual research proposal and institutional proposal.

**Research Report** : Format of the research report, style of writing the report, references and bibliography.

**Books** :


2. OSU safety Manual 1.01.

3. Research Methodology. Methods and Techniques : C. R. Kothari,

Course II : Advances in Chemistry 200 marks (10 credits)

Student can opt any one of the following

(I) Advances in physical chemistry (10 credits)

Part A 100 Marks (5 credits)

Analytical Techniques : Any Five

Principle, Instrumentation, Applications, Analysis and Interpretation of the data for the following techniques:

UV-Visible Spectrophotometry, IR, GCMS, TG-DTA, Nuclear Analytical Techniques, Fluorimetry, NMR, AAS, ICPAES, XRD. Use of Fortran and C ++ programs

Part B 100 Marks (5 credits)

Any two of the following modules:

a. Chemistry of Materials

b. Molecular Modeling and Computational Chemistry

Methods based on Hartree-Fock, Configuration Interaction

Deriving one and two electron properties

Semi-empirical methods

Coupled Cluster theory

Density functional theory, TDDFT

Molecular Dynamics

Drug Discovery and Drug Design

c. Electrochemistry and Electroanalytical Techniques

d. Environmental Chemistry

e. Advanced Topics in Kinetics and Thermodynamics

f. Radiation and Photochemistry
References

8. Chemistry and light by Paul Suppan, The Royal Society of Chemistry


33. Handbook of Instrumental Techniques for Analytical Chemistry Editor by Frank Settle Pearson Education (Singapore).
34. Nanoscale Materials in Chemistry Editor by Kenneth J. Klabunde John Wiley & Sons
(II) Advances in Inorganic chemistry         200 Marks (10 credits)

Part A       100 Marks (5 credits)

1. Chemistry of metals / non-metals (minimum two)

2. Chirality in transition metal Chemistry

3. Biological Inorganic Chemistry

4. Bioorganometallic chemistry

5. Physical methods in Inorganic Chemistry (a) Raman spectroscopy

(b) XPS spectroscopy

Part B       100 Marks (5 credits)

1. Nanomaterials and nanostructures

2. Chemistry of materials (a) Magnetic oxides

(b) Superconductors

(c) Ferroics

3. Surface Science and heterogeneous catalysis

4. Environmental Toxicants

5. Modern Analytical Methods : (a) Inductively coupled plasma spectrometry

(b) Advanced separation techniques :

   i. High performance liquid chromatography

   ii. Gas chromatography for separation and Mass Spectrometry (GC/MS)
Books:


3. Biological Inorganic Chemistry, Robert R. Crichton

4. Bioorganometallic chemistry, Volume Editor G. Simonneaux ( Springer, 2009)

5. Physical methods for chemists R.S. Drago (Saunder Co. 1992)

6. Nanomaterials and nanostructures, Laura Costlow, April Feter (Dominant Publisher,2007)


14. High Performance liquid chromatography : Principles and Methods, Elena D. Katz (John Wiley & Sons Ltd. 2009)


OR

(III) Advances in Organic chemistry 200 Marks (10 credits)

Part A : Advances in Organic Chemistry 100 Marks (05 credits)

1. Advances in C-C bond formation 20 lectures
2. Advances in C-Heteroatom bond formation 10 lectures
3. Retrosynthetic analysis and selected total synthesis 20 lectures
4. Biomolecules and biological activity determination. 10 lectures

Part B : Reaction Mechanism, Stereochemistry & Spectroscopy 100 Mark (5 credits)

1. Advanced stereochemistry and asymmetric synthesis. 15 lectures
2. Reactive Intermediates, reactions and Rearrangements 15 lectures
3. Spectroscopy
   i. Introduction to IR, UV, !HNMR, 13CNMR,Ms techniques 05 lectures
   ii. Introduction to COSY, HSQC, HMBC,NOESY, ROSEY 10 lectures
   iii. Techniques like X-ray, LCMS, GCMS, HPLC, HRMS 05 lectures
   iv. Application of the spectral and analytical techniques 10 lectures
   for structure determination.

Books:
   F.A.Carey and R.J.Sundberg
2. Organic Chemistry
Clayden, Greeves, Warren and Wothers

3. Advanced organic chemistry by J. March, 6th Ed.

(Harcourt college publishers).

5. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster,

6. Stereochemistry of carbon compounds - E. L. Eliel

7. Some modern methods of organic synthesis – W. Carruthers (Cambridge)

8. Organic synthesis – M. B. Smith
Course III : Seminar, Field work & Review Writing* 100 marks (05 credits)

1. **Seminar** : Seminar to be delivered on a relevant theme (01 credits)

2. **Field Work** : Visit to industry/National institutes and interaction with experts. (Report to be submitted) (01 credits)

3. **Review** : Preparation and submission of review article based on research papers addressing a contemporary research problem. (02 credits)

4. **Other activities** : Attending National / International workshop / Symposium / Conferences or participation for oral / poster presentation or interaction with M.Sc. students for problem solving approaches / Work of Nobel laureates in last ten years in Science. (01 credits)

* Above topics shall be prepared in consultation with research guide