



University of Mysore

(Estd.1916)

CHEMISTRY

Ph.D Course work Syllabus



Department of Studies in
Chemistry
Manasagangotri, Mysore
570006



Programme outcome

Students will have a strong foundation in the fundamental and applications of several topics of the chemistry. Students will be able to learn all spectroscopic techniques and interpret the spectral data of chemical compounds. The students will be able to explore the concept of research, research tools and different types of research.

Course outcome

After the completion of this course, the research students gain the knowledge of types of research, research tools and methodology. This course helps to understand the Separation and purification techniques, different spectroscopic techniques used to establish the structure of the chemical compounds.

UNIVERSITY OF MYSORE

Department of Studies in Chemistry, Manasagangotri, Mysore – 06 Ph.D Programme in chemistry

Course – I: Research Methodology and Applied Chemistry

In Paper – I, there will be three units of 16 hours each. The units are as follows:

Unit – I: Research Methodology

Unit – II: Spectroscopy and Thermal Methods of Analysis

Unit – III: Advanced Chemistry, giving equal weightage for all the four branches of Chemistry *viz.*, Analytical/Inorganic/Organic/Physical.

A student has to study this course and appear for the written examination for 70 marks conducted by the university. The remaining 30 internal assessment marks is distributed as follows: A student has to present one seminar and submit one assignment during the course work. Seminar will be assessed for 05 marks and Assignment will be assessed for 05 marks. Further, at the end of the course work average marks will be taken for seminar and assignment/s separately. Two internal assessment tests are conducted for 10 marks each during the course work.

C1		C2	
Internal Assessment test	40 Marks (10+10+10+10) reduced to 10	Internal Assessment test	40 Marks (10+10+10+10) reduced to 10
Home assignment	20 Marks (5+5+5+5) reduced to 05	Seminar	20 Marks reduced to 05
Total	15 Marks	Total	15 Marks

End examination will be conducted for **70 Marks**

The total marks for course –I is 100 (**C1 + C2 + C3 = 15 + 15 + 70**)

Course – II: Review of Literature in the Area of Research

In Paper – II, a student has to present two seminars, one during 8th week and another during 15th week of the course. In seminar- I, a student has to highlight his/her broad area of the research work and in seminar- II the review of literature, objectives etc should be given. It is stated in the letter No: UOM/DOR/5/Ph.D/2011-12 dated 26/08/2011 [(d) on page 2] that Department Council shall assess the students for Paper – II in the area of research paper. **The members in the Department Council of the DOS in Chemistry resolved that Doctoral Committee members (Guide, Chairman of the department and two senior faculty members) shall assess the same.**

C1		C2	
Seminar presentation and report	30 Marks reduced to 15	Seminar presentation and report	30 Marks reduced to 15
Total	15 Marks	Total	15 Marks

End examination will be conducted for **70 Marks** (Report evaluation and viva)

The total marks for course –II is 100 (**C1 + C2 + C3 = 15 + 15 + 70**)

Syllabus for Ph.D. Course Work

Course – I : Research Methodology and Applied Chemistry

Objectives:

To, understand the concept of research and different types of research in the context of chemistry.

Learn literature review on the required topic.

Develop Laboratory experiments related skills.

Study different methods of scientific writing and reporting.

Learn the applications of different spectroscopic techniques for the characterization of the chemical compounds.

Learn statistical treatment of analytical data

Study different purification and separation techniques

Study periodic properties of the elements.

Study solid state chemistry and electrochemistry

Course outcome:

Students are familiar about literature review on the research topic, writing and submission of research papers

Gain the knowledge on purification and separation of chemical compounds and characterize using different spectroscopic techniques.

Understand the periodic properties of elements, solid state chemistry and electrochemistry

Pedagogy:

Conventional methods such as black board and chalk can be used.

Modern methods like power point presentation and ICT method is adopted for teaching.

Molecular models are used for necessary topics.

UNIT – I

RESEARCH METHODOLOGY

Nature, need, scope of research; Types of research: fundamental and applied

Tools and Techniques of Research: Use of library, research books, monograph, periodicals, abstracts, documents, use of internet in chemical literature search.

Reporting of Research: Form and style, format, questions, footnotes, bibliographical references, tables, figures, elucidations, typing of thesis, writing research papers/dissertation, submission, hardcopy, online submission, e-submission etc.

UNIT – II

SPECTROSCOPY AND THERMAL METHODS OF ANALYSIS

Principles and applications of UV-Vis, IR, NMR (^1H , ^{13}C , ^{19}F , ^{31}P and ^{11}B), mass, ESR and NQR spectroscopy for the structural elucidation of compounds.

Two Dimensional NMR Spectroscopy: COSY, NOSEY, INDOR and SPI, DEPT spectra, CIDNP techniques and MRI.

Thermal Methods of Analysis: Principle and applications of TGA, DTA and DSC; Cyclic voltammetry.

UNIT – III

ADVANCED CHEMISTRY

Statistical Treatment of Analytical Data: Student's t-test, Confidence interval of the mean, testing for significance – comparison of the means and two standard deviations.

Standardization and Calibration: Comparison with standards – direct comparison and titrations, External standard calibration – the least square method. Figures of merit of analytical methods – sensitivity and detection limit, linear dynamic range.

Concepts of Acids and Bases: Bronsted-Lowry, Lux-Flood, Lewis, Hard and soft acids and bases(HSAB).

Solvent Systems: Liquid ammonia, acetic acid and sulphuric acid

Periodic properties, catalytic applications, organometallic compounds, metal-metal bonding, spectral and magnetic properties of d- and f-block elements, NMR shift reagents.

Separation techniques

Purification: Crystallization, sublimation, fractional crystallization, distillation techniques (simple distillation, steam distillation, distillation under reduced pressure, fractional distillation)

Solvent extraction

Chromatography: Thin layer chromatography, Column chromatography, Paper chromatography, Gas liquid chromatography, Ion exchange chromatography, High pressure liquid chromatography (HPLC)

Gel Permeation Chromatography: Size exclusion chromatography (Gel filtration) with special reference to separation of proteins, carbohydrates and nucleic acids.

Solid State Chemistry: Crystal and molecular structure studies of organic and inorganic compounds by x-ray crystallography (single crystals), crystal growth, programmes used to solve structure, structure refinement, CIF, CIF-tab, R-value, WinGX, Platon, Ortep, enCifer, Mercury,

CCDC, CSD, Bond-lengths and bond angles, torsion angle, Hydrogen bonding interactions, Packing, Disorder, Polymorphism & pseudopolymorphism.

Electrochemistry: Electrochemical oxidation and degradation of organic compounds, synthesis of nano materials by hydrothermal, electrochemical and solgel methods, Applications: Photodegradation, catalytic reactions and electrical, Effect of inhibitors on the rate of corrosion.

References:

1. Organic Spectroscopy, William Kemp, English Language Book society, Macmillan, 1987.
2. Application of Absorption Spectroscopy of Organic Compounds, John R. Dyer, Prentice Hall of India Private Ltd., New Delhi, 1974.
3. Spectrometric Identification of Organic Compounds, 4th edition, Robert M. Silverstein, G. Clayton Bassler and Terence C. Morrill, John Wiley & Sons, New York, 1981.
4. An Introduction to Practical Organic Chemistry – Robert, Vingrove etc.
5. Fundamentals of Analytical Chemistry, Skoog, West, Hollar and Crouch, 8th Ed.
6. Modern Analytical Chemistry by David Harvey, 3rd Ed.
7. K. Albert, L. Lehninger, D.L. Nelson, M.M. Cox, Principles of Biochemistry, CBZ publishers, 1st edition, New Delhi, 1993.
8. Encyclopedia of Chemical Technology – Kirck-Othmerseries.
9. Inorganic Chemistry (4th edition): J.E. Huheey, E.A. Keiter and R.L. Keiter.
10. Advanced Inorganic Chemistry (5th edition): F.A. Cotton and G. Wilkinson: Wiley
11. An Introduction to X-ray Crystallography, Michael M. Woolfson
12. Crystal Structure Determination, Werner Massa & Robert O. Gould
13. Introduction to Electrochemistry by S. Glasstone.

