

M.Phil DEGREE COURSE IN CHEMISTRY



MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL – 624 101

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KODAIKANAL

M.Phil. CHEMISTRY SYLLABUS

1. Objectives:

1. To introduce and provide knowledge of research methodology.
2. To provide a sound knowledge in the advanced concepts of chemistry.
3. To impart research aptitude and provide adequate training in synthesis, characterization, instrumentation
4. To provide an exposure to research

2. Eligibility for Admission

A candidate who has secured 50% marks or above in the M. Sc. Chemistry degree examination shall be eligible for admission.

The duration of the course shall be for two academic years consisting of four semesters

3. Course Features

The M. Phil. Chemistry degree course comprises of four theory papers. The paper Professional skill is common for all the courses.

The duration of the course shall be for one academic years consisting of two semesters

The paper on the topic of research concerns with the area of specialization chosen by the candidate under a guide which will be related to the project work. It is purely internal (Syllabus framing and question setting)

Each candidate will submit a dissertation on a topic in chemistry after carrying a research project under the supervision of the guide. The duration of the project will be for six months or more as per the discretion of the Department. The project dissertation will be evaluated by an external examiner and viva voce will be conducted by a committee consisting of the guide and the department faculty.

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M.Phil. CHEMISTRY

S. No	Code	Subject	Hours	Credits	Internal	External	Total
		First Semester					
	MCHT11	Research Methodology	6	4	40	60	100
	MCHT12	Advances in Chemistry	6	4	40	60	100
	MPST13	Professional skills	6	4	40	60	100
		Second Semester					
	MCHA21	Area Paper for thesis	6	4	40	60	100
	MCHD21	Dissertation		14(12+2)		200	200
Total				30			600

SEMESTER I

PAPER I

MCHT11

RESEARCH METHODOLOGY

6 hours /4 credits

Objectives

1. To introduce the purpose and importance of research
2. To impart knowledge in the various methods of research.
3. To learn the scientific method of collecting data and to compute statistical parameters to arrive at meaningful conclusions.
4. To know the methodology of writing thesis and journal articles.

Unit I

Philosophy of Science and literature survey

Literature survey – Sources of information – Primary, Secondary, Tertiary sources – Chemical Journals – Journal abbreviations. Chemical abstracts – Subject Index, Author Index, Formula Index and other Indices with examples. Dictionary of Compounds – Beilsteins and other hand books

Web resources – E-Journal – Citation index – Impact factor – H-Index – E-Consortium – UGC infonet – E-Books – Search engines: Scirus, Google Scholar, Chem Industry, Wiki – Databases: Chem Spider, Science Direct, SciFinder, Scopus

Unit II

Methodology of Scientific Document Writing

Introduction to technical writing-types of report, title and abstract, the text-style and conventions in writing. Writing dissertation and thesis – Title, Abstract, Introduction, Literature Review, Experimental Methods, Results and Discussion, Foot notes, Figures, Data Presentation, Tables, Sign Conventions followed – Conclusions and Recommendations – Bibliography.

Preparation of manuscript and posters – writing review article and book reviews – preparing research proposals for grants – ethics in scientific publication – formats for some national and international journals.

Unit III

Data Analysis

True value - standard value - observed value – Error – Types of Errors – Accuracy – Precision, Error Analysis, Minimization of Errors, Deviation from Accurate Results - the Binomial Distribution – the Gaussian Distribution – Mean - - Median – Deviation – from Mean and Median – student’s t-test, F-test – Significant figures in multiplication – Division – Addition and Subtraction – Curve Fitting method of Least Squares – Linear Regression – Multiple Linear Regression – Slope – Intercept and Correlation Coefficient

Unit IV

Good Laboratory Practices and safety

Introduction: History, definition, principles, Good laboratory practices (GLP) and its application. GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring.

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation, Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

Unit V

Analytical techniques and Nanochemistry

The principle, instrumentation and applications of TGA/ DTA/DSC, SEM &TEM, AAS techniques.

Nanochemistry

Basic idea of nanochemistry - Defining nanoassemblies - Simple methods of preparation of nanomaterials - Techniques for the characterization of nanomaterials - AFM and SEM - Important applications of nanomaterials.

Fullerenes – carbon nanotubes - biomaterial-functionalized nanoparticles.

REFERENCES

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3. M. Coghill and L. R. Gardson, The ACS Style Guide – Effective Communication of Scientific information, 3rd Edn, Oxford University Press, 2006.
4. H. Beall and J. Trimbur, A short Guide to Writing about Chemistry, 2nd Edn, Longman, 2001.
5. J. Anderson, B.H. Durston and M. Poole, “Thesis and Assignment Writing”, John Wiley, Sydney 1970.
6. R. Berry, “How to Write a Research Paper”, Pergamon, Oxford, 1986.
7. Ralph Berry, “The Research Project: How to Write It”, 4th Ed., Routledge, Taylor and Francis, London, 2000.
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9. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, New Delhi, 1993.
10. D. Brynn Hibbert and J. Justin Gooding, Data Analysis, Oxford University Press, New York, 2006.
11. C. R. Kothari, Research Methodolgy, Methods and Techniques, Wiley Eastern Ltd, New Delhi, 1991.
12. Handbook Good Laboratory Practice (GLP) Quality Practices for Regulated Non-Clinical Research and Development
13. Willa Y. Garner, Maureen S. Barge, and James. P, Good Laboratory Practice Standards: Applications for Field and Laboratory Studies (ACS Professional Reference Book)
14. Chemical safety matters-IUPAC –IPCS, Cambridge Univ. Press, 1992.
15. G. D. Christian & J. E. O’Reily, Instrumental Analysis, 2nd Ed., Allyn & Balon, 1986.
16. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Instrumental Methods of analysis, 7th ed., CBS publishers, New Delhi, 1986.
17. D. A. Skoog, F. J. Holler and T.M. Niemann, Principles of Instrumental Analysis, 5th Ed., Harcourt Asia Pvt. Lts., 2001
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19. F. A. Settle, Ed. Handbook of Instrumental Technique for Analytical Chemistry, Pearson Edn., India, 1997.
20. C. N. R. Rao, A. Muller, A. cheethan, Eds. The chemistry of Nanomaterials, Wiley, New York, 2004.
21. D. L. Feldheim, C. A. Fross, Jr. Metal Nanoparticles: Synthesis, Characterisation and Applications; Dekker; New York, 2002.
22. G.L. Hornyak, J. Dutta, H.F. Tibbals, A.K. Rao, Introduction to Nanoscience, CRC Press, 2008.

Paper II

MCHT12

ADVANCES IN CHEMISTRY

6 hours /4 credits

Objectives

1. To impart knowledge and understanding in the advanced concepts of organic chemistry
2. To impart knowledge and understanding in the advanced concepts of inorganic chemistry
3. To impart knowledge and understanding in the advanced concepts of physical chemistry
4. To impart research aptitude and provide adequate training in synthesis, characterization, instrumentation

Unit I

Advanced Organic Chemistry

Organic Synthesis - Synthetic planning, Retrosynthetic analysis and disconnection method, Functional group protection.

Asymmetric Synthesis - Basic principles, Asymmetric synthesis using chiral reagents, Asymmetric catalysis, catalytic asymmetric alkylation, hydrogenation, reactions catalysed by enzymes and other proteins. Organo transition metal chemistry-Applications to asymmetric synthesis.

Green Chemistry –Twelve principles of green chemistry - Green chemical methods of synthesis-use of microwaves in organic synthesis - solventless reactions - green solvents - supercritical fluids for extraction - ionic liquids

Unit II

Advanced Physical Chemistry

Electrochemical Techniques

Principles of polarization techniques, Principles of voltammetry, cyclic voltammetry.

Fluorescence Spectroscopy - characteristics-fluorescence anisotropy - resonance energy transfer-steady state and time resolved fluorescence – molecular information from fluorescence – new fluorescence technologies - multi photon excitation - fluorescence correlation spectroscopy-single molecular detection.

Unit III

Advanced Inorganic Chemistry

Spectral and Magnetic properties of complexes: Electronic spectra of metal complexes, selection rules, term symbols, correlation diagrams - electronic spectra of d^n ions, Magnetic susceptibility, application of magnetic moments to structure elucidation of metal complexes.

Medicinal Inorganic Chemistry: Contrast enhancing agents for medical diagnostics, theory of MRI imaging, Gd based contrast agents-synthesis and structural features; optical contrast agents-Ag and AuNPs. Metal complexes for radiotherapy, diagnostic radiopharmaceuticals. Applications of organometallics in medicine and industries

Unit IV

Spectroscopy I

Nuclear Magnetic Resonance Spectroscopy

^1H NMR spectroscopy: Chemical shift – number of signals – peak areas – multiplicity – geminal, vicinal and long – range couplings – factors affecting these parameters

^{13}C NMR spectroscopy: Broadband of off-resonance decoupling, comparison of ^1H and ^{13}C NMR – factors affecting intensity of signals – chemical shifts - γ - gauche effect

2D NMR: NOESY and COSY, application of ^1H NMR & ^{13}C NMR in structure elucidation

Mass spectroscopy - basic principles – molecular ion peak, parent peak, fragments, metastable peak, isotope peaks – determination of molecular weight and molecular fragment – fragment pattern of simple organic molecules – McLafferty rearrangement

Unit V

Spectroscopy II

ESR spectroscopy – Basic concepts- Factors affecting the magnitude of g and A tensors in metal complexes – Anisotropy in g and A values - Zero-field splitting and Kramers degeneracy - Applications of EPR to Cu(II) , Fe(II) , Mn(II) and Ni(II) complexes.

Combined spectroscopy problems involving IR, UV, Mass and NMR.

Reference Books

1. R.E.Ireland, Organic Synthesis, Prentice Hall, 1969.
2. S.Turner, Design of Organic Synthesis, Elsevier, 1976.
3. S.Warren, Designing Organic Synthesis – A programmed introduction to synthon approach, Wiley, New York, 1978.
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5. J.March, Advanced Organic Chemistry, 4th Edn. John Wiley, New York, 1992
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24. P.M. Silverstein, F.X. Wester, Spectroscopic Identification of Organic Compounds, 6th Ed., Wiley 1998.

I Semester - Core III - (Theory)
PROFESSIONAL SKILLS (Common Paper)

Objectives:

After completing the course, the scholars will be able to

- Develop skills to ICT and apply them in teaching, learning contexts and research.
- Acquire the knowledge of communication skills with special reference to its elements, types, development and styles.
- Understand the terms: Communication technology, Computer Mediated Teaching and develop Multimedia/E-contents in their respective subjects.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I - Computer Application Skills

Fundamentals of Computers and windows, Operating System – **MS – Office** Components; **Word**: Equation editor, Table Manipulation – Formatting Features – organizational Chart. **MS – EXCEL**: Statistical Functions – Number Manipulation – Chart Preparation with various types of graphs. **MS PowerPoint**: PowerPoint presentation with multimedia features. **Internet and its applications**: E-mail and attachments – working with search engines.

Unit II - Communication Skills (English/Tamil/Both)

English: Skills of Communication: Listening, Speaking, reading and Writing – Writing Synopsis, Abstract and proposals. Developing good language asbilities – Public speaking – Writing Skills.

Tamil: பயிற்றுவிக்கும் திறன் - பேச்சுத்திறன் - வெளிப்பாட்டுத் திறன் - ஆய்வுத்திட்டம் - ஆய்வுச்சுருக்கம் தயாரித்தல்.

Unit III - Communication technology

Computer Mediated Teaching: Multimedia, E – Content,

Satellite Based Communication – EDUSAT and ETV channels.

Web: Internet I Education.

Unit IV - Pedagogical Skills

Micro teaching Skills: Skill of Induction, Skill of Stimulus Variation. Skill of Explaining, Skill of Probing Questions, Skill of Blackboard, Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills – Research Extension and Consultancy.

Unit V - Industrial Technology

Lecture Techniques: Steps, Planning of a lecture, Lecture Notes, Updating, Delivery of Lecture. Teaching – Learning Techniques: Team teaching, Group Discussion. Seminar, Workshops, Symposium and Panel Discussion – Games and Simulations – Web Based Instructions.

References

- Micael D. and William (2000). Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York.
- Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher development. Jonathan Anderson
- Pandey S.K.(2005). Teaching communication. Commonwealth publisher, Delhi
- Sharma. R.A.(2006), Fundamentals of education technology, Surya publication, Meerut
- Kum Babu A. and Dandapani S. (2006), Microteaching, Neelkamal Publications, Hyderabad
- Vanaja M and Rajasekhar S. (2006), Computer Education, Neelkamal Publications, Hyderabad