

DHANALAKSHMI SRINIVASAN
COLLEGE OF ARTS AND SCIENCE FOR WOMEN,
PERAMBALUR – 621 212
(AUTONOMOUS)

(Affiliated to Bharathidasan University)
(Nationally Reaccredited with "A" Grade by NAAC)

DEPARTMENT OF CHEMISTRY
(M.Phil., Chemistry Course Structure)

(For the candidate admitted from the academic year 2020-2021 onwards)



SEM	COURSE	TITLE	COURSE CODE	INS. PERIODS/ WEEK	CREDIT	MARKS		TOTAL
						IA	UE	
I & II	Core Course –I	Research Methodology	20MPCH1C1	5	5	25	75	100
	Core Course –II	Advanced Topics in Chemistry	20MPCH1C2	5	5	25	75	100
	Core Course –III	Based on Project Work to be framed by the Guide	20MPCH1C3	5	5	25	75	100
	Core Course –IV	Teaching Learning Skills	20MPCH1C4	5	5	25	75	100
	Total			20	20	400		
	Project Work	Dissertation and Viva - Voce	20PDCH2PW	20	20	200		
Total				20	20	200		
Grand Total				40	40	600		

M. Phil Chemistry
CORE COURSE-I
RESEARCH METHODOLOGY

Semester-I

Course code: 20MPCH1C1

Total Periods : 75

Credit: 5

Marks: 75

Exam Hours: 3

OBJECTIVES

To introduce the purpose and importance of research for future development.

UNIT-I :PRINCIPLES OF RESEARCH(15 Periods)

Definition - Need for research. Objectives – Motivation – Types of research – Significance - Formulation of Research Problem – Developing Hypothesis - Preparing Research Design - Selection of Research Problem – Determining Sample Design Characteristics of a Good Sample Design - Collection of Data – Methods of Data Collection - Execution of Work. Analysis of Data – Hypothesis, Testing - Generalization and Interpretation - Preparation of Report - Submission of Report in the form of Thesis .

UNIT –II : LITERATURE SURVEY

(15 Periods)

Print: Sources of information – Primary, Secondary, Tertiary sources – Journals – Journal abbreviations – Abstracts – Current titles – Reviews – Monographs – Dictionaries – Textbooks – Current contents – Introduction to Chemical Abstracts –Types (Chemical, Physical, Analytical), Survey of abstract indexes (substance index, author index, general technique index, collective and comprehensive indices), and Beilstein – Subject Index, Substance Index, Author Index, Formula Index and other Indices with examples, Beilstein compounds and tables of information. Chemical abstract search through loaded CDS. Aids of Computer devices in literature survey.

Digital: Web resources – E-Journal – Journal access – TOC alerts – Hot articles – Citation index – Impact factor – H-Index – E-Consortium – UGC infonet – E-Books – Internet discussion groups and communities – Blogs – Preprint server – Search engines, Scirus, Google Scholar, Chem Industry, Wiki – Databases, Chem Spider, Science Direct, Scientific Finder, Scopus.

Selection of topic and facilities - Selection of specific topics of research laboratory and instrumental facilities –location of journals, e-mail address, specific articles of science citation cards and indices, summarisations of works already done and published in the chosen field.

UNIT -III : METHODS OF SCIENTIFIC RESEARCH AND WRITING SCIENTIFIC PAPERS(15 Periods)

a) Proposal, Paper and Thesis Writing

Assignments and test papers, Thesis and dissertations, style and conventions in writing, selection of topic. Rough drafting of the article – Title, Abstract, Introduction, Literature review problem and time limitation, Experimental methods, Results and discussions, Foot notes, Figures, Data presentations, Tables, Sign convention followed –Conclusions and recommendations. The general format – page and chapter format – use of quotations – footnote – tables and figures. Results and discussions – applicability of the findings to common usage – referencing – abbreviations used etc.

B) General principles of research, inculcation of scientific temper, avoidance of prejudices and lax judgments, undue admiration of authority (i.e. excessive admiration of the work of great minds), false distinction between theoretical and applied research, impulses of a strong will to do research, persistent hard work and concentration, developing high-minded independence of judgment and taste for scientific originality, various stages of scientific research, observation, experimentation, working hypotheses, proof etc.,

C) On writing scientific papers – justification for scientific contributions, bibliography, justice and courtesy in decisions, description of methods, conclusions, the need for illustration, style, publications of scientific works, c) Writing methods - Writing the first draft, revising the first draft on content and structure, revising the second draft on style, writing a thesis, writing review article and book reviews, preparing research proposals for grants.

UNIT IV - CHEMICAL SAFETY AND ETHICAL HANDLING OF CHEMICALS (15 Periods)

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, in incineration and transportation of hazardous chemicals.

UNIT -V : DATA ANALYSIS AND PACKAGES

(15 Periods)

Data: Types of Error - Accuracy, precision, significant figures, use of calculus in the estimation of errors - Frequency distributions, the binomial distribution, the Poisson distribution and normal distribution - describing Data, population and sample, mean, variance, standard deviation, way of quoting uncertainty, robust estimators, repeatability and reproducibility of measurements -Hypothesis testing, levels of confidence and significance, test for an outlier, testing variances, means t-Test, paired t-Test Analysis of variance (ANOVA) - Correlation and Regression - Curve fitting, Fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals - General polynomial fitting.

liberalizing transformations, exponential function fit - r and its abuse - Basic aspects of multiple linear regression analysis.

Electronics and Computer Packages

Basic fundamentals of electronic circuits and their components used in circuits common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments. Elementary aspects of digital electronics. Applications of some computer packages like MS-Excel, Origin, Chem draw, Sciplot, ISIS draw, Chems sketch.

TEXT AND REFERENCES BOOKS

1. J. March, „Advanced Organic Chemistry; Reactions, Mechanisms and Structure“, 6th Ed., Wiley- Interscience, 2007.
2. Santiago Ramon y Cajol, (translated by Neely S Wanson and Larry W Swanson) „Advice for a young Investigator“ A Bradford Book, The MIY Press, Massachusetts, London, England 1999.
3. Maeve O'Connor, „Writing successfully in science“ Chapman and Hall, London, 1991.
4. D. B. Hibbert and J. J. Gooding, „Data Analysis for Chemistry“, Oxford University press, 2006.
5. J. Topping, „Errors of Observation and Their Treatment“, Fourth Edn., Chapman Hall, London, 1984
6. S. C. Gupta, „Fundamentals of Statistics“, Sixth Edn., Himalaya publ. House“, Delhi, 2006
7. H. E. Solbers, „Inaccuracies in Computer Calculation in Standard Deviation“, Anal. Chem. 55, 1611 (1983)
8. P. M. Wanek et al., „Inaccuracies in the Calculation of Standard Deviation with Electronic Calculators“, Anal. Chem. 54, 1877 (1982)
9. R. L. Tokheim, „Digital Electronics-Principles and Applications“, 5th Edn., Tata Mc Graw-Hill, New Delhi, 1999.
10. Alan Jhonson, „Electronics, A Systems Approach“ Hodder and Stoughton, London, 1987.
11. Robert Boylested, Louis Nashelsky, „Electronic Devices and Circuit Theory“, Prentice Hall, 9th Edn., May 2005.
12. Thomas L Floyd, „Principles of Electric Circuits: Conventional Current Version“, Prentice Hall, 7th Edn., Jan 2006.
13. For computer applications any commonly available books as well as common materials available in the web. 5.

CORE COURSE-II

ADVANCED TOPICS IN CHEMISTRY

Semester-I

Marks: 75

Course code: 20MPCH1C2Credits: 5

Total Periods: 75

Exam Hours: 3

OBJECTIVES

- To understand advanced spectroscopic techniques

UNIT I - MICROSCOPY TECHNIQUES

(15 Periods)

Electron Microscopy, Transmission electron microscope (TEM), general design, resolution, electron source, TEM grids, electron lenses, electron – sample interactions- Scanning transmission electron microscope (STEM) Scanning probe microscopy - Atomic and molecular force microscopes (AFM and MFM), Scanning tunnelling Microscope (STM); Scanning near-field and far-field optical microscope (SNOM and SFOM) - Fluorescence microscopy, single-molecule fluorescence imaging, single molecule FRET (Fluorescence energy transfer) techniques, Confocal microscopy.

Unit-II - RESONANCE SPECTROSCOPY (15 Periods)

¹H NMR: Long-range coupling – Homotopic, enantiotopic and diastereotopic systems - Conformationally mobile, open-chain systems, Virtual coupling – Coupling of proton to fluorine, phosphorus - Nuclear Overhauser effect. ¹³C NMR: Off resonance decoupling – Coupling of carbon to deuterium, fluorine, phosphorus – DEPT – Application of proton

and carbon data in identifying small organic compounds. 2D NMR: Principles of 2D NMR spectroscopy - ¹H-¹H COSY, ¹H-¹³C COSY, HMBC and HSQC.

Basic concepts of ESR spectroscopy – g tensor- Factors affecting the magnitude of g and A tensors in metal complexes – Anisotropy in g and A values -Zero-field splitting and Kramer's degeneracy - Applications of EPR to some simple systems like methyl radical, p-benzosemiquinone and naphthalene anion, Cu(II), Fe(II), Mn(II) and Ni(II) complexes – Spin-trapping.

Basic principles of ENDOR spectroscopy and its applications in inorganic chemistry

UNIT III - ELECTRO ANALYTICAL TECHNIQUES

(15 Periods)

Potentiometric sensors- criteria for choosing these sensors, selective electrodes- primary ion-selective electrodes encompassing crystalline and non-crystalline electrodes- membrane ion-selective electrodes including gas-sensing and enzyme substrate electrodes- all solid state ion-selective electrodes – Voltammetric sensors, chronoamperometry- potential sweep techniques (cyclic voltammetry including study of reaction mechanisms)- step and pulse techniques- Normal pulse and differential pulse voltammetry- square wave voltammetry- AC techniques- stripping voltammetry (anodic and cathodic)- stripping analysis.

UNIT IV :APPLICATIONS OF MASS SPECTROMETRY TO BIO MOLECULES AND FLUORESCENCE SPECTROSCOPY

(15 Periods)

Basic Instrumentation - Resolution, EI, CI and APCI methods - base peak, isotopic peaks, metastable peak, parent peak - determination of molecular formula Techniques in Instrumentation - Soft Ionization Methods - Fast Atom-Ion Bombardment-Electron spray Ionization - Matrix-Assisted Laser Desorption/Ionization - Mass Analyzers - Detectors- Hyphenated techniques, GC-MS, LC-MS and tandem Mass spectrometry- Applications to Biomolecules - Molecular weight Determination - Protein Identification - Protein- Peptide Sequencing - Nucleic Acid Applications.

Emission spectra and excitation spectra, 2D - emission spectra, frequency-domain spectra and time-domain spectra- definition of lifetime of an excited state-multiexponential decays- time-correlated single-photon counting technique to obtain time-domain spectra- micro- nano- pico and femto second transient recordings using laser flash photolysis techniques- various laser sources and light-emitting diodes- Fluorescence quenching and its applications in some biological systems like proteins, membranes, DNA etc.

UNIT V - BIOLOGICAL CHEMISTRY

(15 Periods)

Chemistry in biosystems (distinct from non-living systems) - Weak non-covalent interactions - Molecular recognition - Enzyme chemistry - Mechanism of enzyme action - Chymotrypsin - Antibodies as enzymes-Enzymes in synthetic organic chemistry - Coenzyme chemistry - NADH - NADPH and FADH(2) as electron carriers - Pyridoxal phosphate - Thiamine pyrophosphate - suicide enzyme inactivators and affinity labels - Bioenergetics & metabolism -Biological energy - ATP - Carbohydrate metabolism - Lipid metabolism - Citric acid cycle - Enzyme models - utility of cyclodextrins, Crown ethers and calixarenes as enzyme models - Molecular recognition and drug design - Supramolecular chemistry - Supramolecular reactivity and catalysis

TEXT AND REFERENCES BOOKS

Unit I

1. Acc. Chem. Res. July 2005
2. Bengt Nolfing, „Methods in Modern Biophysics“, Springer, 2004.
3. T. Pradeep, Nano: The Essentials, Mc Graw-Hill Edn, New Delhi, 2007.

Unit II

1. P.M. Silverstein, F.X. Wester, Spectroscopic Identification of Organic Compounds, 6th Ed., Wiley 1998.
2. J. Mohan, Organic Spectroscopy Principles and Applications, CRC; 2nd Ed., 2004.
3. W. Kemp, Organic Spectroscopy, 3rd Ed., MacMillan, 1994.
4. D.L. Pavia, G.M. Lampman and G.S. Kriz, Introduction to Spectroscopy, Brooks Cole, 3rd Ed., 2000.
5. H. Gunther, NMR spectroscopy, basic principles, concepts and application in chemistry, John Wiley & Sons, 2nd Ed., 1995.
6. R. S. Drago, Physical Methods in Chemistry, Saunders, 1977.
7. J. A. Weil, J. R. Bolton and J. E. Wertz, Electron Paramagnetic Resonance: Elementary Theory and Practical Applications, John Wiley and sons, 1994.

Unit III

1. Christopher M A Brett and Ana Maria Oliveira Brett, "Electroanalysis" Oxford University Press, Oxford, 1998.
2. Daniel C. Harris, "Quantitative Chemical Analysis", Third Edn., W.H. Freeman and Company New York, 1996.
3. A.J. Bard L.F. Faulkner, Electrochemical methods - Fundamentals and Applications, Second Edn., Wiley-VCH, 1998.
4. Journal of Chemical Education, "State of Art Symposium Electrochemistry" Vol.60, issue No.4, 1983.
5. J. Janata, "Principles of Chemical Sensor", Plenum Press, New York, 1989.
6. Joseph Wang, "Analytical Electrochemistry", Second Edn., Wiley-VCH, 2001

Unit IV

1. Spectrometric Identification of Organic Compounds, 6th Edition, Robert M. Silverstein and Francis X. Webster, Publisher: John Wiley & Sons, Inc, 1998
2. Theme issue on "Frontiers in Mass Spectrometry", Chemical Reviews 2001, Vol. 101, Issue 2.
3. Bioanalytical Chemistry, S. K. Mikkelsen and Eduardo Corton, Publisher: Wiley-Interscience - John Wiley & Sons, Inc., 2004
4. Joseph R.Lakowicz "Principle of Fluorescence Spectroscopy" Third Edn. Springer,USA,2006

Unit V

1. Biochemistry, 3rd edition, C. K. Mathews, K. E. van Holde, K. G. Ahern, Publisher: Pearson Education 2000
2. Principles of Biochemistry, 2nd edition, A. L. Lehninger, D. L. Nelson, M. M. Cox, Publisher: CBS Publishers & Distributors (India) 1993
3. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, 3rd edition, Hermann Dugas, Springer International Edition 2003

COURSE -IV TEACHING AND LEARNING SKILLS

Semester-I

Marks: 75

Course code: 20MPCH1C4Credit: 5

Exam Hours:3

Total Periods: 75

OBJECTIVES

- understand the operations and use of computers and common Accessories and to develop skills of ICT and apply them in teaching learning context and Research

UNIT -I :COMPUTER APPLICATION SKILLS (15 Periods)

Computer system: Characteristics, Parts and their functions – Different generations of Computer – Operation of Computer: switching on / off / restart, Mouse control, Use of key

board and some functions of key – Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations

UNIT- II : COMMUNICATION SKILLS

(15 Periods)

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and written; Non-verbal communication – Intrapersonal, Interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and writing – Methods of developing fluency in oral and written communication – style, Diction and Vocabulary – Classroom communication and dynamics

UNIT- III : COMMUNICATION TECHNOLOGY

(15 Periods)

Communication Technology: Bases, Trends and Developments – Skills of using Communication Technology – Computer Mediated Teaching: Multimedia, E-content – Satellite-based communication: EDUSAT and ETV channels, Communication through web: Audio and Video applications on the Internet, interpersonal communication through the web.

UNIT- IV: PEDAGOGY

(15 Periods)

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation – Versatility of lecture technique – Demonstration, Characteristics, Principles, Planning Implementation and Evaluation – Teaching – Learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Models of teaching: CAI, CMI and WBI

UNIT -V: TEACHING SKILLS

(15 Periods)

Teaching skill: Definition, Meaning and Nature – Types of Teaching skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills

Text and References Books:

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
3. Information and Communication Technology in Education: A Curriculum for Schools and programme of Teacher development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002
4. Kumar K.I (2008) Educational Technology, New Age International Publishers, New Delhi
5. Mangal, S.K. (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana

6. Michael D. and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York
7. Pandey S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi
8. Ram Babu A. and Dandapani S (2006) Microteaching (Vol.1&2) Neelakamal Publications, Hyderabad
9. Singh V.K. and Sudarshan K.N. (1996) Computer Education, Discovery Publishing Company, New York
10. Sharma R. A. (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
11. Vanaja. M. and Rajasekar S. (2006) Computer Education, Neelkamal Publications, Hyderabad.