
JAYARAJ ANNAPACKIAM COLLEGE FOR WOMEN (AUTONOMOUS)

A Unit of the Sisters of St. Anne of Tiruchirappalli

Accredited with 'A' Grade (3rd Cycle) by NAAC

DST - FIST Supported College Since 2015

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PERIYAKULAM – 625 601, THENI DT.

TAMIL NADU.



M. PHIL. CHEMISTRY 2017 - 2020

DEPARTMENT OF CHEMISTRY

PROGRAMME OUTCOMES - M. PHIL.

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Reflect critically on their own, with their peers' and synthetic working situations in the light of new concepts and course input.
2.	Identify relevant sources, evaluate them and to use these appropriately in their studies.
3.	Engage in independent study and group/pair work including the presentation of materials.
4.	Relate skills with self management and task achievement, meeting deadlines, problem-solving and metacognitive awareness.
5.	Associate study skill with data collection and researching, digesting, selecting, planning, writing and presenting articles for publication.
6.	Present reports on their findings in the respective category of work to improve their expertise and imbibe practical abilities.

PROGRAMME SPECIFIC OUTCOMES - M. PHIL.

PSO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO	PO MAPPED
1.	Gain in depth knowledge in advances of various aspects of Chemistry and assess the mechanisms and theories of organic, inorganic and physical Chemistry.	PO-1 PO-2
2.	Handle the spectral data of compounds for their characterization.	PO-4
3.	Identify the formation and purity of compounds by chromatography.	PO-2
4.	Analyse the spectro photometric, analytical, electrometric measurements of compounds and evaluate critically the new findings of their research.	PO-2 PO-5
5.	Formulate the procedure of manuscript and dissertation for their new research findings.	PO-6

M.PHIL. COURSE PATTERN (2017-20)

Sem.	Code	Title of Paper	Hours	Credits
I	17MCH1C01	Research Methodology	10	8
	17MCH1C02	Advances in Chemistry	14	12
	17MCH1E3A/ 17MCH1E3B/ 17MCH1E3C	Indepth study: Metal Complexes and their Applications/ Indepth study: Nano Chemistry and Photocatalysis/ Indepth study: Corrosion and its Control methods	6	-
		Total	30	20
	II	17MCH2E3A/ 17MCH2E3B/ 17MCH2E3C	Indepth study: Metal Complexes and their Applications/ Indepth study: Nano Chemistry and Photocatalysis/ Indepth study: Corrosion and its Control methods	-
17MCH2R01		Project	-	15
		Total for I & II Semesters	30	40

***No External Examination for Indepth Study Paper**

IN-DEPTH STUDY (INTERNAL ONLY)

Semester: I

Hours: 6

Code : 17MCH1E3A

Credits: 5

Ten latest Research articles relevant to the project has to be studied, revised and reported by the student under the concerned project supervisor.

CIA COMPONENTS FOR IN-DEPTH STUDY

Components		Marks
*Mid Semester	:	30
*End Semester	:	30
Attending Seminars (International/National) (Component I)	:	5
Paper Presentation in Seminars/Conferences (Component II)	:	15
Paper to be submitted in any International/National Research article format to the concerned guide (Component III)	:	15
Attendance (Component IV)	:	5
Total	:	100

* Mid Semester and End Semester examinations will be conducted in the I Semester and assessment in the II Semester.

INTERNAL AND EXTERNAL QUESTION PATTERN

Time: 3 Hours

Marks: 60

Five either or questions - one from each unit

5 x 12=60

PAPER I - RESEARCH METHODOLOGY

Semester: I

Hours: 10

Code : 17MCH1C01

Credits: 8

COURSE OUTCOMES:

- ❖ Associate the types and significance of research
- ❖ Formulate scientific papers and proposals
- ❖ Analyze the data to get information
- ❖ Develop the skills on separation and purification of chemical compounds
- ❖ Employ the instrumental techniques to carry out the projects

UNIT I: LITERATURE SURVEY:

Literature survey - sources of information primary - secondary and tertiary resources - chemical journal and journal abbreviations - web publishing - web resources-Journal access through web-digitized and digital formats-E-journals-e-journals consortium-UGC-INFLIBNET - E-books - Online and digital libraries-useful web links- Search engines Alta vista, google , yahoo search -wikis-scifinder - scopus - scirus - science direct -citation index-impact factor, H-index

(30 Hours)

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 of the thesis, literature review, experimental methods, results and discussion, foot notes, figures, different methods of data presentation(graph, chart) - tables, sign conventions followed - conclusions and recommendations - bibliography.

Preparation of manuscript and posters - writing review article and book reviews-

Funding agencies and schemes available - preparing research proposals for grants - ethics in scientific publication - formats for some national and international journals - knowledge about publishers such as ACS, RSC, elsevier, springer - wiley inter science - Taylor and Francis etc - publications from national scientific institutions (CSIR, IASc, IISc)

(30 Hours)

UNIT III: ERROR ANALYSIS:

Types of error- accuracy, precision, significant figures -frequency distribution, the binomial distributions, the poisson distribution and normal distribution- different methods to reduce systematic errors -mean and standard deviation - Q-test, paired t test, T-test, F-test, analysis of variance (ANOVA)- comparing the means of two samples-correlation and regression its mathematical procedure- error in the slope and intercept t- Pearson's correlation coefficient - fitting of linear equations, r-values, multiple linear regression analysis(basic idea)-usage of computer software for statistical analysis **(30 Hours)**

UNIT IV: ANALYTICAL TECHNIQUES - I:

METHODS OF SEPARATION: Distinction between separation and purification - basic principles of separation techniques - filtration, crystallization, fractional distillation - steam and vacuum distillation - solvent extraction

CHROMATOGRAPHY: Paper, column, ion-exchange, gas chromatography GC-MS, LC - MS - MALDI and HPLC techniques and application **(30 Hours)**

UNIT V: ANALYTICAL TECHNIQUES - II:

ELECTRO CHEMICAL METHODS: Voltammetry - principles - linear sweep voltammetry - cyclic voltammetry, differential pulse voltammetry - electrodes and electrolytes - Pulse polarographic methods - applications

Principles and instrumentations : Atomic Force Microscopy (AFM), powder XRD, Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM) and HRTEM - Scanning Tunneling Spectroscopy (STS) - Scanning Tunneling Microscopy (STM) - Thermo Gravimetric Analysis (TGA) - Differential Thermal Analysis (DTA) - Differential scanning calorimetry (DSC) **(30 Hours)**

BOOKS FOR REFERENCE:

UNIT I

1. <http://www.inflibnet.ac.in>
2. <http://www.springerlink.com>
3. <http://www.sciencedirect.com>
4. C.R. Kothari, Research methodology, Methods and Techniques, Wiley Eastern Ltd., New Delhi, 1991

UNIT II

1. H. Beall and J. Trimbur, A short guide to Writing about Chemistry, Longman, 2nd Edition, 2001
2. J. Anderson, B.H. Durston and M. Poole, Thesis and Assignment Writing, John Wiley, Sydney, 1970
3. Ralph Berry, The Research Project: How to write it, 4th edition, Routledge, Taylor and Francis, London, 2000
4. M. Coghill and L.R. Gardson, The ACS Style Guide-Effective Communication of Scientific information, Oxford University Press, 3rd edition 2006

UNIT III

1. Mendham, J., Denney, R.C., BARNES, J.D. and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004.
2. Skoog and West, D.M., Holler, J.F. and Crouch S.R., Fundamentals of Analytical Chemistry Thomson Asia Pvt. Ltd., Singapore, 8th edition, 2006
3. Willard, H.H., Jr. Merrit, L.L., Dean, J.A. and Jr. Settle, F.A., Instrumental Methods of Analysis, CBS Publishers and Distributors, New Delhi, 7th edition 2008
4. S.P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi, 1993
5. D. Brynn Hibbert and J. Justin Gooding, Data Analysis, Oxford University Press, New York, 2006

UNIT IV

1. Budhiraja, Separation Chemistry, New age International (P) Ltd, New Delhi, 2nd edition, 2007
2. Mendham, J. Denney, R.C., BARNES, J.D. and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004
3. Skoog and West, D.M., Holler, J.F. and Crouch S.R., Fundamentals of Analytical Chemistry, Thomson Asia Pvt. Ltd., Singapore, 8th edition, 2006
4. Willard, H.H., Jr. Merrit, L.L., Dean, J.A. and Jr. Settle, F.A., Instrumental Methods of Analysis, CBS Publishers and Distributors, New Delhi, 7th edition, 2008

UNIT V

1. Mendham, J. Denney, R.C., BARNES, J.D. and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004
2. Skoog and West, D.M., Holler, J.F. and Crouch S.R., Fundamentals of Analytical Chemistry Thomson Asia Pvt. Ltd., Singapore, 8th edition, 2006
3. Willard, H.H., Jr. Merrit, L.L., Dean, J.A. and Jr. Settle, F.A., Instrumental Methods of Analysis, CBS Publishers and Distributors, New Delhi, 7th edition, 2008
4. Fujita, H., Micromachines as Tool for Nanotechnology, Chapters 5 & 8, Springer-Verlag Berlin Heidelberg, 2003

PAPER II - ADVANCES IN CHEMISTRY

Semester: I

Hours: 14

Code : 17MCH1C02

Credits: 12

COURSE OUTCOMES:

- ❖ Illustrate asymmetric synthesis using Cram's rule and Prelog's rule
- ❖ Recognize the importance and principles of green chemistry
- ❖ Gain knowledge on nanotechnology
- ❖ Evaluate the uses of inorganic metals in our day to day life
- ❖ Predict the structure of organic compounds using spectroscopic techniques.

UNIT I: ORGANIC SYNTHESIS:

Introduction - Retro synthesis, guidelines for best disconnections - one group disconnection 1, 2-1, 3-1, 4-1, 5 and 1, 6-difunctional disconnections - stereoselectivity, regioselectivity, protecting groups, use of aliphatic nitro compounds in organic synthesis Asymmetric synthesis - strategy classification of methods, enantiomeric excess and diastereomeric excess - first, second, third and fourth generation process, enantioselective asymmetric synthesis **(42 Hours)**

UNIT II: GREEN CHEMISTRY:

Twelve Principles of green Chemistry - green chemical methods of synthesis - use of microwave in organic synthesis - solventless reactions - green solvents - supercritical fluids for extraction - ionic liquids

NANO CHEMISTRY:

Introduction to nano technology and nanomachines - molecular nanotechnology - methods of synthesis of nanomaterials - plasma arching, sol gels - electro deposition - ball milling - analytical tools to study nano materials (SEM & TEM) applications of nano Chemistry - CNT, molecular Switches - rotaxanes - catenanes - lithography - nano structured ferromagnetism - quantum wells, dots, wires applications of nanomaterials - nanomachines - future applications. **(42 Hours)**

UNIT III: BIOINORGANIC CHEMISTRY:

Bioinorganic chemistry of quintessentially toxic metals-lead, cadmium, mercury, aluminium, chromium, iron, copper - detoxification by metal chelation-metals used for diagnosis and chemotherapy - chelation therapy - dimercaptol, pencillamine, EDTA - gold complexes and rheumatoid arthritis - platinum based anticancer drugs- interaction with DNA - nonplatinum anti tumour metal complexes - metal complexes of radiodiagnostic agents - MRI contrast agents (Lanthanides) **(42 Hours)**

UNIT IV

SPECTROSCOPY I:

UV-Visible Spectroscopy: Types of electronic transitions and band assignments, band shifts, isosbestic bands microstates - term symbols and energy levels for d^1 - d^9 systems-electronic spectra of transition metal complexes (from d^1 to d^9 configurations)-intensity of bands - effect of distortion and spin orbit coupling on spectra-evaluation of $10 Dq$ and β values for octahedral complexes of cobalt and nickel-charge transfer spectra

IR and Raman Spectroscopy: Sampling Techniques- combined applications of IR and Raman spectroscopy in structural elucidation of simple molecules like N_2O , ClF_3 , NO_3^- , ClO_4^- . effect of co-ordination on ligand vibrations - uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and DMSO- effect of isotopic substitution on vibrational spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations (group theoretical treatment)- applications of raman spectroscopy

Massbauer Spectroscopy: Isomer shifts - magnetic interactions - moss bauer emission spectroscopy - application to iron and its compounds **(42 Hours)**

UNIT V

SPECTROSCOPY II:

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 : Broad band 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 and ^{13}C NMR in structure elucidation.

Mass spectroscopy: Basic principles - molecular ion peak, parent ion peak, meta stable peak, nitrogen rule isotope peaks - determination of molecular weight and molecular fragment-fragmentation pattern of simple organic molecules - McLafforty rearrangement - Retro Diels Alder reaction

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) and Mn (II) complexes combined spectroscopy problems involving IR, UV, Mass and NMR **(42 Hours)**

BOOKS FOR REFERENCE:

1. Robert E., Ireland, Organic Synthesis, 2nd Edition, Prentice-Hall of India Pvt.Ltd, New Delhi,1988. **Unit I**
2. Mackie R. K. and Smith D. M. Guide book to organic synthesis, London, ELBS, 1982
3. Stuart Warren, Organic Synthesis, The Disconnection Approach, John Wiley & Sons,1982.**Unit I**
4. Ahluwalia, Kidwai, New Trends in Green Chemistry, 2nd Edition, Anamaya Publishers,New Delhi,2006. **Unit II**
5. C.N.R. Rao, A. Muller and A. Cheethan Chemistry of nanomaterials, Wiley, New York, 2004 **Unit II**
6. Bertni,Gray,Lippard,Valentine,Bioinorganic chemistry,1st ed.,Viva Books Pvt.Ltd,New Delhi,1998. **Unit III**
7. Kemp W, Organic Spectroscopy, 3rd edition, ELBS with Macmillan, London,1993. **Unit IV**
8. R.M.Silverstein,G.C.Bassler and T.C.Morrill,Spectrometric Identification of Organic Compounds,5th ed.,Wiley,1991, **Unit IV,V**
9. R.S.Drago, Physical Methods in Inorganic Chemistry, W.B.Saunders Company, 1992 **Unit IV,V**
10. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular spectroscopy, TATA McGraw Hill Co., 4th edition, 2007 **Unit V**

QUESTION PATTERN FOR M. PHIL CHEMISTRY

(INTERNAL AND EXTERNAL)

Time: 3 hrs

Marks: 60

Five either or questions - one from each unit

5 x 12=60

COMPONENTS FOR INDEPTH STUDY

Ten latest Research articles relevant to the project has to be studied, revised and reported by the student under the concerned project supervisor

COMPONENTS:

MARKS: 100

A. Mid Semester	30
B. End Semester	30
C. Report Submission(in MS word) (5)	
a. Power point preparation (10)	
b. Presentation and viva voce (10)	25
D. Paper to be submitted in any International/National research article format (Submission in the month of January)	10
E. Attendance	5
Total	100

CHEMISTRY OF METAL COMPLEXES

Semester: I & II

Hours: 6

Code : 17MCH1E3A & 17MCH2E3A

Credits: 5

COURSE OUTCOMES:

- ❖ Describe the theories of co-ordination chemistry
- ❖ Predict the methods of syntheses of Schiff bases
- ❖ Apply the biological importance of Schiff bases
- ❖ Interpret the binding ability of Schiff bases to biologically important molecules
- ❖ Analyse the recent developments published in reputed journals

NANOCHEMISTRY AND PHOTOCATALYSIS

Semester: I & II

Hours: 6

Code : 17MCH1E3B & 17MCH2E3B

Credits: 5

COURSE OUTCOMES:

- ❖ Grasp the importance of nanochemistry
- ❖ Demonstrate the synthesis of nanoparticles
- ❖ Interpret the spectral data for characterization of nanomaterials
- ❖ Apply the photocatalysis to degradation of dyes
- ❖ Analyze critically the recent articles on photocatalytic activity by nanomaterials

CORROSION AND ITS CONTROL METHODS

Semester: I & II

Hours: 6

Code : 17MCH1E3C & 17MCH2E3C

Credits: 5

COURSE OUTCOMES:

- ❖ Gain knowledge on mechanism of corrosion
- ❖ Analyze the factors influencing corrosion
- ❖ Classify the forms of corrosion
- ❖ Apply the control methods for corrosion
- ❖ Evaluate the methods of studying inhibitors

PROJECT

Semester: II

Code : 17MCH2R01

Credits: 15

COURSE OUTCOMES:

- ❖ Interpret the spectral data of compounds
- ❖ Analyse the spectro photometric , analytical, electrometric measurements of compounds
- ❖ Develop the presentation skills through reviews
- ❖ Analyse critically the new findings of their research
- ❖ Formulate the procedure of manuscript and dissertation for their new research findings

Internal Component for Dissertation Work

Components	Marks
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
Total	50

Submission of M. Phil Dissertation will be on 31st July