

THANTHAI HANS ROEVER COLLEGE

(Autonomous)

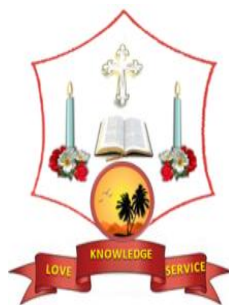
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UGC Recognized 2(f) and 12(B) Institution

Affiliated to Bharathidasan University, Tiruchirapalli

Perambalur - 621 220,

Tamil Nadu, India



M.Phil CHEMISTRY

CHOICE BASED CREDIT SYSTEM SYLLABUS

SEMESTER PATTERN

**PG & RESEARCH DEPARTMENT OF
CHEMISTRY**

(2022-2023 ONWARDS)



THANTHAI HANS ROEVER COLLEGE PERAMBALUR-621212
(AUTONOMOUS)
M.Phil Chemistry -Course Structure Under CBCS
(For the candidates to be admitted from the academic year 2018-2019onwards)



Semester	Course Code No	Title of the Course Paper	Hours /week	Credits	Exam hours	CIA	ESE	Total
First Semester	22MPCH1CC1	Research Methodology in chemistry	4	4	3	75	25	100
	22MPCH1CC2	Recent Trends in Chemistry	4	4	3	75	25	100
	22MPCH1CC3	Teaching and Learning Skills	4	4	3	75	25	100
	22MPCH1CC4	Paper on Topic of Research (Guide will prepare the syllabus and it will be sent to the COE)	4	4	3	75	25	100
Total			16	16	-	-	-	400
Second Semester	22MPCH2DW	Dissertation and Viva-Voce	-	8	-	-	-	200
Total				24	-	-	-	600

CIA- Continuous Internal Assessment

ESE- End Semester Examination

SEMESTER-I

Research Methodology in chemistry

Core course: I
Credits :4
Max.Marks :100

Hours : 3
Course code: 22MPCH1CC1
Internal : 25
External :75

OBJECTIVES

- To know the Idea about the problem choosing the research
- To under stand the method of research
- To know about prepare the thesis

UNIT I Basic Principles of Research

Research ethics-Meaning of Research - 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 Searching and Writing Reports:

Literature Searching

Online searching, Database-Scifinder- Scopus- CA on CD Locating research article-Citation Index, Impact Factor

Writing scientific report :

Planning- preparation, draft revision and refining- writing project proposal to funding agency- Paper writing for International Journals- submitting to editors- Conference presentation- preparation of effective slides and presentation.

UNIT III: Statistical Tools of research

Significant figures- Precision- accuracy-Error analysis- types of errors- Random error- systematic error-gross error-Mean-median- measures of spread -range- standard deviation and variance- F test, t test, Types of correlation, correlation coefficient, Regression analysis -binomial distribution, normal distribution -hypothesis generation and testing of hypothesis

UNIT IV: Introduction to Computing and Networking

Introduction to computers and computing -hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software, High and low level languages, Compilers, Algorithms and Flow charts-

Introduction to networking -Computer networks, Network components, Hubs, switches, repeaters, routers, bridges and gateways -LAN, WAN, internet and internet worldwide web, internet for chemists -online search of chemistry databases, e-journals-search engines for chemistry-chemweb.

UNITV Chemical safety and Disaster Management:

(a) Emergency response: chemical spills-radiation spills- biohazard spills-leaking compressed gas cylinders-fires- medical emergency accident reporting-emergency responses mitigation-preparedness-response-recovery

b) General safety : General safety and operational rules-**nuclear chemistry-radiation safety-transport safety-waste safety-general safety**-safety equipments, personal protective equipments, compressed gas safety-safety practices for disposal of broken glass wares- centrifuge safety-treated biomedical wastes and scientific ethics.

REFERENCES:

1. Thesis and Assignment writing, J. Anderson, B.H.Durston and M.Poole, John Wiley Publications, Sydney. 1970.
2. How to write a research paper, R.Berry, Pergoman, 1969.
3. Fundamentals of analytical Chemistry by D. A. Skoog, D. M. West and F. J. Hooler.
4. Quality in the Analytical Chemistry Laboratory by R. D. Treble and D. G. Holcombe.
5. Eckschlager K., 1969, —Errors, Measurement and results in chemical analysisl, London, Van Nostrant Reinhold company
6. K.V. Raman, “Computer in Chemistry”, Tata McGraw Hill, New Delhi, 1993.
7. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [Prentice Hall] (2002)

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice and On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

SEMESTER-I
RESENT TRENDS IN CHEMISTRY

Hours :3

Course code: 22MPCH1CC2

Credit :4

Max.Marks :100

Internal : 25

External :75

OBJECTIVES

- **To know the methods of analytical techniques**
- **To understand the handling of chemical in the times of analysis**
- **To carry out the interpretation of spectral data's**

UNIT I : NMR, IR and Mass Spectroscopy:

- a) IR spectroscopy- Applications of IR in analysis - NMR spectroscopy: Chemical shifts- and coupling constant- Introduction of NOE- DEPT and 2D NMR, ¹³CNMR and its applications-
c) Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications-
d) Combined spectroscopic problems based on IR- NMR-and mass spectral data.

UNIT II Electroanalytical Techniques

Polarography Theory- DME and importance-disadvantage Current Voltage curves, Diffusion current and its theory- factors affection it Polarographic wave and half wave potentials- polarogram applications. Oscillographic Polarography-Square wave polarography- Tensimetry- Chronopotentiometry- Cyclic Voltammetry- Amperometry- galvanic cell-theoretical principles- applications in chemical investigations-Electrogravimetry- Principles and applications.

UNIT III

Nanotechnology:

Introduction- Nanotechnology and Nanomachines molecular nanotechnology -methods of synthesis of nano materials - plasma arching, sol-gel method - electro deposition, ball milling - analytical tools to study nano materials (SEM, TEM & SPM) -applications of nano chemistry - CNT and its applications, molecular switches, rotaxanes - catenanes - lithography -nano

biometrics-metal nano clusters-nano crystals- quantum wells- dots- wires- etc biological materials - future applications

Sonochemistry

Fundamentals of sound and ultrasound - cavitation and its principle - instrumentation - homogeneous and heterogeneous processes -sonoluminescence - uses in chemistry, material science, medicine and life - synthetic applications -esterification, sponification,hydrolysis, substitution, cannzaro reaction, stecker's synthesis

UNIT IV : Xray Diffraction, XPS, EDX and TEM :

Principle instrumentation and application of Xray diffraction (XRD)- Xray photoelectron spectroscopy (XPS) – difference between XRD and XPS-electron spectroscopy for chemical analysis (ESCA)- transmission electron microscopy (TEM)- Scanning electron microscopy (SEM)- difference between TEM and SEM-Its application SEM-TEM

UNITV: Computational Chemistry

Molecular Modeling: Introduction -Coordinate Systems -Potential Energy surfaces- Molecular graphics -Surfaces -Mathematical concepts-molecular mechanics. Introduction to non-bonded interactions -electrostatic interactions-van der Waals interactions- Manybody effects in empirical potentials -effective pair potentials, hydrogen bonding in molecular mechanics -force field models for the simulation of liquid water. Computer simulation methods: Introduction - calculation of simple thermodynamic properties- phase space- practical aspects of computer simulation.

REFERENCES:

1. Silverstein and Basallar: Spectroscopic identification of organic compounds.
2. V. M.Parikh: Absorption spectroscopy of organic compounds. (J. Wiley)
3. D.W. Williams and Flemming: Spectroscopic methods of organic compound.
4. R.C. Kappor and B.S. Agarwal, Principles of polarography, Wiley Eastern Ltd., 1991.
5. <http://www.sjctni.edu/department/CH/ooc/biometrics.ppt>
[http://www.sjctni.edu/department/CH/ooc/nano preparation.ppt](http://www.sjctni.edu/department/CH/ooc/nano%20preparation.ppt)
<http://www.sjctni.edu/department/CH/ooc/sonochemistry.ppt>

6. Instrumental Methods of Analysis: Chatwal & Anand
7) Principles of Instrumentals Analysis: D.Skoog & West.
8. Andrew R. Leach, Molecular Modelling second edition Pearson Prentice Hall, England 2001.

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
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SEMESTER - I

CORE COURSE III - TEACHING AND LEARNING SKILLS

Course Code: 22MPMB1CC3

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

Objectives

- Acquaint different parts of computer system and their functions
- Understand the operations and use of computers and common accessories
- Develop skills of ICT and apply them in teaching learning context and research
- Appreciate the role of ICT in teaching, learning and research
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia / e-content in their respective subject
- Understand the communication process through the web
- Acquire the knowledge of Instructional Technology and its Applications
- Develop different teaching skills for putting the content across to targeted audience

Unit I - Computer Application Skills

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

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

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

Unit IV - Pedagogy

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 - WBI

Unit V - Teaching Skills

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 Book:

1. Mangal, S.K. (2002) Essential of Teaching - Learning and Information Technology, Tandon Publications, Ludhiana

Reference 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

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
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Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

SEMESTER-I
GUIDE PAPER

Hours : 4
Course code: 22MPCH1CC4

Credits :4
Max-Marks :100
Internal : 25
External :75

SYLABUS PREPARED BY GUIDE THEIR OWN RESEARCH AREAS

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice And On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

PAPER-IV

BACKGROUND PAPER -SYNTHETIC ORGANIC CHEMISTRY

Hours : 4
Course code: 22MPCH1CC4:1

Credits :4
Max-Marks :100
Internal : 25
External :75

OBJECTIVE

- To understand synthesis through environment friendly by studying green Chemistry
- The course “Synthetic organic Chemistry” provides students with a detailed knowledge of fundamental aspects of the subject,
- To analyze the influence of an on the reactivity of a various reagents-
- To know various analytical technique to summarize the research outcomes

UNIT I: Green chemistry:

Introduction - Principles of Green chemistry - Environmental friendly green techniques -

limitations of green chemistry-Solvent less organic synthesis - supercritical carbondioxide and water as solvents ionic liquids reactions of solid supported catalysts- Biocatalysts.

UNIT II: Named Reactions and Strategic Applications in Organic Synthesis

Bamford Stevens Reaction- Barton McCombie Reaction (Barton Deoxygenation)- Baylis-Hillman Reaction -Enamines and selective alkylation (mono and di) via enamine reactions - Henry Reaction -Hunsdiecker Reaction- Peterson Olefination Prevost Reaction Prins Reaction - Ugi Reaction -Weinreb Ketone Synthesis- Wittig reaction and its modifications- Palladium based reactions:Fukuyama Coupling Heck Reaction- Hiyama Coupling- Sonogashira Coupling- Stille Coupling-Suzuki Coupling.

UNIT III: Oxidation and Reduction reactions

Synthetic uses of the following oxidants: OsO₄-DDQ- PCC- MnO₂- SeO₂- Jones reagent-ozone- HNO₃-Chromyl chloride- Lead Tetra Acetate- periodate- peracids-Fetizones reagent

Synthetic uses of the following reductions: NaNH₂, Wilkinson's catalyst- LAH- NaBH₄- (t-BuO)₃AlH- NaBH₃CN-R₃SnH-Me₃SiCl-hydrazine- Alkali metals- MPV reduction-**DIBAL**

UNIT IV: Chromatography:

Principles of chromatography-**chromatogram**-adsorption chromatography-partition chromatography- Thin layer chromatography - R_f value - column chromatography - separation techniques-principles of Gas liquid chromatography - Instrumentation, Applications, Principle and applications of HPLC and HPTLC.

UNIT V: Advanced NMR Spectroscopy

IR spectroscopy: Applications of IR in analysis-

NMR Spectroscopy:¹H NMR Spectroscopy -Multiplicity -Coupling constant -Spin -spin splitting -Vicinal and geminal coupling constants- ¹³C NMR Spectroscopy -Off resonance decoupling and chemical shifts of common functional groups, DEPT spectra- Basic principles of two dimensional correlated NMR spectroscopy- ¹H¹³C COSY, ¹H ¹H COSY, Two dimensional relayed NMR spectroscopy, H relayed (H, C) COSY H relayed (H H) COSY

experiments- Two dimensional exchange NMR,NOESY- Total correlation spectroscopy, two dimensional inadequate experiments.

Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications.

References:

1. Rashmi Sanghi, Green Chemistry - Environment friendly alternatives- Srivastava, Narosa Publishers, New Delhi-
2. House H-O- Modern Synthetic Reactons, W-A- Benjamin- Norman R-O-C- Modern Methods in organic synthesis- Macmillan- 1967-
3. Corey, E-J- Reaction and reagent in organic synthesis, V-C-H- 1988-
4. Willard and D- Merrit, Instrumental methods of analysis- W-B- Saunder, 1987-
5. Silverstein, R-M- and F-X- Webster, Spectrometric identification of Organic Compounds, John Wiley, 1998-
6. Stothers, J-B-, Carbon-13 NMR Spectroscopy- Academic, 1972-

PAPER-IV

THEORIES OF COORDINATION CHEMISTRY

Hours : 4

Course code: 22MPCH1CC4:2

Credits :4

Max-Marks :100

Internal : 25

External :75

OBJECTIVE

- To understand the key features of coordination compounds, including the variety of structures.
- Use knowledge of the periodic table to locate the position of the d block and the transition metals.
- To understand the structures of complexes containing monodentate and polydentate ligands

Unit I: d block elements: General characteristics of d block elements - Group IB, IIB, IIIB, IVB, VB, VIB, VIIB and VIII elements - metallic character, atomic and ionic radii - oxidation states, colour, complex formation, catalytic and magnetic properties-comparison of IB and IIB group elements with special reference to coordination compounds.

Unit II: Basic concept of coordination chemistry: Basic concept of coordination complexes - central metal ion -ligands - types of ligands -coordination number, oxidation numbers and coordination sphere -Werner's theory of complexes. IUPAC Nomenclature - mononuclear and polynuclear complexes. Stability of complexes-relation between stepwise and overall stability constants- factors affecting the stability-EAN rule -Magnetic properties.

Unit III: Coordination Chemistry: Theories of Metal-Ligand Bond: Valence Bond theory and its limitations -Crystal field theory - splitting of d orbitals under various geometries -Factors affecting the magnitude of CFSE and evidences for CFSE (Structural and thermodynamic effects) -Spectrochemical series - Jahn Teller distortion -Spectral and magnetic properties of complexes -Site preferences - Limitations of CFT -Ligand field theory -MO theory -sigma -and pi-bonding in octahedral, square planar and tetrahedral complexes-Nephelauxetic effect -The angular overlap model.

Unit IV: Coordination Chemistry: Reaction Mechanism: Kinetics and mechanism of reactions in solution -labile and inert complexes -Ligand displacement reactions in octahedral and square planar complexes -acid hydrolysis, base hydrolysis and anation reactions -trans effect -theory and applications- Electron transfer reactions -electron exchange reactions - complementary and non-complementary types -inner sphere and outer sphere processes -Cross reactions and Marcus Hush theory - isomerisation and racemisation reactions of complexes -Molecular rearrangement -Reactions of four and six-coordinate complexes -Inter conversion between stereoisomers. Application of trans effect -synthesis of isomers of Pt(II) complexes - theories of trans effect and cis-trans isomerisation reaction. Application of substitution reactions in the synthesis of platinum and cobalt complexes.

Unit V: Bioinorganic Chemistry: Essential and non-essential metals in biological systems- **Metalloporphyrins-Metalloproteins uses- hemoglobin- myoglobin structure-** metal ion interaction with DNA and RNA - Biochemistry of cobalt, copper, zinc, molybdenum and platinum and iron-antibacterial and antifungal activities of complexes.

References:

1. James E. Huheey, Ellen A. Keiter, and Richard L. Keiter, "Inorganic Chemistry; Principles of Structure and Reactivity", 4th edn., Harper Collins College Publishers, New York, (1993).
2. F. A. Cotton and G. Wilkinson, "Advanced Inorganic Chemistry" 3rd edn., Wiley Eastern, New Delhi, (1972).
3. J. D. Lee, "Concise Inorganic Chemistry" 4th edn., ELBS, (1991).
4. F. A. Cotton, G. Wilkinson and P.L..Gaus, "Basic Inorganic Chemistry" John Wiley and Sons, Inc. 3rd edn., (1994).
5. R.L.Carlin "Transition Metal Chemistry" Marccel Dekke, New York, Vol. 1-5 (1965-69).
6. G.L. Eichron, "Inorganic Biochemistry" Elsevier Publications, New York, (1975).
7. S.F.A. Kettle, Physical Inorganic Chemistry -A Coordination Chemistry Approach, Oxford University Press (1996).
8. D.E. Douglas, D.H. McDaniel, J.J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed. 1994.