DEPARTMENT OF CHEMISTRY

COURSE STRUCTURE & SYLLABI
(For the students admitted from year 2023-2024 onwards)

Programme : M.Phil. Chemistry

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JAMAL MOHAMED COLLEGE (AUTONOMOUS)
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TIRUCHIRAPPALLI – 620 020

M.Phil. CHEMISTRY

Sem	Course Code	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
						CIA	ESE	
I	23MPCH1CC1	Core - I	Research Methodology	4*	4	25	75	100
	23MPCH1CC2	Core - II	Advanced Physical Methods and Molecular Modelling in Chemistry	4*	4	25	75	100
	23MPCH1CC3	Core - III	Teaching and Learning Skills (Common Paper)	4*	4	25	75	100
	23MPCH1CC4	Core - IV (Elective)	Paper on Topic of Research (The syllabus will be prepared by the guide and examination will be conducted by the COE)	4*	4	25	75	100
		*One hour library for each course						
	Total				**16**			**400**
II	23MPCH2PD		Dissertation**	-	8	-	200	200
Grand Total					**24**			**600**

****Evaluation of the Dissertation Viva voce shall be made jointly by the Research Supervisor and the External Examiner**

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPCH1CC1	Core - I	4	4	25	75	100

Course Title	Research Methodology

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Principles of Research** 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 *	12
II	**Survey of Literature** Need for literature survey – Primary, Secondary and Tertiary Sources. Journals, Chemical Abstracts – Subject index, Substance index, Author index, Formula index and other indices. Other similar abstracts for special topics. Current Titles – Reviews – Monographs – Selection of Research topic – Selection of Research Facility – Location of Journals and Articles. Use of computers in the Literature Survey – Websites – Search Engines - chemspider, google scholar, scifinder, scopus, Internet, E-mail. *Scientific Information and Documentation Centers – INSDOC, BANSDOC, NCSI, British Library – Digital Library – e-Journals – e-Content *.	12
III	**Assignment, Research Paper and Thesis Writing** Assignment – Topic selection, Front Page, Text and References. Research Paper – Preparation of Manuscript for Publication in International Journals Published by Elsevier, Interscience, Wiley and Springer- submission procedure. Thesis - Rough drafting – Title, Abstract, Introduction, Scope of the Work, Literature Review, Problem and Time Limitation, Experimental Methods, Results and Discussion Foot Notes- Data Presentation - Figures and Tables, Sign Conventions followed, bibliography, Conclusion and Recommendations. Abbreviations used. *Storing and Retrieval of Information using Computer – CD, Pen Drive, DVD*.	12
IV	**Statistical Analysis of Data** Various types of errors – precision and accuracy – significant figures, various statistical tests on the accuracy of results, positive and negative deviation from accurate results – the Gaussian distribution – the normal distribution of random errors, mean value, variance and standard deviation, reliability interval, deviations from the Gaussian law of error distribution, t-tests- comparison of the mean with the expected value, comparison of the results of two different methods, comparison of the precision of two methods by F-test, Gross errors and elimination of outlying results, graphical methods – Linear regression, regression line, *standard deviation, correlation coefficient*–Multiple Linear regression (one variable with two other variables).	12

V	**Information Technology Skill** Internet – meaning and importance, types of networking – LAN, WAN and MAN – Internet – www, website and webpage's, mode of connection, network protocols-TCP, IP and HTTP, browsing the internet – browsing softwares, URL addresses, domain name, search engines, exploring websites and downloading materials from websites, E-mail – sending, receiving and storing mail and chatting. Power point – creating a presentation – slide preparation – *popular websites for data collection in chemistry*.	**12**
VI	Current Trends (For CIA only) Plagiarism – types and checker – quillbot and grammar checker	

……. Self Study

Text Books:

1. C.R. Kothari, Research Methodology: Methods & Techniques, 2nd Edition, Vishwa Prakasan, India, 2002
2. Scoog, West, Holler andCrouch, AnalyticalChemistry, 8th Edition, Thomson – India, 2007.
3. Zikr – urRahman, Modern Teaching Methods andTechniques, 1st Edition, Anmol Publication Pvt. Ltd, New Delhi,2006.
4. T.M. Srinivasan, Use of Computers and Multimedia in Education, 1st Edition, Aavisakar Publication, Jaipur, 2002.

Reference Book(s):

1. J. Anderson, B.H. Durstonand M. Poole, Thesis and Assignment Writing, Reprint, John Wiley Publications,Sydney, 1987.
2. R. Berry, How to Write aResearch Paper, 2nd Edition, Pergoman, India, 1986.
3. R.M. Verma, Analytical Chemistry:Theory and Practice, 3rd Edition (Reprint), CBS Publishers and Distributers,New Delhi, 2018.
4. K.V. Raman, Computers in Chemistry, 1st Edition, Tata McGraw-Hill Publishing company Limited,New Delhi, 2004

Web Resource(s):

1. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2. https://archive.nptel.ac.in/courses/127/106/127106227/

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply different methods of Data Collection and transform the data into fruitful information.	**K1 & K2**
CO2	Prepare a monograph applying acquired knowledge on information technology.	**K3**
CO3	Compare the reliability of data and Organize a research design through literature survey.	**K4**
CO4	Justify and support the research data.	**K5**
CO5	Propose a hypothetical research design with anticipating results.	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	3	3	3	2	3	2	2.7
CO2	3	3	3	2	3	3	3	2	3	2	2.7
CO3	3	3	3	2	3	3	3	2	3	2	2.7
CO4	3	3	3	2	3	3	3	2	3	3	2.8
CO5	3	3	3	2	3	3	3	2	3	2	2.7
Mean Overall Score											2.72
Correlation											High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Loganathan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPCH1CC2	Core - II	4	4	25	75	100

Course Title	Advanced Physical Methods and Molecular Modelling in Chemistry

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Characterization and Applications of Nano Materials** Surface morphology and nanostructure – Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM); *Structural Characterization - UV-Visible and FT-IR spectroscopy*; Structure orientation and micro texture-X-ray Diffraction (XRD); Elemental analysis – Energy Dispersive X-ray Micro analysis (EDX) and Atomic Absorption Spectroscopy(AAS). Applications of carbon nanomaterials in the field of fuel cells and batteries; Energy and environmental applications- Energy production and storage - Applications of nanomaterials in electronics- semiconductors and chemical sensors, biotechnology- detection of biomolecules and medicine-drug design and drug delivery.	12
II	**2D-NMR and NQR spectroscopy** Spectroscopy 2D- NMR – basic principle and types-homonuclear through-bond correlation methods- Correlation spectroscopy (COSY- ^{1}H-^{1}H COSY & ^{1}H-^{13}C COSY), Exclusive spectroscopy (E COSY), Total correlation (E COSY), Total correlation spectroscopy (T COSY), Incredible natural-abundance double-quantum transfer experiment (INADEQUATE)- Heteronuclear through-bond correlation methods-Heteronuclear single-quantum correlation spectroscopy (HSQC), Heteronuclear multiple-bond correlation spectroscopy (HMBC)- Through-space correlation methods-Nuclear Overhauser effect spectroscopy (NOESY), Rotating frame nuclear Overhauser effect spectroscopy (ROESY)- *Resolved-spectrum methods-Higher-dimensional methods*. NQR spectroscopy – Characteristics of quadrupolar nucleus – effects of field gradient and magnetic field upon quadrupolar energy levels – NQR transitions – applications of NQR spectroscopy.	12
III	**Inorganic Spectroscopy** ^{31}P, ^{14}N and ^{15}N NMR spectra – basic theory, standard reference, chemical shift, coupling constants and biological applications. Combined applications of UV-Visible, FT-IR, Raman and EPR spectral data for solving the structure of metal (Co, Ni, Cu and Zn) complexes- *^{1}H-NMR spectra of zinc complexes*- Magnetic studies for the characterization of the complexes by VSM.	12
IV	**Molecular Modelling-I** Molecular Modelling – definition and importance-types of molecular model-spheres, ball-and-stick, skeletal, polyhedral, composite and computer-based models- molecular mechanics- software for molecular mechanics modelling - coordinate systems- potential energy surfaces- molecular graphics- definition, relation with molecular models- *non-bonded interactions- electrostatic and van der Waals interactions in molecular modelling*- hydrogen bonding in molecular mechanics.	12

V	**Molecular Modelling –II** Computer simulation methods- definition and advantages- data preparation and process for the preparation of computer simulation model- softwares for simulation- differences between simulation and model- types of simulation models- force field model for the simulations of liquid water- *calculation of simple thermodynamic properties, phase space*, drug design and delivery using simulating models.	**12**
VI	**Current Trends (For CIA only)** Advances in nuclear magnetic resonance for drug discovery	

……. Self Study

Text Books:

1. T. Pradeep , Nano: The EssentialUnderstanding Nanoscience andNanotechnology Tata McGraw-Hill,New Delhi 1st Edition,(Reprint) 2020.
2. P. S. Kalsi, Spectroscopy ofOrganic Compounds New Age International Publishers NewDelhi, 6th Edition, 2007.
3. WilliamKemp , NMR in Chemistry , Palgrave, USA, 3rd Edition(Reprint), 2011.
4. R. S. Drago, Physical Methods in Chemistry W. B. Sounders , Reprint, 2017.
5. Kazuo Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds: Part A: Theory and Applications in Inorganic Chemistry, John Wiley & Sons, Inc Sixth Edition 2008 .
6. Andrew R.Leach , Molecular Modelling, Pearson PrenticeHall, England 2nd Edition, 2001.

Reference Book(s):

1. C. P. Poole Jr and F. J. Ownes, Introduction to Nano Technology, John Wiley New Jersey, 1st Edition 2003.
2. B. P. Straughan and S. Walker, Spectroscopy, Chapman and Hall, UK Vol. 1 1st Edition (Reprint) 2018.
3. H. Kaur, Spectroscopy Pragati Prakasan Publications, Meerut, 3rd Edition 2006.
4. E. A.V. Ebsworth, W.H. Rankin and Cradock, Structural Methods in Inorganic Chemistry, ELBS 2nd Edition, 1991.
5. Willard, Merrit, Dean and Settle Instrumental Methods of Analysis, CBS Publishers and Distributors, India, 6th Edition, 1986
6. Alan Hinchliffe, Molecular Modelling for Beginners Wiley Publication, 2nd Edition, India, 2008.

Web Resource(s):

1. https://onlinecourses.nptel.ac.in/noc20_cy36/course
2. https://www.youtube.com/watch?v=Gn0I9z0Zbq4
3. https://www.youtube.com/watch?v=ebO38bbq0_4

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Understand the principles of SEM, TEM, IR, Raman and 2D-NMR	**K1 & K2**
CO2	Apply characterization techniques to nanomaterials, inorganic and organic compounds.	**K3**
CO3	Compare the molecular interactions by simulation and nuclear magnetic studies	**K4**
CO4	Assess the drug likeness of a molecule through insilico method	**K5**
CO5	Design and synthesize drug molecules	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2.7**
CO2	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2.8**
CO3	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2.7**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2.8**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2.7**
Mean Overall Score											**2.74**
Correlation											**High**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. M. Purushothaman

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPCH1CC3	Core - III	4	4	25	75	100
Course Title	Teaching and Learning Skills						

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Communication and Interaction** The theory of communication – communication cycle – Types of communication, communication and language, communication in the class room, Lecture and Lecture demonstration as communication. Interaction methods – Interaction analysis, observation schedule and record. Bale's interaction process categories – Flander's system of interaction analysis – verbal interaction category system. *Reciprocal category system – Equivalent talk categories*.	12
II	**Educative Skill** Psychology – Definition – Nature – Meaning of Educational Psychology – Definition – Nature – Scope. Teaching and learning – meaning – characteristics –effective teaching – concept of learning –comparison between teaching and learning. Mental health – Frustration – *concept of adjustment – Defence mechanism* – Mental hygiene.	12
III	**Uses of teaching strategies** Group methods of instruction – lecture – demonstration – seminars – workshops – case analysis – panel discussion – team teaching – individual approaches – Teleconferencing – Video conferencing – Description – Advantages – Micro teaching –Characteristics of Micro teaching – Teaching skills - Programmed Instruction - Computer Assisted Instruction (CAI) – * Language Laboratory*.	12
IV	**Educational Technology** Educational technology – definition – objectives – teaching technology – characteristics of teaching technology – behavioural technology – pedagogy of teaching – General advantage of using teaching aids – Broad classification of teaching aids – Hardware and software in teaching aids. Instructional media – media attributes – multimedia andinstructional development – *Multimedia centre – uses and abuses of multimedia*.	12
V	**Guidance and Counselling** Meaning and definition of Guidance and Counselling- need for guidance – aims of guidance- nature of guidance - principles of guidance philosophy- types of guidance- educational, vocational, personal and social guidance- benefits of guidance- benefits tostudents, teachers, parents community and administrators – role and functions of guidancecell – Counsellor-definition, qualities of a good counsellor, characteristics of counselling,*types of counselling* class teacher as a counsellor- specific duties of a teacher in guidanceservice, differences between guidance and counselling.	12
VI	**Current Trends (For CIA only)** Online Teaching – Types, e content preparation, Opportunities and challenges	

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Text Books:

1. Zikr – ur Rahman, Modern Teaching Methods and Techniques, 5th Edition, Anmol Publications Pvt. Ltd, New Delhi, 2005.
2. R. A. Sharma, Educational Technology and Management Models Media and Methods, 1st Edition, R. Lall Book Depot. Meerut, 2011.
3. Vanaja, Educational Technology, 7th Edition, Neel Kamal publications Pvt. Ltd. Hyderabad, 2016.
4. K. Nagarajan and Deva Seetharaman, Psychology of learning and Human Development, 2nd Edition, Sriram Publishers, Chennai, 2014.

Reference Book(s):

1. B. N. Dash, Elementary Educational Psychology and Methods of Teaching, 1st Edition, Neel Kamal publications Pvt.Ltd., New Delhi, 2007.
2. P. Sambasiva Rao and D. Bhaskar Rao, Techniques of Teaching Psychology, 1st Edition, Sonali Publications, New Delhi, 2006.
3. S. K. Kochhar, Methods and Techniques of Teaching, 1st Edition, Sterling Publisher Pvt. Ltd, New Delhi, 2013.
4. K. Sampath, A. Panner selvam and S. Santhanam, Introduction to Educational Technology, 4th Revised edition, Sterling Publisher Pvt. Ltd, 2000.
5. S. Robinson, Fundamentals of Education Psychology, 2nd Edition, Ane Books Pvt. Ltd, 2008.
6. T.M. Srinivasan, Use of Computers and Multimedia in Education, 1st Edition, Aavisakar publication, Jaipur, 2002

Web Resource:

1. https://archive.nptel.ac.in/courses/127/108/127108015/

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Explain theory of communication	**K1 & K2**
CO2	Apply teaching Strategies	**K3**
CO3	Analyze different types of communication and interaction methods	**K4**
CO4	Compare teaching & learning and guidance & counselling	**K5**
CO5	Adapt educational technology	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**3**	3	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**2.7**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3.0**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3.0**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3.0**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3.0**
Mean Overall Score											**2.94**
Correlation											**High**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Zakir Hussain