

MAHARAJA SUHAIL DEO STATE UNIVERSITY, AZAMGARH
SYLLABUS OF Ph.D. (CHEMISTRY) COURSE

Semester	Category of the Courses	Type of the Courses	Paper Title	Credits
I	Major	CHR101 Paper-I Compulsory	Modern Techniques in Chemical Sciences	6
		CHR102 Paper-II Compulsory	Thrust Area in Chemical Sciences	6
		CHR 103 Paper -III Qualifying	Research Methodology & Computer Applications	4
		Research Project	The topic of the research project will be opted by the student with the consent of his/her Research Supervisor. Therefore syllabus for the research project will not be required.	Non credit
				Total Credit Load 16

Detailed Syllabus

Name of Academic Programme/Class	Ph.D.	
Subject	CHEMISTRY	
Course/Paper Code	CHR101	
Course/Paper Title	Modern Techniques in Chemical Sciences	
Credit Assigned	6	
MAX MARKS:100	PASSING MARKS:50	
TOTAL NUMBER OF LECTURES=35		
UNIT	TOPICS	No of Lectures
I	Modern Techniques in Chemical Sciences: Basic theory, instrumentation and analytical applications: Spectroscopic techniques [NMR, ESR, MS (EI, FAB, MALDI-TOF), IR, UV-Vis, Fluorescence and Phosphorescence, Atomic Absorption, Biosensors.	10
II	Techniques for Materials Characterization : Basic theory and analytical applications of the following physical methods: Xray diffraction methods (single crystal and powder method), Thermo-analytical methods (TGA, DSC, DTA), Microscopic methods (SEM, TEM, AFM), Surface Properties (XPS, BET), Cyclic Voltammetry, SQUID.	8
III	Separation Techniques-I: Introduction, classification of chromatographic methods, terms and relationships in chromatography, sample characterization High performance liquid chromatography (HPLC), Gas chromatography (GC) and ion exchange chromatography, GPC.	6

IV	Separation Techniques-II: Principle, Instrumentation and Application of Reverse Osmosis (RO), Nanofiltration (NF), Ultra Filtration (UF) and Micro Filtration (MF), gel electrophoresis, chiral separations.	4
V	Computational Chemistry: Theoretical Chemistry a quantum approach, MO theory, Ab initio calculation, Geometry optimization, basis set, electronic structure calculations.,	7
Books Recommended	1. F.W Fifield & D. Keal, <i>Principles and Practice of Analytical chemistry</i> Blackwell Publishing Company, (2004) 2. Pradyot Patnaik, (2004), <i>Dean's Analytical chemistry, Hand Book Second edition</i> McGraw-Hill Hand Books 3. J. D Seader /Ernest J. Henley, <i>Separation Processes Principles</i> ; John Wiley & Sons Inc. N.Y. (1998) 4. Skoog, Holler, Nieman, <i>H.B Principles of Instrumental Analysis Fifth edition</i> College publishers. 5. G.H. and H. Freiser, <i>Solvent Extraction in Analytical Chemistry, 1st edition</i> (1958), John Wiley, New York. 6. B. L. Karger, L.R. Snyder and C. Howarth, <i>An Introduction to Separation Science, 2nd Edition</i> (1973) John Wiley, New York. 7. E.W. Berg, <i>Chemical Methods of Separation, 1st edition</i> (1963), McGraw Hill New York. 8. D.G. Peters, J.M.Hayes and C.M. Hieftij, <i>Chemical Separation and Measurements, 2nd edition</i> 1974, Saunders Holt, London. 9. R. M. Silverstein and F.X. Webster, <i>Spectroscopic Identification of Organic Compounds, 6th Edition</i> (2003) John Wiley, New York.F 10. J. R. Dyer, <i>Application of Absorption Spectroscopy of Organic Compounds</i> , Prentice Hall, New Delhi (1978). 11. J.M. Hollas, <i>Modern Spectroscopy, 4th edition</i> (2004), John Wiley and Sons, Chichester. 12. C.N. Banwell and E.M. Mc Cash, <i>Fundamentals of Molecular Spectroscopy, 4th edition</i> (1994), Tata McGraw Hill, New Delhi. 13. R. S. Drago, <i>Physical Methods in Chemistry, International Edition</i> (1992), Affiliated East-West Press, New Delhi. 14. D.A. Skoog, F.J. Holler and T.A. Nieman, <i>Principles of Instrumental Analysis, 5th Edition</i> (1998), Harcourt Brace & Company, Florida. 15. H.A. Strobel, <i>Chemical Instrumentation – A Systematic Approach, 2nd Edition</i> (1973), Addison Wesley, Mass. 16. R.L. Pecsok, L. D. Shields, T. Cairns and L.C. Mc William, <i>Modern Methods of Chemical Analysis, 2nd Edition</i> (1976), John Wiley, New York	
Course/Paper Code		CHR102
Course/Paper Title		Thrust Area in Chemical Sciences
Credit Assigned		6
MAX MARKS:100		PASSING MARKS:50
TOTAL NUMBER OF LECTURES=30		
UNIT	TOPICS	No of Lectures
I	Emerging Green Chemistry: Green chemistry, introduction, 12 principles, Solvent-free synthesis; Environmentally benign solvents: Water and Ionic liquids as green solvents and catalysts in organic synthesis. Microwave in chemical synthesis: Basic principles,	6

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	advantages and examples. Sonochemistry and green aspects;	
II	Nano-Chemistry: Introduction, Nucleation and growth, heterogeneous nucleation, Size effect, Synthesis and assembly, techniques, General methods of preparation and synthesis. Types of nano materials, their Properties and applications. Carbon nanotube, micro- and mesoporous materials.	6
III	Formation of Carbon-Carbon bonds via organometallic reagents: (i) Palladium-Catalyzed Coupling Reactions, (ii) Organoboron Reagents, (iii) Organozinc Reagents, (iv) Organocupper Reagents.	6
IV	Multicomponent reactions (MCRs): Definition, Advantages and examples particularly, Ugi reaction, Biginelli reactions, Strecker amino acid synthesis, Passerini synthesis, Mannich reaction,	6
V	The chemistry of molecular recognition: Host and Guest Chemistry. Supramolecular interactions and their characterization, Supramolecular catalysis and transport processes, Cyclodextrin- a naturally occurring cyclic host, calixarene- a versatile host; Chemo sensor, Electrochemical sensors, Origin and source of chirality, chiral ligands, chiral drugs, asymmetric epoxidation	6
Books Recommended	<ol style="list-style-type: none"> 1. Mike Lancaster, <i>Green Chemistry: An Introductory Text</i>, Royal Society of Chemistry, 2002. 2. Nina Hall(<i>Editor-in-chief</i>), <i>The new Chemistry</i>, Cambridge university Press, 2000. 3. CNR Rao, Muller and Cheetham, <i>The Chemistry of Nano Materials</i>, Vol.I & II, Wiley-VCH (2005) 4. Geoffrey A. Ozin, and Andre Arsenette, <i>Nano Chemistry</i>, RSC Publishing, 2005 5. S. C. Tjong, <i>Nano Crystalline Materials</i> Elsevier, 2006 6. George S. Zweifel, Michael H. Nantz, <i>Modern Organic Synthesis - An Introduction</i>, 1st Edition, 2007; ISBN: 978-0-716-77266-8; Ed. W. H. Freeman 7. Dale L. Boger, <i>Modern Organic Synthesis</i>, TSRI press. 8. P. S. Kalsi, <i>Organic Reactions and Their Mechanisms</i>, 1st Edition (1996), New Age International Pub., New Delhi. 9. M. B. Smith, <i>Organic Synthesis</i>, (1998) Mc Graw Hill Inc, New York 10. J. Clayden, N. Greeves, S. Warren and P. Wothers, <i>Organic chemistry</i>, Oxford University press INC, New York, 2001 11. M.B. Smith & Jerry March, <i>March's Advanced Organic Chemistry</i>, 5th Edition (2001), John Wiley & Sons, New York. 12. M. N. Hughes, <i>Inorganic Chemistry of Biological Processes</i>, 2nd Ed. (1981), John Wiley & Sons, New York. 13. W. Kaim and B. Schwederski, <i>Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, An introduction and Guide</i>, Wiley, New York (1995). 14. S. J. Lippard and J. M. Berg, <i>Principles of Bioinorganic Chemistry</i>, University Science Books, (1994) 15. I. Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine, <i>Bioinorganic Chemistry</i>, Viva Books Pvt. Ltd., New Delhi (1998). 16. Ariga Katsuhiko, Kunitake Toyoki, <i>Supramolecular chemistry- fundamentals and applications: advanced text book</i>, Publisher: Iwanami Shoten Publishers, Tokyo, 2006. 17. Jean Marie Lehn, <i>Supramolecular chemistry: concepts and perspective</i>, WileyVCH (June 1995). 18. Crego-Calama, Mercedes Reinhoudt, Davis N. Ed. <i>Supramolecular chirality, Topics in current Chemistry</i>, vol 265, 2006, Springer Verlag. 	

	19. F. A. Cotton and G. Wilkinson, <i>Advanced Inorganic Chemistry</i> , 6th Edn., (1999), John Wiley & Sons, New York. 20. Catalysis: Principles and Application, editor(s) : B. Viswanathan, S. Sivasanker, A.V. Ramaswamy ISBN: 978-81-7319-375-0: (2007). 21. Jacobsen, E.N., Pfaltz, A.; Yamamoto, H. (ed), <i>Comprehensive Asymmetric Catalysis I-III</i> ; Springer Verlag: Berlin, 1999. 22. Textbook of Polymer Sciences, F. W. Billmeyer Jr, <i>Wiley. Polymer Sciences</i> , V. R. Gwariker, N. V. Vishwanathan and J. Sreedhar, <i>Willey-Eastern</i> . 23. Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Ottanbrite. 24. Contemporary Polymer Chemistry, H. R. Alcock and F. W. Lambe, <i>Prentice Hall</i> . 25. Physics and Chemistry of Polymers, J. M. G. Cowie, <i>Blackie Academic and Professional</i>	
Course/Paper Code	CHR103	
Course/Paper Title	Research Methodology & Computer Applications	
Credit Assigned	4	
MAX MARKS:75	PASSING MARKS:50	
TOTAL NUMBER OF LECTURES=25		
UNIT	TOPICS	No of Lectures
I	Research methodology: Definition of Research, Components of Research Problem, Various Steps in Scientific Research : Hypotheses, Research Purposes, Research Design, Literature searching, Literature Survey, defining the question and formulating hypothesis/ hypothesizes, Collection of research data, tabulating and cataloging. Sampling and methods of data analysis	5
II	Errors in measurements and statistical methods: Types of errors; mean deviation, standard deviation and probable errors; propagation of errors with summation, difference, product and quotient, Probability Theories – Conditional Probability, Poisson Distribution, Binomial Distribution and Properties of Normal Distributions, Estimates of Means and Proportions; Chi-Square Test, Association of Attributes – t-Test – Standard deviation – Co-efficient of variations. Correlation and Regression Analysis, plotting of graphs.	5
III	Laboratory practices and safety guidelines: Safe working procedure and protective environment, Laboratory safety measures, Handling radiation, Chemical hazards and their types, Safe chemical use, Proper storage and disposal of hazardous materials, Bio-hazardous and other toxic experimental materials, Maintenance of equipments .	5
IV	Computer applications in scientific writing skills: Applications of Microsoft Excel, power point and origin for data processing and data analysis, research paper –presentation using power point (which include texts, graphs, pictures, tables, references etc.)(oral in power point/poster); Curve fitting, Method of least square fit, least square fit (straight line) to linear equations and equation reducible to linear equations. Non-linear curve fitting, back ground correction and mathematical manipulation in data using origin. Structure and	5

	Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Pictures and Graphs, citation styles, writing manuscript in Latex, Steps to better writing.	
V	<p>Ethics in Science: The source of ethical issues in science: examples from different disciplines. Ethical issues in science research and reporting: objectivity and integrity, the problem of plagiarism and related issues, international norms and standards, Scientific temper and virtues, expectations from scientific community.</p> <p>IPR and Patent regime: Recording and storage/retention of recorded materials. Management and use responsibilities in proper utilization of the facilities. Socio-legal issues, originality</p>	5
Books Recommended	1. "How to write and Publish" by Robert A. Day and Barbara Gastel, (Cambridge University Press). 2. "Survival skills for Scientists" by Federico Rosei and Tudor Johnson, (Imperial College Press). 3. "How to Research" by Loraine Blaxter, Christina Hughes and Malcum Tight, (Viva Books). 4. "Probability and Statistics for Engineers and Scientists" by Sheldon Ross, (Elsevier Academic Press). 5. "The Craft of Scientific Writing" by Michael Alley, (Springer). 6. "A Students's Guide to Methodology" by Peter Clough and Cathy Nutbrown, (Sage Publications).	

