

SYLLABUS

M. Phil. COURSE

IN

CHEMISTRY



2017-2018

PT. RAVISHANKAR SHUKLA UNIVERSITY
RAIPUR - 492 010, CHHATTISGARH

M. Phil. IN CHEMISTRY

DURATION : 01 YEAR

M.M. : 500

COURSES

Name of Course		Total Marks
Compulsory		100
Course I : Research Methodology in Chemistry		
Out of following three courses , one has to opt any two courses.		100
Course II : Medicinal and Physical Organic Chemistry		
Course III: Advanced Environmental Chemistry		100
Course IV : Chemistry of Nanomaterials		100
Seminar	Based on Theory	50
Dissertation	Seminar based on Dissertation	50
	Script Writing	75
	Viva-voce	25
Total Marks		500

Note : A Student shall submit a dissertation based on his/her Practical work.

M. Phil.

COURSE - I

RESEARCH METHODOLOGY IN CHEMISTRY

M.M. – 100

UNIT-I RESEARCH METHODOLOGY

Purpose of research; Research project Conceptualization, choice of methods; Elements of a research proposal, operationalization choices and illustrations. Research design: formulation, pre-testing of research instruments and procedures, units of analysis, time dimension. Experimental design and use of indicators in research. Survey Research: Guidelines for asking question and questionnaires construction, Self-administered questionnaires, Interview and other survey methods; their strength and weaknesses. Sampling: the logic of sampling , concepts and terminologies , population and Sampling frames , types of sampling design .Field studies : steps in the conducting field study ; evaluation research: how to carry out evaluation research , Fundamental knowledge of Patent and IPR.

UNIT-II LITERATURE SEARCH TECHNIQUE

IUPAC rule for nomenclature –Introduction to chemical abstracts –Subject Index, Substance Index, Author Index, Formula Index and other indices-Uses of these indices with examples-current contents –organization –methods of using the titles and index –other similar abstracts for special topics related to chemistry. Use of computer browsing for literature search and downloading –basics of internet services –various sources of abstracts ,articles and papers of browsing and downloading, Techniques of conversion from one format to another Structure drawing programs and their uses –searches through structure . Use of Literature, Knowledge of National and International Journals, Impact Factor, Citation-Index, h Index,SCI Journals, Plagiarism

UNIT-III INSTRUMENTAL TECHNIQUES

Principle, instrumentation and application of electro-analytical, spectrophotometry, fluorimetry, AAS, AES, XRF and NMR techniques. Principle instrumentation and application of chromatography and MS techniques. Classical Method of Analysis

UNIT-IV SAMPLING AND MODELING

Measurement and sampling technique of air pollutants using air monitors in selected atmospheric receptors. Statistical approach in environmental monitoring and analysis using selected parameters (correlation and regression analysis, factor analysis etc.) and graph plotting (Boxplot, histogram etc.)

UNIT-V STATISTICAL ANALYSIS

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 binomial distribution, 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, student's t-distribution, and t-test- 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 line, standard deviation, correlation coefficient-Multiple linear regression (one variable with two other variables).

BOOK SUGGESTED:

1. Thesis and Assignment Writing – J. Anderson, B.H. Dursten and M.Poole, Wiley Eastern (1977).
2. A Hand Book of Methodology of Research – P. rajamal and P. Devadoss, R.M.M.Vidya Press (1976).
3. instrumental Methods of Analysis – H.H. Willard, L.L.Merritt, J.a.Dean, F.A. Settle, CBS Publishers & Distributors, 1986.
4. Practical Process, Research and Development – Neal G. Anderson, Amazow

COURSE – II

MEDICINAL AND PHYSICAL ORGANIC CHEMISTRY

M.M. - 100

UNIT – I

Classification of drugs, Identification of active part: Pharmacophore, drug likeliness. Binding Forces: covalent bonds, ionic bonds, hydrogen bonds and van der waal's bonds.

Lipid, Membrane and Cell coats: Lipid structure, Membrane Structure, Membrane Proteins, transport of molecules through Membrane, the extracellular matrix and cell walls.

UNIT – II

Chemistry of Drug (and related compound) Metabolism: General Pathway, Sites of drug biotransformation, oxidative reactions : of aromatic moieties, olefins, benzylic carbon atoms, allylic carbon atoms, oxidation of carbon atom to carbonyls and imines, aliphatic and alicyclic carbon atoms, oxidation involving carbon-heteroatom systems. Reductive reactions of aldehydes, ketones, nitro and azo compounds. Hydrolytic reactions of esters and amides.

Conjugation reactions of sulfate, glycine, glutamine. Acetylation and methylation reactions, during metabolism.

UNIT – III

MICELLAR CHEMISTRY

Physical and chemical properties of surfactants and micelles in aqueous solutions, micelle formation and structure thermodynamics, micellar effects on hydrophobic interactions of protein structure, effect of additives on the CMC ,principle of micellar catalysis, micellar catalysis of hydrolysis, solvolysis , micellar enzymology.

UNIT –IV

STRUCTURAL EFFECTS ON REACTIVITY : Linear free energy relationships (LFER). The Hammett equation, substituent constants, theory of substituent effects. Interpretation of ρ -values. Reaction constant ρ . Deviations from Hammett equation. Dual parameter correlations, Inductive substituent constant. The Taft model, σ_p -and σ_m -scales.

KINETIC ISOTOPE EFFECT : Theory of isotope effect. Primary and secondary kinetic isotope effects. Heavy atom isotope effect. Tunneling effect, Solvent effects and solvent isotope Effects

UNIT –V

SOLVATION AND SOLVENT EFFECTS : Qualitative understanding of solvent solute effects on reactivity, Classification of solvents, Solvation, Thermodynamics of Solvation, effects of solvation on Reaction Rates and Equilibria, Various Empirical indexes based on Physical properties, Dielectric Constant, Grunwald- Winstein Parameters. Koppel Palm Treatment, Solvent sensitive Reaction Rates, Spectroscopic parameters and Scales for Specific Solvation, use of solvation Scales in Mechanistic studies, solvent effect from curve Crossing models

BOOK SUGGESTED:

1. Introduction to Medicinal Chemistry, A Gringuage, Wiley – VCH.
2. Wilson and Gisvold's Test Book of organic Medicinal and Pharmaceutical Chemistry, Robert F. Dorde.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International.
4. Burger's Medicinal Chemistry and Drug Discovery, Vol – 1(Chapter – 9 and Ch-14), Ed. M.E. Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw – Hill
6. The Organic chemistry of Drug Synthesis and Design Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley.
8. Medicinal Chemistry, Alex Cringauz, Wiley-VCH, NY.
9. Comprehensive Medicinal Chemistry, Ed. Corwin Hanch, Vol. 1-6, Elsevier.
10. Biochemistry, the Chemical Reactions of Living Cells, David E. Metzler, Vol. I, Harwart Academic Press.
11. Micells & Y.Moroi
12. Mechanism and Theory in Organic Chemistry, T H Lowry and KS. Richardson, harper and Row.
13. Physical Organic Chemistry, N.S.Isaacs
14. The physical Basis of Organic chemistry, H.Maskil.
15. Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.L.Delgado and W.A.Remers, Lippincott Williams of Williams.

COURSE – III

ADVANCED ENVIRONMENTAL CHEMISTRY

M.M. - 100

UNIT-I

HEAVY METAL TOXICOLOGY: concept, heavy metals in environment (i.e. Arsenic, Selenium, Cadmium, Mercury, Thallium, Lead), sources, toxicity, transformations, biochemical effects, remedial measures

ORGANIC POLLUTANT TOXICOLOGY: introduction, application potential, limitation of pesticides uses, toxicology of major pesticides, environmental impacts of pesticides, pesticide persistence, bioaccumulation and biomagnifications pesticide resistance

RADIATION HAZARDS: introduction, atomic radiations, natural radiations, effects of radiations, radioactivity and effects on man, impacts of radioactive radiations, radioactive waste, ionizing radiation and effects, radiation protection

UNIT-II

INDUSTRIAL AND SLUDGE WASTE MANAGEMENT: Municipal, sediment, steel plant, cement plant and thermal power plant.

HEALTH IMPACTS: human disease (i.e. infection disease, chemicals, diet, water born pathogens, vector born, Minamata disease), radiation damage, climate change and human health, respiratory hazards.

RISK ASSESSMENT: Concept, risk evaluation (i.e. hazard identification, exposure assessment, hazard assessment and risk characterization), public perception of risk, risk communication.

UNIT-III

STANDARD FOR ENVIRONMENTAL QUALITY ASSESSMENT AND MONITORING: Introduction, Environmental Protection standards in India, international standards, environmental quality monitoring: ISO14000, ISO14000-impact on developing countries

ENVIRONMENTAL IMPACT ASSESSMENT: concept, process, evaluation methodology, and approaches

ENVIRONMENTAL AUDIT: Concept, setting an audit programme, typical audit process, carrying out the audit, benefits of environmental auditing, environmental audit programmed in India

UNIT-IV

Biotechnological approach of environment, Biodegradation of pollutants, toxic site reclamation, removal of spilled oil & grease deposits, reducing environmental impacts of herbicides and pesticides, biosensors.

Biotechnological energy and agricultural production management.

Biomass, biogas, bioethanol, biohydrogen, biofertilizers, biopesticides.

BIOLOGICAL ENERGY: Biofuels, natural vegetations, energy tree plantations, specific energy crops, power from biomass, biomass programmes, biomass and the environment.

UNIT-V

SUSTAINABILITY : Concept, sustainable uses of natural resourced materials and waste management, sustainability in agriculture

MODELS : Mathematical models, approaches, model applications in air, aquatic and land environments.

NATURAL DISASTERS : Earthquakes, Tsunami, windstorms, floods, drought, volcanoes, el-nino, ozone hole, smog, pollen and their allergens, atmospheric turbidity.

BOOK SUGGESTED:

1. Perry, G. 1980. Introduction of Environmental Toxicology, Elsevier, Netherland.
2. Santra, S.C. 1994, Ecology; Basic and Applied , M.D. Publication, New Delhi (India).
3. Santra, S.C. 2001, Enviromental Science, New Central Book Agency (P) Ltd. Calcutta (India).

Course -IV
CHEMISTRY OF NANOMATERIALS

**UNIT I: GENERIC METHODOLOGIES FOR NANOCHEMISTRY AND
NANOTECHNOLOGY:**

Introduction and classification - What is nanotechnology? - Classification of nanostructures - Nanoscale architecture; Summary of the electronic properties of atoms and solids - The isolated atom - Bonding between atoms - Giant molecular solids - The free electron model and energy bands - Crystalline solids - Periodicity of crystal lattices -Electronic conduction; Effects of the nanometre length scale - Changes to the system total energy - Changes to the system structure - How nanoscale dimensions affect properties?

UNIT -II. MATERIAL CHEMISTRY :

Preparation and Properties of Nanoparticles, Materials-Metals, Ceramics (Oxide, carbides, sulphides, nitrides).physical and chemical Methods, Size and Shape controlled Synthesis, Sol-gel methods, Optical Properteis, Electrical and Magnetic Properties, Application of Nanoparticles.

UNIT-III . CHARACTERIZATION METHODS.

X-ray diffraction - Debye-Scherrer formula – dislocation density – micro strain – Synchrotron Radiation – Principle and Applications –Raman Spectroscopy and its Applications – Dynamic Light Scattering (DLS). Electron microscopes: scanning electron microscope (SEM) – transmission electron microscope (TEM); atomic force microscope(AFM) – scanning tunneling microscope (STM) - XPS – Working Principle, Instrumentation and Applications. Differential scanning calorimeter (DSC) – Thermogravimetric/Diffferential Thermal Analyzer (TG/DTA) – UV – Visible Spectrophotometer - FTIR – Principle and Applications – Photoluminescence (PL) Spectroscopy.

UNIT-IV APPLICATIONS ON NANOCHEMISTRY

Nanobiology - Introduction - Bio-inspired nanomaterials - Interaction Between Biomolecules and Nanoparticle Surfaces - Different Types of Inorganic Materials Used for the Synthesis of Hybrid Nano-bio Assemblies -

UNIT-V APPLICATIONS OF NANO IN BIOLOGY

Applications of Nano in Biology -Nanoprobes for Analytical Applications - Current Status of Nanobiotechnology - Future Perspectives of Nanobiology; Nanosensors, Electrochemical , Nanobiosensors - Smart Dust; Nanomedicines, Nanodrug Administration Diagnostic and Therapeutic Applications.

References:

1. Nanoparticles: From Theory to Application Edited by Gu'nter Schmid, @ 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
2. Nanoparticles and Catalysis Edited by Didier Astruc @ 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike HagermanShriver and Atkin's Inorganic Chemistry, Fifth Edition, Oxford, 2010.
4. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
5. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, Wiley Interscience, 2003.
6. Nano:The Essentials: Understanding Nanoscience and Nanotecnology, T.Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.