VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI

DEPARTMENT OF STUDIES IN INDUSTRIAL CHEMISTRY

Ph. D Entrance Examination Syllabus

Part A: Research Methodology

Unit-1: Research methods and Foundation of research

Fundamentals of Research Methodology: Definition and Objectives of Research. Types (Descriptive, Analytical, Applied, Fundamental, Qualitative, Quantitative, Conceptual and Empirical) and Significance of Research. Research Approaches. Research Methods versus Methodology. Criteria of a Good Research. Problems encountered by Researchers in India. Research Problem. Definition of Research Problem. Necessity of defining Research Problem. Techniques involved in Defining a Research Problem. Methods of selecting a Research Problem.

Unit-2: Experiment design and Statistics

Research Design: Meaning and Need of Research Design. Important concepts related to Research Design. Features of a Good Design. Different Research Designs. Basic Principles of Experimental Designs.Processing and Analysis of Data; processing operations, problems in processing.Types of analysis, statistics in research, importance of statistical analysis. Measure of relationship- simple regression, multiple correlation and regression analysis. T-test: application of this test. Analysis of variation and co-variations; what is ANOVA, basic principles

UNIT-3: Research sources

Selection of research problems and literature survey: primary sources- Journals periodicals, abstracts; Secondary listing of titles, reviews –annual Treatises, serials, monographs and text books, encyclopedia, catalogues, index of tabulated data- Science citation index- Searching the chemical literature-location of journal article- materials on a given topic- information about specific compound-Choosing a problem-abstract of a research paper. Scientific ethics. Internet: Introduction to internet-web browsers-World Wide Web-Search engines-literature survey in Chemistry-popular website in chemistry-Database in chemistry.

References

1) C. R. Kothari, Research Methodology: Methods and Techniques, New Age International Pulishers, New Delhi, 2004
2) Deepak Chawla and Neena Sodhi, Research Methodology, Concepts and cases, 2nd ed., Vikas Publishing House Pvt Ltd., New Delhi, 2015
3) Vinayak Bairagi and Mousami V Munot, Research Methodology: A practical and Scientific Approach, CRC Press, New York, 2019
4) Comstock Gary, Research Ethics, Cambridge University Press, 2013
5) Vogel's Quantitative Inorganic analysis, 7th Ed., 2012
6) G.D. Christian, Analytical Chemistry, 7th Ed., Wiley , 2013

Part A: Industrial Chemistry

Industrial applications of Organometallic compounds:

Homogeneous catalysis, hydrogenations of olefins, oxo-process, Waker process, water gas shift reactions, carbonization. Heterogeneous catalysis, Fischer- Tropics reaction, Ziegler-Natta polymerization.

Metal complexes in medicine:

Interaction of metal complexes with nucleic acids, metal ion deficiency effects, toxicity of metal ions and treatment of toxicity, chelating agents in medicine, bacterial agents, antiviral agents and anticancer agents, metal complexes as drugs and therapeutic agents.

Separation and Purification Techniques:

Principle of: Recrystallization : using various solvents and mixture of solvents Fractional crystallization: e.g. Separation of naphthalene and diphenyl: Fractional distillation : e.g. Separation of Benzene, acetone, ethyl alcohol etc.: Steam distillation: Soxhlet Extraction.

Biological and Pharmacological Screening of compounds

Principle, material and methodology for the following activities: Antimicrobial (Antibacterial, antifungal and antiviral); Analgesic ; Anti-inflammatory; Anthelmintic and Mechanism of action

Analytical and spectroscopic techniques

Chromatographic technique: Classification, basic principle, theory of chromatography, TLC, principle and applications.
Gas Chromatography and HPLC: Introduction, principle, instrumentation and applications.
UV-Vis spectroscopy: Principle. Beer's law, Deviation of Beers law, Instrumentation and applications.
IR Spectroscopy: Principle. Fingerprint region, Instrumentation and functional group analysis.
H NMR Spectroscopy : Introduction to NMR, quantum description of NMR, chemical shift, spin-spin coupling, coupling constant, instrumentation, applications, interpretation and limitations.
Mass spectroscopy: Principle. Fragmentation, Instrumentation and applications.
Spectroscopic applications: UV-visible, IR, 1H NMR, 13C NMR, mass spectroscopy in structural elucidation of organic compounds. Problems on structural elucidation involving all the above spectroscopic methods.

Nanomaterials

Synthesis : Reduction, Sol- gel method, Reverce micelles, combustion method, microwave and co-precipitation method.
Characterization: Powder X-ray diffraction (PXRD), Scanning Probe Microscopy (SEM), Transmission electron microscopy(TEM), Atomic force microscopy(AFM)

Properties and Application of nanomaterials

Properties of Nanomaterials: role of size in nanomaterials, Electronic Properties:, Dielectric Properties, Magnetic Properties: Diamaganetic, Paramaganetic, Ferromaganetic and Antiferromaganetic, Optical Properties, Semiconductor nanoparticles, Luminescence in Semiconductor nanoparticles: Photoluminescence, Cathodoluminescence and Thermoluminescence.

Applications: Automobiles, Textiles, Cosmetics, Domestic Appliances, Biotechnology and Medical field, Space and Defence, Nanotechnology and Environment.

References:

1) Vogel's Quantitative Inorganic analysis, 7th Ed., 2012
2) G.D. Christian, Analytical Chemistry, 7th Ed., Wiley , 2013
1. Inorganic chemistry – James E Huheey, Harper and Row Publishers (2004)
2. Organometallic Chemistry – R.C. Mehrothra and A. Singh, 2nd Edn., New Age, International Publications, 2006
2. B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Textbook of Nanoscience and Nanotechnology, Univ. Press, 2012.
3. Jonathan W. Steed, David R. Turner, Karl J. Wallace, Core Concepts in Supramolecular Chemistry and Nanochemistry, John Wiley & Sons, 2007.
4. Organometallic Chemistry – R.C. Mehrothra and A. Singh, 2nd Edn., New Age, International Publications, 2006.
5. Inorganic Chemistry – 2nd edition, D.F Shriver, P.W.Atkins and C.H.Langtore Oxford University Press (1994).
6. Con Inorganic Chemistry – J.D. Lee, ELBS.
7. Bioinorganic Chemistry – A.K. Das, Books & Allied (P) Ltd., 2007.
8. Jaroslava varc-Gajic, Biological Activity of Natural Products (Biochemistry Research Trends) , Nova Science Publishers, 2013.