Department of Industrial Chemistry, ISTAR
Pre-Ph.D. Course

Paper-I
Research Methodology

Introduction:
Meaning, Objectives, Motivation, Types of research, Approach and Significance, Characteristics of scientific research, Value of and value free scientific research, definition and selecting a problem, Scientific methods in research, criteria of good research, sources for selecting research topics.

Research Design:
Meaning, need, features, concepts, goals, characteristics, different phases in research design designs for different types of research, advantages of research design, Basic principles and experimental design.

Measurement and Scaling techniques:
Measurement in research, measurement in scales, source of error in measurement, tests for sound measurement, measurement tools. Observation purpose, types, process, factors affecting observation, recording observation, observation schedule, Scaling-means, techniques

Statistical techniques:
Measures – Means, median, mode and comparison
Analysis of variance and covariance – Analysis of variance and covariance (ANOVA) – Definition, types, basic principle, techniques, methods, two way ANOVA, analysis of covariance
Multivariate Analysis techniques : Growth, characteristics and applications, classification, variables, multivariate techniques, factor analysis-rotation, R-type and Q-type factor analysis, path analysis

Interpretation and report writing:
Meaning, technique, precaution, significance, different steps in writing report, layout and presentations, mechanism and precautions in writing research reports
Computers:
Role in research and Application in chemistry: Computer and computer technology, Computer system, Characteristics, Binary number system.
MS Office: Tools and application
Internet web programming: Hardware and software requirement for internet, ISP and internet account, Web home page, URL, Browser, Security on web, Searching tools and search engines,
Internet as resource for chemical literature: The structure of chemical information, Important electronic based resources and how to find information on compounds-synthetic routes, physical and chemical properties, abstracts and journals in chemistry, Electronic form of journals and their resource, patents and the disclosure of chemistry inventions.

Books suggested for further reading
1. Research Methodology, Methods and techniques, C.R.Kothari, New Age International Publishers, New Delhi
2. Research Methods, Ram Ahuja, Rawat Publication, New Delhi
5. Research Methodology, Attar Singh, Mohit Publication, New Delhi
7. Research Methodology, P. Madam, V. Paliwal and R. Bhardwaj, Global vision publication house, New Delhi
Paper II

Selected topics in Industrial Chemistry

Evaporation and Crystallization:
Isolation and purification of organic compounds (solids and liquids), Approaches for crystallization, Batch and continuous type crystallization, Theory of crystallization, Multiple effect evaporator, Batch and continuous type evaporator, Accessories of evaporator.

X-ray diffraction and G.C-M.S:
Single crystal and power pattern: Basic principle, application with some typical examples, Energy dispersive X-ray methods, Mass Spectrometry for the structural elucidation of organic compounds.

Unit Process:
Study of following processes with special emphasis on chemistry & chemical engineering principles of following processes: Hydrogenation, Halogenation, Esterification, Epoxidation, Sulphonation

Polymer processing:
Compression & Injection Moulding, Blow moulding, Extrusion: Fundamental principles, working

Books suggested for further reading

1. Instrumental methods of chemical analysis, B.K. Sharma, Goel pub., 26th edition.
3. Polymer Processing, Morton & Jones, Chapman & Hall.
5. Unit operations : Volume I & II by. K.A.Gavhane
6. Chemical Engineering volume I & II by J.M. Coulson and K.F. Richardson (Asian books Pvt Ltd. New Delhi)
7. Unit processes in organic synthesis, Groggins, Tata Mgraw Hill pub. 5th edition.
8. Chemistry and technology of basic organic and petrochemical synthesis, N.N. Lebedev, Mir pub.

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Paper III
Review Writing and Presentation/Seminar

Each student will submit a literature review report on his chosen research and student will give a presentation/seminar.