

## Syllabus for Ph.D /M.Phil – Part 1 Examination

### G01 – Research methodology:

#### Unit 1: Survey of Literature:

- i. Sources – Primary and Secondary sources - Journals, Papers, reviews, communications, notes, patents, Journals of different fields of Chemistry (Organic, Inorganic, Physical, Polymer, Pharmaceutical, Industrial and Analytical). Titles, importance of categorization and their importance, Abbreviations of names, Nomenclature of compounds and their usage.
- ii. Abstracts –Types (Chemical, Physical, Analytical), Survey of abstract indexes author index, general technique index, collective and comprehensive indices, Aids of Computer devices in literature survey.
- iii. Specific articles of science citation cards and indices, summarizing the works already done and published in the chosen field.

#### UNIT-II Proposal, Paper and Thesis Writing

- i. Assignments and test papers, Thesis and dissertations, style and conventions in writing, selection of topic.
- ii. Rough drafting of the article, Title, Abstract, Literature review, problem and time limitation, Experimental methods, Results and discussions, Foot notes, Figures, Data presentations, Tables, Sign convention followed, Bibliography, conclusions and recommendations.
- iii. The general format, page and chapter format, use of quotations, foot note, tables and figures, Results and discussions, applicability of the findings to common usage, referencing, abbreviations used etc.

#### UNIT-III Statistical Analysis of Data

- i. Various types of errors – precision and accuracy – significant figures, various statistical tests on the accuracy of results, positive and negative deviation from accurate results.
- ii. Gaussian distribution, Normal distribution of random errors, mean value, variance and standard deviation, reliability interval, deviations from the Gaussian law of error distribution.
- iii. 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).

#### **UNIT-IV Introduction to Computing , Networking and C – Programming**

- i. Introduction to computers and computing : Hardware, organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software, High and low level languages, Compilers, Algorithms and Flow charts.
- ii. Introduction to networking: Computer networks, Network components, Hubs, switches, repeaters, routers, bridges and gateways – LAN, WAN, internet and internet worldwide web, internet for chemists: online search of chemistry databases, e-journals, search engines for chemistry, chemweb.
- iii. Structure of a C program : Data types, Constants and Variables, Keywords, Operators and Expression. Control structure : if, if-else, nested if-else, while, while-do, for, nested for, goto, continue, break, switch case statements.

#### **UNIT-V Instrumental Analytical Methods Used for Research:**

Use of analytical techniques for Research, Gas Chromatography, UV-Vis Spectrophotometer, Atomic Absorption Spectroscopy, Gas Chromatography –Mass Spectrometry (GC-MS), Liquid Chromatography-Mass spectroscopy (LC-MS), Scanning Electron Microscope (SEM). Basics, use of the above techniques in research.

#### **Reference Books:**

1. **Research Methodology – Methods and Techniques** - Dr.C.R.Kothari, 2009
2. **Research Methodology** – P.Saravanel,2009
3. G.W.Ewing, **Instrumental methods of chemical analysis**, McGraw Hill Pub, 1975.
4. Douglas. A.Skoog, **Principles of instrumental analysis**, Saunders College Pub.Co, III Edn., 1985

## **G02 – Research Trends- Advances in Chemical Sciences**

### **Unit 1: History and types of Chemical Warfare agents:**

Introduction: History of Chemical warfare agents, Chemical Weapons convention (CWC). Types of CW agents: Blister agents, Nerve agents, Choking agents, Blood agents.

### **Unit 2: Properties of Chemical Warfare Agents:**

Properties of agents, exposure limits, mechanism of action of various agents.

### **Unit 3: Detection of Chemical Warfare agents:**

Detection of CW agents: Spot detection techniques, stand alone detector, hand held detectors, various analytical methods for identification of CWC agents using GC, GC-MS, FTIR and LC-MS.

### **Unit 4: Protection from Chemical Warfare agents:**

Protection from CW agents: use of gas mask, protective clothing, self contained breathing apparatus (SCBA), Development of protective measures from research activities.

### **Unit 5: Decontamination and Destruction of Chemical Warfare agents:**

Decontamination and Destruction of CW agents: various techniques for decontamination of CW agents, destruction using incineration and neutralization methods.

### **Reference Books:**

1. **Chemical Warfare Agents - Synthesis and properties** – DRDE, Gwalior
2. **Chemical Warfare Agents: Toxicology and Treatment** - Marrs, Timothy C., and Sidell, Frederick R. John Wiley and Son, 1996.
3. **First Responder Chem-Bio Handbook** – Ben Yenske, Tempest Publishing, 1998.

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## **G03 – Special Paper- Colloids, Catalysis and Nano materials**

### **Unit 1: Introduction to Colloids:**

Basic principles and surface activity, solution chemistry of surface active components, Particle interaction and stability.

### **Unit 2: Properties and investigation of colloids:**

Properties of colloids, scattering of colloidal suspensions, Brownian movement and Tyndall effect, experimental investigation of colloidal functionality, chemistry of colloidal formulations.

### **Unit 3: Introduction and types of catalysis:**

Introduction to catalysis, types of catalysis – homogenous, heterogenous, electro and organo catalysis, thermodynamic and kinetic analysis, mechanism of catalysis, Catalytic inhibitors and promoters

### **Unit 4: Introduction to nano materials and their synthesis:**

Introduction and importance of nanomaterials, types of nano materials, types of nano materials, single and multiwalled carbon nano tubes, nano fibres and nano rods, synthesis by wet process, colloidal chemical, hydro thermal, sol-gel methods, PVD and CVD techniques, electro deposition techniques.

### **Unit 5: Characterization and application of nano materials:**

Surface morphology and nanostructure-SEM, TEM, AFM; Structural Characterization - UV-Visible and FT-IR spectroscopy, Structure orientation and microtexture-XRD.

Photocatalytic applications, applications of carbon nanomaterials in the field of fuel cells, batteries; Energy and environmental applications- Energy production and storage - nanomaterials as actuators and thermal insulators, membranes for chemical processes-Applications of nanomaterials in electronics, biotechnology, medicine. Application of nanomaterials as chemical sensors, detection of biomolecules, pollutants and drugs.

### **Reference Books:**

1. **Colloids and interfaces with surfactants and polymers** - James W. Goodwin, 2009
2. **Hand book of Surface and Colloid Chemistry** – K.S. Birdi, 3<sup>rd</sup> Edition, 2009, Taylor & Francis Group, LLC.
3. **Introduction to Catalysts and Catalysis** – Anne Marie Helmenstine, 2009
4. **Chemical Kinetics** – Laidler
5. C.N.R. Rao, A. Muller and A.K. Cheetham (Eds.), **The Chemistry of Nanomaterials** Vol.I & Vol.II., Wiley-VCH, 2004
6. P. Ajayan, L.S. Schadler, P.V. Bawn, **Nanocomposite Science and Technology**, Wiley-VCH, 2003.
7. G. Schmid (Eds), **Nanoparticles**, Wiley-VCH, 2004