

# **SYLLABUS FOR PET EXAMINATION**

## **Analytical Chemistry**

**Eligibility:** M.Sc. in Analytical Chemistry (Annual System) or (Semester System)

M.Sc. Chemistry with 24 credits of Analytical chemistry (Semester system) or 6 units of 4 credits each (annual system)

# SYLLABUS FOR Ph. D. CHEMISTRY ENTRANCE TEST

## **A) Analytical Chemistry:**

Fundamentals of Analytical Chemistry, Acid-base titrations - indicators and applications. Complexation, precipitation and redox titrations, Gravimetry. Electroanalytical methods – Potentiometry, pH metry, Ion selective electrodes, Polarography, Modified Polarographic Methods, Amperometric titrations, Electrogravimetry and Coulometry. Thermal Methods of Analysis: TGA, DTA, DSC, TMA, EGA, TT. Molecular Fluorescence Spectroscopy, Atomic Spectrometric Methods.

Analytical Separations: Solvent extraction; Chromatography: Principles, Classification of chromatographic techniques, Theory of column efficiency in chromatography, Gas Chromatography, Liquid Chromatography, Ion-exchange Chromatography, Size-exclusion chromatography and Affinity chromatography, Thin Layer Chromatography.

Basic Principles and Application of Spectroscopy, Microwave Spectroscopy, Vibration Spectroscopy, Raman Spectroscopy, UV-Vis Spectroscopy, NMR Spectroscopy, Mass Spectroscopy. Hyphenated methods: GC-MS, LC-MS, MS-MS, GC-IR, ICP-MS.

## **B) Food and Biochemical Analysis:**

Food Additives & analysis of food products; Food Quality Parameters: Composition & Impurities in Food. Classification of food colors, Food & Biochemical analysis: Wheat flour, Milk & Milk products, Tea & Coffee, Honey, Jam & Jelly, Bread, Biscuits, Ice Cream, Butter, Cheese, Soft drinks, Alcoholic beverages, Cereals and pulses, Confectionery, Fruits, Vegetable, Egg, Fish, Meat. Analysis of blood sample, Serum plasma, Urine test, Blood sugar, Electrolytes in body, Substance Glutamic-Oxaloacetic Transaminase Test (SGOT), Substance Glutamate Pyruvate Transaminase (SGPT), Sputum. Body profile: Liver profile, Renal profile, Thyroid profile.

Food, Water, Air borne diseases: Signs & symptoms.

## **C) Environmental Chemistry:**

Air pollution - Sources and sinks of gas pollutants, and their effects on ecosystem. Methods of control of air pollution. Water pollution: Types of sources and classification of water pollutants, and their effects on ecosystem. Methods of control of water pollution: water and waste water treatment. Radiation pollution: Classification & effects of radiation, protection and control from radiation. Environmental toxicology: Chemical solutions for better industrial processes.

## **D) Pharmaceutical Analysis:**

Active Pharmaceutical Ingredients (API) and drug products, Dosage form, Introduction to Pharmacopoeia and its importance. Application of analytical techniques in pharmaceutical industries: - Official sources of Impurities and limit test (As, Pb, Fe, Chloride, Sulphate).

- Techniques of Analysis: Gravimetric, Volumetric and Instrumental Techniques, Assay of main classes of drugs Chemotherapeutic agents. Quality Assurance (QA)& Quality Control (QC) - Concept of Total Quality Management. Good documentation practices (GDP), Concept of good laboratory& manufacturing practices (CGLP),(CGMP).

#### **E) Cosmetics:**

Common processes used for cosmetic formulations, raw materials, Colors and Perfumes. Cosmetic formulation: Skin creams, Face Powders, Lipsticks, Shampoos, Manicure preparations, Hair grooming preparations, Nail lacquers, Dentifrices.

Herbal Cosmetics products for: Skin, Nails, hairs, dentifrices.

Quality control: raw materials, Intermediate and bulk finished products, determination of specific microorganisms.

#### **F) Organic Analysis:**

Introduction organic functional group analysis, principles & methods of analysis. Nanotechnology: Introduction; Carbon nanotubes: Significance, Preparative methods, Types SWNT,MWNT and applications. Nanomaterials.

Organic synthesis: Principles of organic synthesis, Wacker process, Ziegler Natta, Grignard Reaction, Williamson Synthesis. Organic trace analysis: Introduction, Units, Sampling, Concentration techniques and estimation methods. Micro-elemental analysis of C,H,N,O and halogens. Composite problems involving UV-Vis, IR, NMR and mass for structural elucidation of simple organic compounds.

#### **G) Industrial Products and Forensic Analysis:**

Analysis of Steel, Cement and Ferrous materials, Ceramic materials, Clays and feldspars, Glasses, Ferrous slags. Analysis of other products: a) Surfactants and Detergents b) Effluent water analysis c) Soil and fertilizer analysis. Forensic Analysis: Blood & Hair.

#### **H) Medicinal Chemistry:**

Antiseptic and disinfectants, Chemotherapeutic agents, Antibiotics, Sulphonamides, Diuretics, Hypoglycemic agents, Drugs acting on central nervous system, Drugs acting on peripheral nervous system, Hypotensive agents and cardiovascular drugs, Vitamins and co-enzyme, Antihistamines, Corticosteroids, sex steroids.

#### **I) Biosensors, Agrochemicals & Organic Polymers:**

Biosensors: Definition, components, types and applications.

Types of Transducers, fabrication of probes for sensors and evaluation of sensor performance.  
Agrochemicals: Introduction, Classification, Mechanism of action, Synthesis and Analysis.  
Insecticides, Herbicides, Fungicides and pesticides.

Organic Polymers: Basic Concepts, degree of polymerization, Nomenclature and Classification.  
Copolymers, Polymerization processes, Mechanism of polymerization, Optical Activity in polymers.  
Analysis of Polymers: Determination of molecular weight of polymers, End-Group analysis, Thermal Transition in Polymers.

### Reference Books:

1. Skoog D.A., West D.M., Holler and Crouch, Fundamentals of Analytical Chemistry, Cengage Learning, Wiley-VCH Weinheim, 2011.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, Vogel's Quantitative Chemical Analysis, Pearson Education, ELBS, 6<sup>th</sup> Edition, 2009.
3. Gary D. Christian, Purnendu Dasgupta, Kevin Schug, Analytical Chemistry, John Wiley, 7<sup>th</sup> Edition, 2013.
4. George Latimer, Official Methods of Analysis of AOAC International (AOAC = Associate of Analytical Communities), Publication – AOAC, 19<sup>th</sup> Edition, 2012.
5. Suzanne Nielson, Food Analysis, Springer, 2010.
6. V. Villavecchia, Treatise on Applied Analytical Chemistry, Methods and Standards for the Chemical Analysis of Industrial and Food Vol I & II, Nabu Press, 2012.
7. Editor Dr. Pico Yolanda, Chemical Analysis of Food: Techniques and Applications, Academic Press, 2012.
8. Semih Otles, Methods of Analysis of Food Components and Additives, CRC Press, 2<sup>nd</sup> Edition, 2011.
9. S. M. Khopkar, Environmental Pollution Analysis, New Age International Publication, 2011.
10. G. L. Robertson, Food Packaging Principle & Practice, CRC Press, 3<sup>rd</sup> Edition, 2012.
11. Malik Vijay, Laws Relating to Drugs And Cosmetics, Eastern book comp, 23<sup>rd</sup> Edition, 2013.
12. V. K. Selvaraj, Practical Pharmaceutical Chemistry, Campus Books International Publisher, 2012.
13. D.G. Watson, Pharmaceutical Analysis, Churchill Livingstone Publisher, 3<sup>rd</sup> Edition, 2012.
14. P.P. Sharma, Cosmetics, Formulations, Manufacturing and Quality Control, Vandana Publication Ltd, 4<sup>th</sup> Edition, 2010.
15. A. Salvador, A. Chisvert, Analysis of Cosmetic Products, Publisher – Elsevier, 2011.
16. Harald Gunther, NMR Spectroscopy, Wiley –VCH Weinheim, 2013.
17. Edited by M. B. Smith, March's Advance Organic Chemistry, John Wiley & Sons, 7<sup>th</sup> Edition, 2013.
18. William D. Callister Jr., D. G. Rethwisch, Fundamentals of Materials Science & Engineering, John Wiley and Sons. Inc., New York, 4<sup>th</sup> Edition, 2012.

19. Robert A. Meyers, Encyclopedia of Analytical Chemistry, Wiley Interscience, 2012.
20. Thomas L. Lemke, David A. Williams, V. Roche & S.W. Zito, Foye's Principles of Medicinal Chemistry, Published by Lippincott Williams & Wilkins, 7<sup>th</sup> Edition, 2012.
21. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 5<sup>th</sup> Edition, 2013.
22. Edited by Q. A. Acton, Agrochemicals: Advances in Research & Application, Scholarly Editions Book, 2012.
23. ManasChanda, Introduction to Polymer Science and Chemistry, CRC Press (Taylor and Francis Group), 2<sup>nd</sup> Edition, 2013.