Post-graduation in Pharmacy (Residency)

Program Overview – Pharmacy
Overall Program Overview

- Multidisciplinary: Integrates chemistry, biology, technology, and clinical practice.
- Research and Innovation Focus: Development of new drugs, biotechnologies, and materials.
- Public Health Centered: Application in hospital settings, quality control, health safety.
- Professional Training: Prepares for careers in pharmaceutical industry, hospitals, research laboratories, or health agencies.

I. Pharmaceutical Chemistry and Analytical Sciences

1. **Therapeutic Chemistry**

- Design and synthesis of active molecules.
- Structure-activity relationship (SAR).
- Innovation in drug development.

2. **Analytical Chemistry**

- Assay methods (HPLC, UV-Vis, mass spectrometry).
- Quality control of raw materials and finished products.
- Data interpretation for clinical and regulatory purposes.

3. **Inorganic Chemistry and Pharmaceutical Inorganic Chemistry**

- Role of metals and salts in pharmacology and toxicology.
- Elemental analysis of formulations.
- Compliance with pharmacopeia standards.

4. **Chemistry and Physicochemistry of Materials**

- Study of materials for formulation.
- Compatibility, stability, controlled release.
- Design of innovative drug delivery systems.

II. Pharmaceutical Technology and Hospital Pharmacy

5. **Pharmaceutical Technology / Pharmaceutics**

- Formulation (tablets, capsules, injectables).
- Bioequivalence, bioavailability, stability studies.
- Compliance with Good Manufacturing Practices (GMP).

6. **Hospital Pharmacy**

- Management of the drug circuit in hospitals.
- Preparation of magistral and sterile forms.
- Coordination with medical teams.

7. **Clinical Pharmacy**

- Personalized therapeutic monitoring.
- Prevention of adverse effects.
- Pharmaceutical advice and patient education.

III. Clinical Biology and Biotechnology

8. **Clinical Biology**

- Diagnostic biological analyses.
- Interpretation of biological data.
- Molecular biology techniques.

9. **Hematology & Hemobiology**

- Analysis of blood cells and associated pathologies.
- Compatibility tests and transfusions.
- Monitoring pharmacological effects on blood.

10. **Toxicology**

- Study of toxic effects of substances.
- Management of poisonings and overdoses.
- Evaluation of drug and chemical safety.

11. **Medical Biochemistry**

- Study of biomolecules and metabolism.
- Enzymatic targets and mechanisms of action.
- Biochemical toxicity of drugs.

12. **Immunology**

- Immunity mechanisms and vaccine responses.
- Immune pathologies (autoimmunity, allergies, deficiencies).
- Immunological techniques and therapy development.

13. **Parasitology**

- Parasite life cycles and diagnostics.
- Mechanisms of antiparasitic drugs.

- Prevention and treatment strategies.

14. **Microbiology**

- Identification of pathogens.
- Infection control, antibiotics, and resistance.
- Application in sterilization and pharmaceutical production.

IV. Natural Sciences and Natural Products

15. **Pharmacognosy**

- Identification of natural active molecules.
- Extraction, purification, and pharmacology of plants.
- Contribution to modern phytotherapy.

16. **Medical Botany**

- Taxonomy, morphology, chemistry of medicinal plants.
- Therapeutic applications and sustainability.
- Conservation of medicinal plant resources.

V. Medical Physics and Biophysics

17. **Medical and Pharmaceutical Biophysics**

- Application of physical principles in biology and pharmacology.
- Biophysical techniques (imaging, ligand-receptor interactions).
- Contribution to diagnostics and therapeutic tools.

VI. Public Health, Quality, and Environment

18. **Hydrology and Bromatology**

- Analysis of water and food quality.
- Control of chemical and microbial contaminants.
- Application in public health and pharmaceutical nutrition.

VII. Pharmacology

19. **General Pharmacology**

- Study of drug mechanisms of action.
- Evaluation of efficacy and toxicity.
- Application in clinical therapeutics and development.

Curriculum Highlights

This program trains versatile professionals, scientifically rigorous, focused on therapeutic innovation, and aware of the health responsibilities related to drugs.

I. Multidisciplinarity and Rich Content
Combines fundamental disciplines (chemistry, biophysics, biochemistry, microbiology) with applied fields (pharmacology, pharmaceutics, toxicology, immunology), allowing:

- Comprehensive understanding of drugs from molecule to patient.
- Training for diverse careers: pharmaceutical industry, hospitals, labs, research, or regulatory agencies.

II. Therapeutic and Clinical Orientation
Modules such as Therapeutic Chemistry, Clinical Pharmacy, Pharmacology, Clinical Biology, Toxicology prepare students to optimize drug treatments, ensure patient safety, and collaborate with health professionals.

III. Emphasis on Quality, Regulation, and Technology
Through Pharmaceutics, Analytical Chemistry, GMP training, students learn industry standards for quality and safety, essential for production and quality assurance roles.

IV. Natural and Biotechnological Dimension
Modules like Pharmacognosy, Medical Botany, Parasitology open doors to natural products and traditional medicine research.

V. Analytical Approach and Scientific Rigor
Courses in Analytical Chemistry, Biochemistry, Pharmaceutical Biophysics equip students with modern chemical and biological characterization tools.

VI. Close Link to Public Health Issues
Modules in Immunology, Hematology, Hydrology and Bromatology, Microbiology, Clinical Biology provide essential bases for health monitoring, diagnosis, disease prevention, and product safety.

VII. Training in Research and Innovation
Many modules encourage:

- Analyzing structure-activity relationships.
- Developing new drugs or smart materials.
- Understanding molecular disease mechanisms and modern therapies.

Core Courses

1. Advanced Pharmaceutical Chemistry

- Drug design, QSAR, molecular docking.
- Structure-activity relationships.
- Synthesis of bioactive molecules.

2. Advanced Pharmacology and Pharmacokinetics

- Detailed study of molecular drug action mechanisms.
- Absorption, distribution, metabolism, excretion (ADME).
- Pharmacokinetic/pharmacodynamic modeling (PK/PD).

3. Biotechnology and Bioengineering

- Production techniques for biomedicines: recombinant proteins, monoclonal antibodies, vaccines.
- Use of viral and non-viral vectors.
- Applications in gene therapy.

4. Applied Molecular Biology and Genomics

- Amplification techniques (PCR, qPCR), sequencing, transcriptomics.
- Biomarkers, targeted therapies, personalized medicine.

5. Applied Toxicology

- Toxicological risk assessment.
- Toxicogenomics, toxicokinetics.
- Regulatory preclinical studies.

6. Advanced Pharmaceutical Technology

- Engineering controlled release systems.
- Pharmaceutical nanotechnologies.
- Innovative formulation processes.

7. Research Methodology / Biostatistics

- Experimental design.
- Statistical analysis of biological and pharmaceutical data.
- Software tools (SPSS, R, GraphPad).

8. Advanced Analytical Methods

- Spectroscopy (NMR, UV-Vis, IR), chromatography (HPLC, GC-MS).
- Validation of analytical methods according to ICH.

9. Pharmaceutical Regulation and Regulatory Affairs

- Good practices (GMP, GLP).
- Registration dossiers.
- International regulations (EMA, FDA, WHO).

Advanced Topics

1. Nanomedicine and Targeted Delivery Systems

- Polymeric nanoparticles, liposomes, dendrimers.
- Stimuli-responsive systems (pH, temperature, enzymes).
- Targeted therapies (tumor targeting, CNS targeting).

2. Personalized Medicine and Pharmacogenomics

- Genetic variability in drug response.
- Multi-omics approaches (genomics, proteomics, metabolomics).
- Therapeutic prediction algorithms.

3. Gene and Cell Therapies

- Gene transfer, CRISPR/Cas9, genetic silencing (siRNA, shRNA).
- Induced pluripotent stem cells (iPSCs).
- Cellular immunotherapies (CAR-T cells).

4. Advanced Pharmaceutical Biotechnologies

- Large-scale cell culture (bioprocesses, bioreactors).
- Production of biomedicines (recombinant proteins, vaccines).
- Purification and characterization of therapeutic proteins.

5. Applied Microbiology and Infection

- Antimicrobial resistance (beta-lactamases, biofilms).
- Development of new antibiotics or bacteriophages.
- Microbiota and human health.

6. Computational Medicinal Chemistry

- Virtual screening, molecular modeling.
- Docking, molecular dynamics.
- Artificial intelligence in drug design.

7. Pharmaceutical Epidemiology and Pharmacoeconomics

- Post-marketing studies, pharmacovigilance.
- Medical-economic evaluation of treatments.
- Cost-effectiveness analysis.

8. Advanced Immunopharmacology

- Cytokines, immunomodulators, vaccine adjuvants.
- Cancer immunotherapy, autoimmunity.
- Immune tolerance and next-generation vaccines.

9. Structural Biology and Proteomics

- Protein crystallography, NMR, cryo-electron microscopy.
- Mapping protein-protein interactions.
- Quantitative proteomics (label-free, SILAC, iTRAQ).