# PROGRAMME STRUCTURE AND SCHEME OF EXAMINTION
# (Ph.D. PHARMACEUTICAL SCIENCES)

| | SEMESTER-I (YEAR-1)(COURSE WORK) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Semester** | **Course Code** | **Title of the Paper(s)** | **Course Type** | **Credits** | | | | | **Marks** | | |
| | | | | **L** | **T** | **P** | **D** | **C** | **EA** | **IA** | **TM** |
| **SEMESTER-I** | **PHDPS-101** | **RESEARCH METHODOLOGY** | **CC** | **4** | **0** | **0** | **0** | **4** | **80** | **20** | **100** |
| | **PHDPS-102** | **RESEARCH AND PUBLICATION ETHICS** | **CC** | **2** | **0** | **0** | **0** | **2** | **80** | **20** | **100** |
| | **PHDPS-103** | **ANALYTICAL TECHNIQUES IN PHARMACEUTICAL SCIENCES (MAJOR SUBJECT)** | **CC** | **3** | **0** | **0** | **0** | **3** | **80** | **20** | **100** |
| | ***PHDPS-** | **MINOR SUBJECT** | **MS** | **2** | **0** | **0** | **0** | **2** | **80** | **20** | **100** |
| | **PHDPS-110** | **CREDIT SEMINAR** | **CC** | **0** | **1** | **0** | **0** | **1** | **-** | **100** | **100** |
| | **SUB-TOTAL** | | | **11** | **1** | **0** | **0** | **12** | **320** | **180** | **500** |
| | | ***Minor Subject (MS) (Any one courses)**<br>**PHDPS- 104- Pharmaceutics**<br>**PHDPS- 105- Pharmaceutical Chemistry**<br>**PHDPS- 106- Pharmacology**<br>**PHDPS- 107- Pharmacognosy**<br>**PHDPS- 108- Pharmacology & Toxicological Screening Methods**<br>**PHDPS- 109- Recombinant Biotechnology** | | | | | | | | | |
| | | **CC: Compulsory Course/MS: Minor Subject/ L: Lecture/ T: Tutorial/ P: Practical/ D: Dissertation/ C: Credit/ EA: External Assessment/ IA: Internal Assessment/TM: Total Marks** | | | | | | | | | |

| SEMESTER-II-VI (YEAR-1-3) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Semester** | **Course Code** | **Title of the Paper(s)** | **Course Type** | **Credits** | | | | | **Marks** | | |
| | | | | **L** | **T** | **P** | **D** | **C** | **EA** | **IA** | **TM** |
| **SEMESTER-II** | **PHDPS-121** | **SYNOPSIS SEMINAR** | **CC** | **0** | **3** | **0** | **0** | **3** | **---** | **---** | **---** |
| **SEMESTER-II** | **PHDPS-131** | **DISSERTATION** | **RP/D** | **0** | **0** | **0** | **15** | **15** | **---** | **---** | **---** |
| **SEMESTER-III** | **PHDPS-131** | **DISSERTATION** | **RP/D** | **0** | **0** | **0** | **15** | **15** | **---** | **---** | **---** |
| **SEMESTER-IV** | **PHDPS-131** | **DISSERTATION** | **RP/D** | **0** | **0** | **0** | **15** | **15** | **---** | **---** | **---** |
| **SEMESTER-V** | **PHDPS-131** | **DISSERTATION** | **RP/D** | **0** | **0** | **0** | **15** | **15** | **---** | **---** | **---** |
| **SEMESTER-VI** | **PHDPS-131** | **DISSERTATION** | **RP/D** | **0** | **0** | **0** | **15** | **15** | **320** | **180** | **500** |
| | **SUB-TOTAL** | | | **0** | **3** | **0** | **75** | **78** | **---** | **---** | **---** |

| GRAND TOTAL OF ALL SEMESTERS (I-VI) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Semester** | **Course Code** | **Title of the Paper(s)** | **Course Type** | **Credits** | | | | | **Marks** | | |
| | | | | **L** | **T** | **P** | **D** | **C** | **EA** | **IA** | **TM** |
| **SEMESTERS-(I-VI)** | **GRAND TOTAL OF ALL SEMESTERS (I-VI)** | | | **11** | **4** | **0** | **75** | **90** | **640** | **360** | **1000** |
| | **CC/CT: Compulsory Course or Core Theory/ L: Lecture/ T: Tutorial/ P: Practical/ D: Dissertation/ C: Credit/ EA: External Assessment/ IA: Internal Assessment/ TM: Total Marks** | | | | | | | | | | |

# BABA FARID UNIVERSITY OF HEALTH SCIENCES

**PHDPS-101::RESEARCH METHODOLOGY**
**(Semester-I)**

| | | | | | |
|---|---|---|---|---|---|
| L+T+P+D | : | **4+0+0+0** | **Relative weightage** | | |
| Credits: | : | **4** | Internal Assessment/Exam | : | **20** |
| Contact hours | : | **56** | End-semester Examination | : | **80** |

| Unit | Content | Lectures (in hrs) |
|---|---|---|
| I | History, myths and ethnic practices; need, importance and impact of research; types of research; research process. | 5 |
| II | Synopsis writing: Selecting research problem, formulation of research projects; survey of literature; research infrastructure; experimental designs; sampling designs; recording of observations; measurement and scaling techniques; GLPs. | 8 |
| III | Formulation and types of hypothesis; collection, maintenance, storage and analysis of data; measures of central tendencies and relationships and error analysis; tests of significance. | 7 |
| IV | Compilation and presentation of results, Writing of manuscripts; research reports and thesis; organization of reference material using endnote; bibliography; plagiarism; IPR and patent application, entrepreneurship. | 8 |
| V | Financial support and various funding agencies; Multidisciplinary and multi-institutional research; writing research proposal for external funding. | 6 |
| VI | Computer and informatics; introduction; word processing, excel, power point presentation; graph and figure plotting; web browsing; information resources and various databases. | 8 |
| VII | Demonstration of departmental research activities and instrumentation. | 14 |

# BABA FARID UNIVERSITY OF HEALTH SCIENCES

**PHDPS-102::RESEARCH AND PUBLICATION ETHICS**
**(Semester-I)**

| | | | | | |
|---|---|---|---|---|---|
| L+T+P+D | : | **2+0+0+0** | **Relative weightage** | | |
| Credits: | : | **2** | Internal Assessment/Exam | : | **20** |
| Contact hours | : | **28** | End-semester Examination | : | **80** |

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| **I** | Philosophy and Ethics: Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgements and reactions. | 4 |
| **II** | Scientific Conduct: Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data. | 5 |
| **III** | Publication Ethics: Publication ethics: definition, introduction and importance. Best practices / standards setting initiative and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributorship. Identification of publication misconduct, complains and appeals. Predatory publishers and journals. | 7 |
| **IV** | Open Access Publishing: Open access publications and initiatives. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies. Software tools to identify predatory publications developed by SPPU. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.<br>Publication Misconduct: Group Discussions: Subject specific ethical issues, FFP, authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad. Software tools: Use of plagiarism software like Turnitin, Urkund and other opensource software tools. | 7 |
| **V** | Databases and Research Metrics: Databases: Indexing databases. Citation databases: Web of Science, Scopus, etc. Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: h-index, g index, i10 index, altmetrics. | 5 |

# BABA FARID UNIVERSITY OF HEALTH SCIENCES

**PHDPS-103: ANALYTICAL TECHNIQUES IN PHARMACEUTICAL SCIENCES**
**(Semester-I)**

| | | | | | |
|---|---|---|---|---|---|
| L+T+P+D | : | **3+0+0+0** | **Relative weightage** | | |
| Credits: | : | **3** | Internal Assessment/Exam | : | **20** |
| Contact hours | : | **42** | End-semester Examination | : | **80** |

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| **I** | **UV-Visible spectroscopy**: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy.<br>**IR spectroscopy**: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier – Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy. | 9 |
| **II** | **Spectro-flourimetry:** Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.<br>**Flame emission spectroscopy and Atomic absorption spectroscopy**: Principle, Instrumentation, Interferences and Applications. | 7 |
| **III** | **NMR spectroscopy**: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Brief outline of principles of FT-NMR. Applications of NMR spectroscopy.<br>**Mass Spectroscopy**: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. | 12 |
| **IV** | **Chromatography:** Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution and applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Affinity chromatography h) Ultra-high performance liquid chromatography i) Hydrophilic interaction chromatography j) Supercritical fluid chromatography (SFC). | 7 |
| **V** | **Electrophoresis**: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Isoelectric focusing. **X ray Crystallography**: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, Xray powder technique, Types of crystals and applications of X-ray diffraction. | 7 |

# BABA FARID UNIVERSITY OF HEALTH SCIENCES

***PHDPS: Minor Subject**
**(Semester-I)**

| | | | | | |
|---|---|---|---|---|---|
| L+T+P+D | : | **2+0+0+0** | **Relative weightage** | | |
| Credits: | : | **2** | Internal Assessment/Exam | : | **20** |
| Contact hours | : | **28** | End-semester Examination | : | **80** |

**PHDPS-104:** Pharmaceutics

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| **I** | **Pre-formulation Studies**<br>Introduction, pre-formulation testing criteria, regulatory requirements, testing systems, solid-state characterization, transport across biological membranes | **6** |
| **II** | **Polymers**<br>Polymer classification, physiochemical properties and polymer solutions, biodegradable and non-biodegradable polymers, application of polymers in controlled release of drugs, transport of small molecules in polymers, ionic polymers as drug carriers, polymer drug interactions | **4** |
| **III** | **Controlled Drug Delivery**<br>Introduction, basic concept, rationale of SR/CR drug delivery, physicochemical and biological factors influencing design and performance of CR products, vitreous body, colon targeting, lung targeting | **4** |
| **IV** | **Pharmaceutical Process Validation**<br>Basic concept, regulatory basis of validation , benefits of validation, types of process validation related to prospective retrospective and concurrent process validation , re- validation of validation process | **4** |
| **V** | **Optimization**<br>Introduction to statistical methods and factorial design, quality by design | **4** |
| **VI** | **Bioequivalence Studies**<br>Basic pharmacokinetic concepts, *in vitro* and *in vivo* methods in establishment of bioequivalence | **4** |
| **VII** | **Pharmaceutical Packaging** Containers and Closures, Glass as a packaging material | **2** |

**PHDPS-105: Pharmaceutical Chemistry**

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| I | **Stereochemistry**<br>Optical isomerism, chirality and molecular symmetry; stereo-chemical designation of chiral centre(s) (R&S); chiral axis; resolution of racemic mixture-techniques including chiral chromatography, geometric Isomerisim: cis, trans; E, Z ,conformational analysis: boat-chair conformations; staggered, gauche, eclipsed conformations | **8** |
| II | **Fundamentals of Medicinal Chemistry**<br>Basics of drug action: covalent, ionic, ion-dipole, hydrogen bonding, vander waals interactions ,bio-isosterism ,drug receptor interaction ,constitution of cell membrane | **4** |
| III | **Drug Design**<br>Analogue synthesis versus rational drug design, discovery of lead compounds, pharmacophore identification, structure modifications of lead compound (prototype), combinatorial chemistry and high throughput screening | **6** |
| IV | **Natural Products**<br>Drugs of natural origin: from plants, micro-organisms, animal source, marine products, biosynthesis of natural products, approaches of structure elucidation | **5** |
| V | Techniques of Quantitative Estimation of Drugs for Determination of Purity | **5** |

**PHDPS-106: Pharmacology**

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| I | **Molecular Aspects of Drug Action**<br>Receptor occupancy, types of drug targets, main families of receptors and ion channels, signal transduction mechanisms coupling receptors to cellular function | **6** |
| II | **Cellular Mechanisms of Drug Action**<br>Short-term regulation of cellular function (excitation, contraction and secretion), slower mechanisms of cell response (cell proliferation, apoptosis) and their pathophysiological significance | **4** |
| III | **Toxicity Studies**<br>Acute, sub-acute, sub-chronic, chronictoxicity | **6** |
| IV | **Regulatory Guidelines**<br>Guidelines for maintenance and experimentation using laboratory animals (CPCSEA,OECD, ICH, ICMR, Schedule Y) | **4** |
| V | ***In-vitro* Experimentation Techniques**<br>Animal cell lines and their uses, radio ligand binding assay, patch clamp, ELISA | **8** |

**PHDPS-107: Pharmacognosy**

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| I | **Organoleptic Evaluation of Plant Drugs**<br>Gross morphology, detection of foreign matter, quantitative microscopy, veinislet number, vein termination number, stomatal number, stomatal index, palisade ratio, micrometry, measurement of fibers, trichomes, starch grains, calcium oxalate crystals, lycopodium spore analysis, fluorescence analysis, determination of moisture content, ash values, extractive values, swelling index, refractive index, optical rotation | **8** |
| II | **Primary and Secondary Plant Metabolites** | **6** |
| III | **Extraction Techniques**<br>Maceration, percolation, sonication, soxhlet assisted extraction, | **4** |
| IV | **Cultivation of Medicinal Plants and Harvesting** | **4** |
| V | **WHO Guidelines for Assessment of Crude Drugs**<br>Evaluation of identity, purity, quality of crude drugs, determination of pesticide residue, determination of microorganisms, aflotoxins, determination of arsenic and heavy metals (Hg,Pb,Cd) | **2** |
| VI | **Herbal Drug Standardization**<br>TLC fingerprint profile, quantitative estimation of biomarker by HPTLC | **2** |
| VII | Nutraceuticals | **2** |

**PHDPS-108: Pharmacology & Toxicological Screening Methods**

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| I | **Laboratory Animals**<br>Common lab animals: description, handling and applications of different species and strains of animals; transgenic animals: production, maintenance and applications; anesthesia and euthanasia of experimental animals; maintenance and breeding of laboratory animals; CPCSEA guidelines to conduct experiments on animals; good laboratory practice | **8** |
| II | **Preclinical Screening of New Substances for the Pharmacological Activity**<br>General principles of preclinical screening; CNS pharmacology: behavioural and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti epileptics and nootropics; drugs for neurodegenerative diseases like parkinsonism, alzheimers and multiple sclerosis; drugs acting on autonomic nervous system; respiratory pharmacology: antiasthmatics, drugs for COPD and anti-allergic; reproductive pharmacology: analgesics, anti-inflammatory and antipyretic agents; cardiovascular pharmacology: antihypertensives, anti-arrythmics, anti-anginal, anti-atherosclerotic agents and diuretics; drugs for metabolic disorders like anti-diabetic, anti-hyperlipidemic, and agents; anti cancer agents; immunosuppressants and immunomodulators | **8** |
| III | **Limitations of Animal Experimentation and Alternate animal Experiments** | **4** |
| IV | **Extrapolation of in vitro Data to Preclinical and Preclinical to Humans** | **4** |
| V | **Regulatory Guidelines for Conducting Toxicity Studies**<br>OECD, ICH, EPA, Schedule Y, OECD principles of Good laboratory practice (GLP) | **4** |

**PHDPS-109: Recombinant Biotechnology**

| Unit | Contents | Lectures (in hrs) |
|---|---|---|
| I | **Tools of Genetic Engineering**<br>Cloning vehicles, modifying enzymes, DNA ligase, DNA polymerase, polynucleotide kinase, T4 DNA ligase, nick translation system, terminal deoxynucleotidy1 transferase, reverse transcriptase, restriction endonucleases Type I & II | **6** |
| II | **Cloning Vectors**<br>Plasmids, lambda phage, phagemids , cosmids, artificial chromosomes, yeast vectors, shuttle vectors, virus based vectors | **4** |
| III | **Methods of Gene Transfer**<br>Transformation, transduction , particle gun, electroporation, liposome mediated, microinjection, Agrobacterium mediated gene transfer | **4** |
| IV | **Preparation and Application of Molecular Probes**<br>DNA probes, RNA probes, radioactive labelling, non radioactive labelling, use of molecular probes, DNA fingerprinting | **4** |
| V | **Analysis and Expression of Cloned Gene In Host Cells**<br>Expression vectors, restriction enzyme analysis, southern blotting, northern blotting, western blotting, in-situ hybridization, colony and plaque hybridization, factors affecting expression of cloned genes, reporter genes, fusion proteins | **4** |
| VI | **Gene Libraries**<br>cDNA synthesis, genomic DNA libraries, amplification of gene libraries, identifying the products of cDNA clones | **4** |
| VII | **Isolation, Sequencing and Synthesis of Gene**<br>Different methods of gene isolation, techniques of DNA sequencing, artificial DNA synthesis | **2** |