



**INVERTIS INSTITUTE OF PHARMACY, INVERTIS UNIVERSITY
BAREILLY**

Course Structure and Syllabi for Pre-PhD

Part I

Compulsory for all

Credit: 04

S.No	Paper	Paper Code
1.	Research Methodology	PhDRM 101

Part II

Choose any one subject of the following

Credit: 04

S.No	Paper	Paper Code
1.	Advanced Pharmaceutics	PhDPH 102
2.	Modern Pharmaceutical Sciences	PhDPH 103
3.	Advanced Pharmacology and Toxicology	PhDPH 104
4.	Biological Screening Method	PhDPH 105
5.	Advanced Medicinal Chemistry	PhDPH 106
6.	Modern Pharmaceutical Chemistry	PhDPH 107
7.	Modern Pharmacognosy	PhDPH 108
8.	Phytochemistry and Phytopharmaceuticals	PhDPH 109

Note: (i) Part II paper will be chosen by the research scholar on the advice of the Supervisor/Co-Supervisor(s).

(ii) Evaluation of the course will be based on university ordinance.

PhDRM-101 RESEARCH METHODOLOGY for Engineering Stream

UNIT I

Research Topic: Selection of problems, stages in the execution of research, preparation of manuscript and report writing. Search engines: google, pubmed, google scholar, EMBL, etc. Publication of Report in Journals: Standard of research journals, impact factor, citation index, H index, and more. Proof reading, reading journals and review, Patent/IPR.

UNIT II

Introduction of computer science- Database management systems, presentation graphics, management of data by office applications: MS-office, MS-Word, MS-Excel, and MS-PowerPoint. Generation and analysis of data, basics of softwares: Matlab and Labview. LaTeX overview – document classes, Packages, document environment, Block structure, and special pages.

UNIT III

Measures of dispersion: sampling methods: random sampling - types of variables: qualitative and quantitative variables - continuous and discontinuous variables - scaling method – mean - standard deviation- standard error - coefficient of variation. Comparison of means: chi square test, student's t test and ANOVA.

UNIT IV

Spectrophotometer: principle and applications, Ultra violet, Infra Red, IR, Nuclear magnetic resonance (NMR), fundamental and procedure of chromatography. Principle and application of electron microscopy, scanning electron microscopy, transmission electron microscopy, X-ray diffraction.

Recommended Books

- Snedecor, G. W. and W.G. Cochran, Statistical methods, 1978, Oxford and IBH publishing CO Pvt. Ltd.
- Authoring a PhD, thesis: how to plan, draft, write and finish a doctoral dissertation, Duncary, P. 2003. Macmillan.
- Zar, J.H., Biostatistical analysis, 1996, Prentice Hall, Upper Saddle River, New Jersey, USA.
- Davis Martha, Scientific courses and presentations, 2005, Academic press, Tokyo.
- Kemp William, Organic spectroscopy, 1991, Palgrave, New York.
- Kalsi, P.S., Spectroscopy of organic compounds, 2004, New Age publishers, New Delhi.
- Silverstein Robert & Webster Francis, Spectrometric identification of Organic Compounds, Wiley India. 6th edn

PhDPH102 ADVANCED PHARMACEUTICS

UNIT I

Preformulation:-Introduction and concept, Need, Advantages, Organization. Techniques:- Solubility & pKa, Brief account of preformulation of i) Conventional tablet - Compaction of powders with particular reference to distribution and measurement of forces within the powder mass undergoing compression including- physics of tablet compression; Effect of particle size, moisture content, lubrication, lubricant sensitivity ii) Oral liquids, Suspension, iii) Semisolid.

Polymer: Introduction, Evaluation of polymers, Mechanism of Drug release from polymers, Applications of Polymers in controlled release of active agents and in other formulations. Introduction to biodegradable polymers and its application.

UNIT II

Stability: Concept of stability of pharmaceuticals. Understanding of statistical aspects in expiry period. Degradation pathways, Physical instabilities & evaluation methods. Overages and ICH guidelines.

Excipients: Overview of excipients used in formulations. Factors affecting the selection. Introductory aspects of drug-excipient and excipient- package interactions. Study of newer excipients like cyclodextrin, ion exchange resins, film coating materials, superdisintegrants, directly compressible vehicles, surfactants- micelle formation, Standardization of excipients.

UNIT III

Diffusion & Dissolution: Concept and importance of dissolution. Steady state diffusion. Determination of diffusion coefficient & its importance. Concept & importance of dissolution. Dissolution test, Historical development & USP dissolution test. Dissolution model like Hixson-Crowell, Higuchi's Model. Drug release modeling through polymer matrix & laminates. Concept of membrane controlled delivery & its importance in dosage form design.

UNIT IV

Optimization: Definition, need, advantages, Meaning of general terms involved in optimization process. Classification of optimization methods. Brief description and importance of experimental design with special reference to designs adequate for large number of variables.

Basic understanding with at least one example of following optimization techniques:-Simplex method, langarengian method, EVOP, Grid search method.

Recommended Books

1. Lachmann and Libermann.Theory and Practice of Industrial Pharmacy, Fifth edition, Varghese Publishing House. India
2. Leon Lachmann. Pharmaceutical dosage forms: Tablets Vol. 1-3 Second Ed.
3. Leon Lachmann.Pharmaceutical Dosage forms: Disperse systems, Vol, 1,2,3; Second edition.
4. Gillbert and S. Banker, Modern Pharmaceutics;. Fourth Edition. Volume 121.
5. Remington's Pharmaceutical Sciences. Vol.I-II, 21 st Edition.
6. Alfred martin.Physical Pharmacy; Fourth Edition, Published by B. I. Waverly Pvt. Ltd.
7. Pharmaceutical Preformulations; By J.J. Wells.
8. Aulton M.E., ' Pharmaceutics-The Science of Dosage form Design ' Churnchill Livingstone.
9. Carstensen J.T., 'Drug Stability-Priciples & Practice ' Marcel Dekker, New York. 10.
10. Malmsten M. , ' surfactants and Polymers in Drug Delivery' Marcel Dekker ,NewYork.
11. Weiner M.L., & Kotkoskie L.A., 'Excipient Toxicity & Safety' Marcel Dekker, New York.

PhDPH103 MODERN PHARMACEUTICAL SCIENCES

UNIT I

Theory of controlled release drug delivery systems. Release and diffusion of drugs from C.D.D.S., General methods of design and evaluation of C.D.D.S. Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering approach to achieve controlled drug delivery.

Sustained release formulations: Introduction, concept advantages and disadvantages. Physicochemical and biological properties of drugs relevant to sustained release formulations.

UNIT II

Solids: Basics of process automation of solid dosage form production. Study of newer excipients used in Gastro retentive Drug Delivery Systems, Mucoadhesive Systems, and Colon specific Drug Delivery Systems and sustained release Drug Delivery Systems, pulsatile drug delivery systems. Formulation development of mouth dissolving tablets, taste masking formulation, sublingual and buccal formulations.

UNIT III

Semisolids: Semisolid formulation with special reference to penetration enhancers. Emulgels, semisolids based on Liposomes, Niosomes.

Liquids: Study of advances in liquid formulation including multiple emulsion, micro emulsion including Self Emulsified Drug Delivery Systems and Self Micro Emulsified Drug Delivery Systems.

UNIT IV

Nanopharmaceuticals: Generation and significance of Nano-Pharmaceuticals like nanosuspensions, nanogels, nanocarrier systems, solid lipid nanoparticle, Dendrimers.

Regulatory consideration in controlled release: Modification requirements to demonstrate safety, efficiency & controlled release nature. Bioavailability, assurance, WHO & Indian condition.

Recommended books:

1. Roiche, Design of Biopharmaceutical Properties Through Prodrugs and Analogs.
2. Jolles and Wooldbridge, Drug Design: Facts or Fantasy.
3. Julian, Drug Delivery Systems.
4. Robinson and Vincent, Controlled Drug Delivery.
5. Robinson, Sustained and Controlled Drug Delivery Systems.
6. Noxon, Microencapsulation.
7. Chien, Novel Drug Delivery Systems.
8. Deasy, Microencapsulation and Related Processes.
9. Gutcho, Microencapsulation and Related Processes.
10. Lisbeth, Illum & Davis, Polymers in Controlled Drug Delivery.

PhDPH104 ADVANCED PHARMACOLOGY & TOXICOLOGY

UNIT I

Pharmacodynamics: - Drug receptor interaction theory, occupation theory and rate theory. Receptor occupation and response relationship, spare receptors, silent receptors, orphan receptors, presynaptic and postsynaptic receptors. Receptor characterization method: Pharmacological characterization methods, radio ligand methods, monoclonal antibodies, receptor subtypes.

UNIT II

Drug development process, clinical trials, safety evaluation, bioequivalence studies, statistical design in clinical trials, data analysis technique.

Biotransformation of drugs: Phase I and II. Excretion of drugs: Renal and non-renal (mechanisms and factors affecting). Clearance: Renal and hepatic clearance. Kinetic of drug absorption: compartment models evaluation of pharmacokinetic parameters.

UNIT III

Drugs acting on central nervous system: General Anaesthetics, sedative and hypnotics, anti-psychotics, anti-depressants, anti-epileptics, analgesics, anti-migraine agents and anti-parkinsonism agents.

Drugs acting on autonomic nervous system: Sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics and neuromuscular junction and ganglionic blockers.

UNIT IV

Recent development in chemotherapeutic agents, multi-drug resistance, antiviral, antibacterial, anti-protozoal and cancer chemotherapy. Drug therapy in pediatrics and geriatrics.

Preclinical models employed in the screening of new drugs belonging to following categories: Antipsychotic, analgesic and anti-inflammatory, anti-hypertensive, anti-diabetic, anti-ulcer agents.

Pharmacovigilance

Recommended Books

1. Basic and Clinical pharmacology by Bertram G. Katzung (International edition) Lange medical book / Mc Graw Hill, USA 2001 8th edition
2. Pharmacology by Rang H.P, Dale MM and Ritter JM., Churchill Livingstone, London, 4/e
3. Goodman and Gilman's The pharmacological basis of therapeutics (International edition) Mc Graw Hill, USA 2001 10th edition.
4. Harrison's principles of internal medicine two Vols, 2001 by Braunwald, Fauci, Kasper, Hauser, Longo Jameson, Mc Graw Hill, Newyork 15th edition
5. Pharmacology by K.D.Tripati.
6. Drug Discovery and evaluation – Pharmacological assays by H.Gerhard.Vogel, 2nd edition, Springer verlag, Berlin, Heidelberg.

PhDPH105 BIOLOGICAL SCREENING METHODS

UNIT I

Drug discovery process: Principles, techniques and strategies used in new drug discovery. High throughput screening, human genomics, and economics of drug discovery, Regulations.

Bioassays: Basic principles of bioassays, official bioassays, experimental models and statistical designs employed in biological standardization.

UNIT II

Alternatives to animal screening procedures, cell-line, patch –clamp technique, In-vitro models, molecular biology techniques.

Principles of toxicity evaluations, ED50, LD50 and TD values, International guidelines (ICH recommendations) OECD guidelines for toxicologicals, cosmoceuticals and pharmaceutical.

Screening methods involved in toxins and pathogens.

UNIT III

Preclinical studies: General principles and procedures involved in acute, sub-acute, chronic, teratogenicity, mutagenicity and carcinogenicity.

Screening of different classes of drugs using micro-organisms. Vitamin and antibiotic assays.

Enzymatic screening methods: α -glucosidase, α - amylase, DNA polymerase, nucleases, L-asparaginase, lipases and peptidases.

UNIT IV

In-vitro In-vivo studies for screening of anticancer, diabetes, ulcer, alzimer, hepatotoxicity, neuropharmacology, renal and CVS diseases.

Recommended Books

1. Basic and clinical pharmacology by Bertram G. Katzung (International edition) Lange medical book / Mc Graw Hill, USA 2001 8th edition
2. Pharmacology by Rang H.P, Dale MM and Ritter JM., Churchill Livingstone, London, 4/e
3. Goodman and Gilman's The pharmacological basis of therapeutics (International edition) Mc Graw Hill, USA 2001 10th edition.
4. General and applied toxicology by B.Ballantyne, T.Marrs, P.Turner (Eds) The Mc Millan press Ltd, London.
5. Drug Discovery by Vogel's
6. Drug Discovery and evaluation – Pharmacological assays by H.Gerhard.Vogel, 2nd edition, Springer verlag, Berlin, Heidelberg.
7. Tutorial Pharmacy (Vol I and II) by Cooper and Gunns.

PhDPH106 ADVANCED MEDICINAL CHEMISTRY

UNIT I

Reactions mechanisms: Generation, stability, structure and reactivity of free radicals, carboanions, carbocations and carbenes. Mechanism of free radical, electrophilic, nucleophilic (addition and substitution reactions, elimination reactions). Electrocyclic, pericyclic and sigmatropic reactions.

Structural elucidation: Applications of UV, IR, H1 NMR, C13 NMR, XRD, mass spectroscopic data in structural elucidation of natural, synthetic and semi-synthetic drugs.

UNIT II

Synthetic strategies: Introduction, target selection, disconnection approach, functional group inter conversions, reagents, retro synthesis, region selectivity, linear and convergent synthesis.

Drug Receptors: Receptor types and isolation, drug receptor Interaction, theories of drug action, mechanism of drug action. Chemistry and pharmacology of drugs used in CVS, CNS with emphasis on recent drugs.

UNIT II

Enzyme Inhibitors: A detailed study of the following types of enzyme inhibitors, related drugs and their pharmaceutical significance:

- a. PG Synthetase (Cyclooxygenase)
- b. Angiotensin converting enzyme (ACE) Inhibitors
- c. Acetyl Cholinesterase (Ach E) Inhibitors.
- d. Phosphodiesterase (PDE) inhibitors.

UNIT IV

Rational Drug Design: QSAR; parameters involved in QSAR, lipophilicity (polarisability, electronic and steric parameters). Quantitative models – Hansch analysis, free Wilson analysis and their relationships, linear relationships and applications of Hansch and free Wilson analysis. Molecular modeling drug design CADD.

Recommended Books

1. Org. Chemistry of Drug Design and drug Action. Richard B. Silvermann
2. Berger's Medicinal Chemistry and Drug Design. 6th Edition.
3. Identification of organic compounds by Silverstain.
4. Comprehensive Medicinal Chemistry Corwin Hansch
5. Medicinal Chemistry by William O Foye.
6. Introduction to Medicinal Chemistry by G. Patrick.
7. Advanced organic chemistry by Jerry March.
8. Introduction to principles of drug design by Smith and Williams, Harwood Academy press.
9. Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold.
10. Advanced organic chemistry. Part A and B. Francis A, Carey and Richard J.Sunberg
11. Some modern methods of organic synthesis. W. Carruthers Cambridge University Press. Cambridge.

PhDPH107 MODERN PHARMACEUTICAL CHEMISTRY

UNIT I

Modern concept and principles of Drug design, Analog design, Receptors and Enzymes as drug targets and their characterization, Drug-target interactions, Intracellular signaling pathways, Pharmacokinetic parameters in drug design, Modern tools for drug design & drug discovery: Molecular Modeling, Docking, X-RD, Quantitative Structure – Activity Relationship methods & Combinatorial Synthesis.

UNIT II

Classification, synthesis, mode of action, structure-activity relationship, biosynthesis (wherever applicable) and recent advances of following categories of drugs:

Non-steroidal anti-inflammatory drugs including COX-2 inhibitors, Anti- histamines (H1, H2 & H3), Oral hypoglycaemic agents, Antihypertensives, Anxiolytics, Flouroquinolones as antibacterial agents, Anticancer & Anti-HIV drugs.

UNIT III

Classification, synthesis, mode of action, structure-activity relationship, biosynthesis (wherever applicable) and recent advances of following categories of drugs:

Structure of lipids, polysaccharides and carbohydrates; Relationship between their physico-chemical properties and their biological function.

UNIT IV

Steroids: Sex Steroids and related agents, Alkaloids: Quinine and steroidal alkaloids, Antibiotics: Newer antibiotics and Macrolides, Hormones: Oxytocin and Thyroid hormones, Glycosides and Saponins: Cardiac Glycoside, Triterpenoid glycosides (Panax ginseng), Prostaglandins, Thromboxanes and Leukotrienes.

Recommended Books

1. Org. Chemistry of Drug Design and drug Action. Richard B. Silvermann
2. Berger's Medicinal Chemistry and Drug Design. 6th Edition.
3. Identification of organic compounds by Silverstain.
4. Comprehensive Medicinal Chemistry Corwin Hansch
5. Medicinal Chemistry by William O Foye.
6. Introduction to Medicinal Chemistry by G. Patrick.
7. Advanced organic chemistry by Jerry March.
8. Introduction to principles of drug design by Smith and Williams, Harwood Academy press.
9. Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold.
10. Advanced organic chemistry. Part A and B. Francis A, Carey and Richard J.Sunberg
11. Some modern methods of organic synthesis. W. Carruthers Cambridge University Press. Cambridge.

PhDPH108 MODERN PHARMACOGNOSY

UNIT I

Evaluation of drugs: Concepts, considerations, parameters and methods. Herbal formulations, their standardization and associated complexities

General methods and principles of extraction methods, types of extraction and their merits and demerits for crude drugs, selection and purification of solvents for extraction. General methods of isolation of different class of phytochemical.

UNIT II

Role of primary and secondary metabolite and TCA cycle. Detailed Phytochemical study of following classes of phytoconstituents including important drugs .

- a) alkaloids
- b) glycosides
- c) steroids
- d) flavanoids
- e) Natural Antioxidants

UNIT III

Applications of UV, IR, NMR and Mass spectrometry in the structural elucidation of phytoconstituents.

In-vitro In-vivo pharmacological screening methods for different category of herbal drugs.

UNIT IV

Biotechnology, Mutation, Polyploidy, and hybridization in relation to improvement of Crude drugs.

Plant growth regulators and their use in pharmacognosy, scope and limitations. Tissue culture:History, media, requirements for growth of culture, isolation of organ,tissue and cells; transfer and maintenance of culture, growth measurement and application of tissue culture with reference to medicinal plants, its scope and limitations

Recommended Books

1. Text book of Pharmacognosy by Trease and Evans.
2. Phytochemical methods by JB Heraborne.
3. Instrumental methods of analysis by BK Sharma.
4. Pharmacognosy and Phytochemistry by Vinod Rangari.
5. Plant Tissue culture by Razdawn.
6. Text book of Pharmacognosy by Brady and Tyler.
7. Quality control of herbal drugs and approach to evaluation of botanicals by Dr. Puloak Mukherjee.
8. Instrumental methods of chemical analysis by Chatwal. K, anand.

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9. Vogel's text book of quantitative chemical analysis by G.H.Jeffery, J.Bassett, J.Mendhan, R.C.Denny.

10. Pharmacognosy, by C. K. Kokate, A. P. Purohit & S. B. Gokhale.

PhDPH109 PHYTOCHEMISTRY & PHYTOPHARMACEUTICALS

UNIT I

Overview of natural product isolation:

Extraction techniques: Counter current extraction, Supercritical fluid extraction, Solid phase extraction, Microwave-assisted extraction, Ultrasound extraction (Sonication), Phytonics process, parameters for selecting appropriate extraction method, steps in extraction process (size reduction, extraction, filtration, concentration, drying)

UNIT II

Chromatographic separation techniques:

Principle and applications of TLC, HPLC, HPTLC & Column chromatography, Flash column chromatography, RP- column chromatography

UNIT III

Standardization of herbal drugs according to WHO: Sources of variation in chemical make-up of plant derived drugs: genotypic, ecotypic and biotypic variations and variations resulting during processing and storage. Conventional methods used in herbal drug standardization and their limitations. WHO parameters used in herbal drug standardization.

Quality control and quality assurance of herbal drugs, heavy metals, microbial loads in context to herbal industry.

UNIT IV

Brief introduction to Pharmacological Screening Methods with examples of following category of medicinal Herbs: Hepatoprotectives, Anti-diabetics, Anti-asthmatic, Hypolipidemics, Antioxidants, Anti-inflammatory, Analgesics & Anti-cancer.

Recommended books

1. Text book of Pharmacognosy by Trease and Evans.
2. Instrumental methods of analysis by BK Sharma.
3. Pharmacognosy and Phytochemistry by Vinod Rangari.
4. Text book of Pharmacognosy by Brady and Tyler.
5. Quality control of herbal drugs and approach to evaluation of botanicals by Dr. Puloak Mukherjee.
6. Instrumental methods of chemical analysis by Chatwal. K, anand.
7. Vogel's text book of quantitative chemical analysis by G.H.Jeffery, J.Bassett, J.Mendhan, R.C.Denny.
8. Pharmacognosy by C. K. Kokate, A. P. Purohit & S. B. Gokhale.
9. Hornok,L. (ed.) Cultivation & Processing of Medicinal Plants, Chichister, U. K:J.