

**Department of Pharmaceutical Sciences
School of Engineering and Technology
Dr. H. S. Gour Vishwavidyalaya Sagar MP
(A Central University)**

Scheme of Ph.D. Programme

Credit requirements

- I. Course work - 16
- II. Publications - 20
- III. Teaching assistantships - 20

I. Scheme of Ph.D. Course Work: One Semester

Part A: Pre Ph.D. course – 12

Part B: Ph.D. course through review of published research – 4

Total Credits – 16

Course code	Part-A	Pre-Ph.D. Course	Credits
	Course	Title	
PHSC-1401	Course – I: Compulsory	Research Methodology (Theory)	04
	Course – II: Core		
PHSC -1402		Current Trends in Pharmaceutical Sciences (Theory)	03
PHSC -1403		Current Trends in Pharmaceutical Sciences (Practical)	01
PHSE -1404	Course – III: Elective	Note: Candidate can opt for one course from the following:	04
	a	Advances in Pharmaceutics Research (Theory)	
	b	Molecular Biology in Targeted Drug delivery (Theory)	
	c	Advances in Medicinal Chemistry (Theory)	
	d	Advances in Herbal Drug Technology (Theory)	
	PART-B Course – IV	Ph.D. course through review of published research	
PHSC -1405		Review of published research in relevant field	03
PHSC -1406		Seminar and Viva-Voce based on the above review	01
		Course Credit	16

II. * Publication work: 20 Credits

S. No.	Published work	Credits
1	Paper presented in national seminars/ conferences/workshops	2
2	Paper presented in international seminars/ conferences/workshops	4
3	Paper approved in referred national Journals	5
4	Paper approved in referred international Journals	10

. III. * Teaching assistantships: 20 Credits

S. No.	Published work	Credits
1	Independent teaching of one-semester course of 2 credits	5
2	Involvement in assessment evaluation, examination, course development, development of reading material (Supervisor concerned will audit the workload claimed and shall certify)	1

Note: The above requirements of credits are abstracted from Ordinance 23 (A). Other requirements will be as per Ordinance 23 (A)

Syllabus for Pre-Ph.D. course

Course – I : Compulsory Course Title: Research Methodology (T)

Course Code: **PHSC-1401**

Course Credit: **04**

Unit-I (18 Hrs):

Basics of research: Definition, setting goals and objectives, types of researches

Literature review: Need, sources, search procedure and collection, citation index, impact factor

Formulation of research problem: Problem source, objectives, domain restriction

Unit-II (18 Hrs):

Hypothesis formation: Null and alternative hypothesis, errors in hypothesis, basics of statistical test construction, one-tail and two-tail critical regions, p-values, degrees of freedom, level of significance.

Z-Test, Chi-square-test, t-test for means, and comparisons, *F-test* of variance comparisons, one-way and two-way ANOVA.

Sampling methods: Need and requirement, judgment and random sampling, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, sources of sampling errors and non-sampling errors.

Unit-III (18 Hrs):

Research design and standard test procedure: Need and synthesis of design of experiments, quality by design, randomization, replication, local control, experimental error

Standard design: Construction of completely randomized design, block design, latin square design.

Optimization: Quantitative process studies using factorial design, two level full and factorial design, factorial design for process optimization, experimental design for formulation optimization.

Unit-IV(18 Hrs):

Research proposal writing: Problem definition and formulation, design, objective, hypothesis formulation, population identification, setup requirement, measurement procedure, data analysis, table display, expected output.

Research report writing: Pre-writing considerations, developing an outline, introduction, review, key elements, experimental methods used, measurement procedure used, result, discussion, conclusions, referencing format for books, journals and other literature, paper writing, formats of paper writing in journals, thesis writing formats, CONSORT and ICMJE guidelines, STROBE observational studies, clinical study report writing, protocol writing, investigational brochure.

Unit-V (18 Hrs):

Computer applications in research and development: Introduction to ICT, use of communication and information technology, applications of world wide web and internet services.

Documentation and presentation techniques using various tools of MS-Office.

data collection, analysis, graph plotting and decision making using ISIS draw / smart draw and SPSS.

Recommended Books:

1. Kothari C.R.: Research Methodology- Methods and Techniques Wiley Eastern Ltd.
2. Gupta and Kapoor: Fundamentals of Applied Statistics, Sultan Chand, New Delhi.
3. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi.
4. Joe Habraken: M.S. Office, 8 IN 1, Printice Hall of India.
5. S. Jaswal: Information Technology TODAY (4th Edition), Galgotia Pub. Pvt. Ltd. New Delhi.

Course In-charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– II Core

Course Title: Current Trends in Pharmaceutical Sciences (T)

Course Code: **PHSC- 1402**

Course Credit: **03**

Unit- 01 (18 Hrs):

Pharmaceutical stability: stability indicating assays, ICH guidelines for stability testing of various pharmaceuticals.

Intellectual property right (IPR) considerations: patenting systems, patent search, components of patent applications, claims.

Unit- 02 (18 Hrs):

Screening tools and technologies: X-ray diffraction, scanning electron microscopy and transmission electron microscopy, confocal laser scanning microscopy, atomic force microscopy.

Unit- 03 (18 Hrs):

WHO guidelines for assessment of herbal medicines. GMP and other regulatory requirements as per schedules of Drugs and Cosmetics Act and rules for herbal, ayurvedic and other drugs of traditional origin. preparation of documents for new drug application and export registration,

Unit- 04 (18 Hrs):

Cell cycle; phases of cell cycle, molecular events during cell cycle, regulation of cell cycle.

Signaling pathway: signal transduction, G proteins, cyclic nucleotide and kinase signaling, phospholipid and Ca^{++} signaling, signaling via regulated proteolysis.

Approaches to the rational design of enzyme inhibitors, drug target binding forces, bioinformatics and its role in drug discovery, structure based drug design.

Unit- 05 (18 Hrs):

Techniques of blood collection in laboratory animals, screening methods in pharmacology for anti-inflammatory, cardiovascular activity, psychotropic and neurotropic activity and anti-diabetic activity.

Recommended Books:

1. Niazi S.K Hand book of Preformulation. Informa healthcare, New York
2. Gibson M. Pharmaceutical Preformulation and formulation. LHS Health group, CRC press, New York.
3. Vyas S.P. and Khar RK Targeted and controlled drug delivery, CBS Publisher & Distributer, New Delhi.
4. Molema G and Meijer KF. Drug targeting organ-specific strategies, Wiley-VCH, Verlage GmbH.
5. Remington's Pharmaceutical Sciences.
6. Vogel H.G. " Drug Discovery and Evaluation, Pharmacological Assays", 2nd edition, Springer.
7. Rasstad – Modern Pharmacognosy.
8. Paul J. Schewer, Chemistry of Marine Natural Products.
9. WHO Guidelines for herbal medicinal products.
10. David Morgan" The Cell cycle: Principles of control"
11. Ralph A. Bradshaw, Edward A. Dennis " Hand book of cell signaling"

Course In-charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– II Core

Course Title: Current Trends in Pharmaceutical Sciences (P)

Course Code: **PHSC- 1403**

Course Credit: **01**

Practicals based on the syllabus of theory

Course In-charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– III Elective

Course Title: Advances in Pharmaceutics Research (T)

Course Code: **PHSE- 1404 a**

Course Credit: **04**

Unit – I (18 Hrs)

Nanotechnology in drug delivery: Multifunctional drug carriers, polymer-drug conjugates, smart drug delivery systems.

Nanoparticulate drug delivery systems: application of liposomes, niosomes, microemulsions, nanoparticles, dendrimers etc for drug delivery.

Unit – II (18 Hrs)

Lipid nanoparticulate drug delivery systems: a revolution in dosage form design and development, lipids, classification of solid lipids for delivery of bioactive. solid lipid nanoparticles (SLN), nanostructured lipid carriers (NLC) etc.

Functional properties of lipids used in formulating lipid drug delivery systems: Crystallinity and polymorphism of lipids, melting characteristics of lipid matrices crystallinity and polymorphism vs drug loading capacity and drug release, strategies to improve drug loading in lipid particulate drug delivery systems

Unit – III (18 Hrs)

Nanoparticulate toxicity and their routes of exposure. Toxicological aspects of NPs, proposed mechanism of NP induced toxicity (oxidative stress), toxicity assessment of novel drug delivery systems.

Unit – IV (18 Hrs)

Gene delivery systems: recent progress in viral and non-viral therapy.

Gene therapy: Chronology, viral gene delivery systems, retroviral systems, lentiviral systems, non- viral gene delivery system: Physical methods: Gene gun; Chemical methods: polymers, electrostatic interaction, encapsulation, adsorption, vesicular and particulate systems.

Unit – V (18 Hrs)

Smart polymers: Classification of smart polymers and their applications as biomaterials pH-sensitive polymers, temperature responsive polymers; polymers with dual stimuli-responsiveness, phase sensitive smart polymers, light sensitive smart polymers, polymers of natural origin, polymer-protein bio-conjugates.

Recommended Books:

1. Niazi S.K Hand book of Preformulation. Informa healthcare, New York.
2. Gibson M. Pharmaceutical Preformulation and formulation. LHS Health group, CRC press, New York.
3. Vyas S.P. and Khar RK Targeted and controlled drug delivery, CBS Publisher & Distributer, New Delhi.
4. Molema G and Meijer KF. Drug targeting organ-specific strategies, Wiley-VCH, Verlag GmbH.
5. Remington's Pharmaceutical Sciences.

Course In charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– III Elective

Course Title: Molecular Biology in Targeted Drug delivery (T)

Course Code: **PHSE- 1404 b**

Course Credit: **04**

Unit – I (18 Hrs)

Membrane dynamics and transport mechanism

Introduction to biological membrane, composition and structure of biological membrane,

Transport processes: diffusion,

Protein mediated transport : membrane proteins, channel proteins from open, water-filled

Passageways, carrier proteins change, facilitated diffusion uses carrier proteins

Active transport, carrier – mediated transport

Vesicular transport: phagocytosis, endocytosis exocytosis

Epithelial transport: paracellular, transcellular, transcytosis.

Unit – II (18 Hrs)

Receptors

Structure, receptor regulation

Binding and activation: agonist vs antagonist, constitutive activities, theories of drug interaction like occupation theory, Ariens and Stephenson rate theory and induced fit theory.

Types of receptors: Transmembrane, G-Protein linked, enzyme-linked (tyrosine kinases) other intracellular transcription factors

Ligands: extracellular and intracellular

Role in genetic disorders, role in the immune system

Unit – III (18 Hrs)

Cell signaling and apoptosis

Overview, signaling via hydrophobic molecules, signaling via ion channels, signaling via G-protein-coupled receptors: G proteins, G-protein effectors

Signaling via cell surface enzymes : receptor tyrosine kinases, receptor serine/threonine kinases

Non-receptor tyrosine kinases, Ras and other small G-Protein

Intracellular signaling: signaling by cAMP, signaling by NF- κ B, signaling by STAT, the MAPK signaling pathway, apoptosis

Role of mitochondria in apoptosis and aging

Unit – IV (18 Hrs)

Cell Cycle

Cell cycle initiation and termination mechanism of the S phase mitosis, MPF and the initiation of mitosis, termination mechanism of mitosis, meiosis.

Unit – V (18 Hrs)

DNA recombination, homologous recombination, the Holliday model of DNA crossover, gene conversion, unequal crossover, site specific recombination, transpositional recombination

Recommended Books:

1. S. P. Vyas and D. V. Kohli, 'Methods in Biotechnology and Bioengineering', CBS Publishers, New Delhi.
2. J. M. Pezzuto, M. E. Johnson and H. R. Manesse, 'Biotechnology and Pharmacy, Chappmen and Hall, New York.
3. J. R. Crowther, 'Methods in Molecular Biology, Vol. 2 ELISA Theory and Practice,' Humana Press, Totowa, NJ.
4. G. G. Carmichael and G. K. McMaster, 'Methods in Enzymology,' Academic Press.
5. S. P. Vyas and H. D. Kumar, 'Advances in Pharmaceutical Biotechnology,' CBS Publishers, New Delhi.
6. G. P. Talwar and S. K. Gupta, 'A Handbook of Practical and Clinical Immunology,' CBS Publishers, New Delhi.
7. S. Sadasivam and A. Manickem, 'Biochemical Methods,' New Age International Publishers, New Delhi.
8. Vyas S.P. & Khar R.K.: Targeted & Controlled Drug Delivery, CBS Publisher, New Delhi

Course In charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– III Elective

Course Title: Advances in Medicinal Chemistry (T)

Course Code: **PHSE- 1404 c**

Course Credit: **04**

Unit – I (18 Hrs)

Drug, discovery and design:, Molecular modeling methods, molecular mechanics, molecular dynamics, principle of docking, concept of prodrug design, concept of combinatorial chemistry, high throughput screening, 3D- QSAR based CoMFA, Adv CoMFA and COMSIA approaches.

Unit – II (18 Hrs)

Bioinformatics: Drug receptor interactions, drug target binding forces, types of receptors, mechanisms of receptor signal transduction, receptor selection for drug design.

Unit – III (18 Hrs)

Targets for development of drugs for following diseases: cancer, tuberculosis, malaria, epilepsy, and cardiovascular diseases.

Unit – IV (18 Hrs)

Interpretation of spectra from UV, IR, PMR, CMR, 2DNMR and Mass spectrophotometer for structure elucidation of organic compounds.

Unit – V (18 Hrs)

Green Chemistry: Principles of green chemistry, Alternative starting materials, reagents, solvents, catalysts, types of chemical transformations, Salient examples of green chemistry and its future prospects, Microwave assisted synthesis and processing techniques.

Recommended Books:

1. Microwaves in Organic and Medicinal Chemistry by C. Oliver Kappe and Alexander Stadler, Wiley VCH Verlag, GmbH and Co. KGaA.
2. An introduction to medicinal chemistry by Graham L. Patrick, Oxford University Press.
3. Wilson and Gisvold's text book of organic medicinal and pharmaceutical chemistry by John H Block and John M, Beale, 12 ed.
4. Medicinal chemistry, A molecular and biochemical approach by Thomas Nogrady and Donald F. Weaver , 3 ed., Oxford University Press.
5. Essential bioinformatics, by jin Xiong, Cambridge University Press, 1 ed.
6. Burgers' Medicinal chemistry drug discovery Edt by Donald J. Abraham, 6 ed , vol 1 Recent Advances in QSAR studies Methods and applications, by Jeezy Leszczynski, Springer
7. Fundamental of medicinal chemistry by Gareth Thomas An introduction to cheminformatics by Andrew R. Leach and Valerie J. Gillet

Course In charge:

Course Instructor:

Syllabus for Pre-Ph.D. course

Course– III Elective

Course Title: Advances in Herbal Drug Technology (T)

Course Code: **PHSE- 1404 d**

Course Credit: **04**

Unit – I (18 Hrs)

Building blocks and basic metabolic pathways involved in biosynthesis of phyto-constituents use of radiotracers enzymes and cofactors in study of biosynthetic pathways.

Unit – II (18 Hrs)

Profiles for commercial cultivation technology and post harvest care of ashwagandha, belladonna, guggul, papaya, dioscorea, isapgol, umbelliferous fruits, ginger, turmeric, aloes, digitalis, vinca, ephedra, senna, guar, peppermint, colchicum, lemongrass.

Unit – III (18 Hrs)

Modern methods of assay of phyto-constituents including andrographolide, amarogenin, asiaticosides, atropine, solasodine, bacoposide, caffeine, cubebol, citral, curcumin, digitoxin, diosgenin, embelin, emetine, ergometrine, eugenol, gingerol, glycyrrhethinic acid, hesperidine, kutkoside, piperine, plumbagin, quinine, quinidine, sennosides, taxol, vinca alkaloids, withaferin.

Unit – IV (18 Hrs)

Pharmaceutical aids: Profile for manufacture and commerce of papain, pectin, pharmaceutical gums, starch, absorbent cotton and gelatin.

Marine natural products: introduction, chemistry and biology of marine natural products, marine toxins, marine biomedicinals falling under the class of cardiovascular, anticancer, antimicrobial, anti-inflammatory and antibiotic drugs.

Unit – V (18 Hrs)

Basic principles of ayurveda, salient features of the techniques of preparation and standardization of traditional formulations as per Aurvedic Pharmacopoeia.

Recommended Books:

1. Peach, T. Tracey, M.V. (1955), Modern methods of plant analysis Springer Berlin
2. Stahl, Ergon (1969), Thin Layer Chromatography, Springer, New York
3. Turner, Evaluation of Phytochemicals
4. Wallis, T.E. (1985), Text Book of Pharmacognosy, CBS Publication, New Delhi
5. Trease & Evans, W.C., Pharmacognosy, 16th Ed.
6. Turner, R.A., Screening Methods in Pharmacology, Academic Press.
7. Tyler, V.E., Brady, L.R. & Robbet, J.E., Pharmacognosy, Lea & Febiger, 9th Ed., 1981, Philadelphia New York.
8. WHO Guidelines
9. Indian Pharmacopoeia
10. Herbal Pharmacopoeia

Course In charge:

Course Instructor:

Course-IV
Course Title: Review of published research in relevant field

Course Code: PHSC-1405

Course Credit: 03

Course-IV
Course Title: Seminar and Viva-Voce
(Review of published research in relevant field)

Course Code: PHSC-1406

Course Credit: 01

