Ph.D. Course Work Common Syllabus

Paper Name: Research Methodology	Paper Code: PHD-101/RM	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. To introduce the fundamental concepts, methods, and ethics of scientific research.
2. To develop skills in research design, data collection, analysis, and interpretation.
3. To enable students to formulate research problems and communicate findings effectively.

Unit	Contents	Lectures
I	Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.	**10**
II	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.	**10**
III	Sampling: Concepts of Statistical approach, Sample, Sampling Frame, Sampling Error, Sample Size. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	**15**
IV	Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Techniques of Scientific Measurement. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Encyclopedias, The art of Scientific Communication.	**12**

V	Use of tools/techniques for Research: methods to search required information effectively, Reference Management Software like Endnote/Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism. Presentation in Seminars and Conferences, Sponsored Research-basics, Major funding bodies for research, National- DST, UGC, CSIR, ICMR, DBT, SERB, ISRO, and DRDO, International- NSF, NIH, Horizon Europe and UNESCO.	**13**
	Total	**60**

Suggested Readings

1. Kothari, C. R., and Gaurav Garg. Research Methodology: Methods and Techniques. 4th ed., New Age International Publishers, 2019.
2. Creswell, John W., and J. David Creswell. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 5th ed., SAGE Publications, 2018. https://us.sagepub.com/en-us/nam/research-design/book255675
3. Saunders, Mark, Philip Lewis, and Adrian Thornhill. Research Methods for Business Students. 8th ed., Pearson Education, 2019.
4. Bryman, Alan. Social Research Methods. 5th ed., Oxford University Press, 2016. https://global.oup.com/ukhe/product/social-research-methods-9780199689453
5. Flick, Uwe. An Introduction to Qualitative Research. 6th ed., SAGE Publications, 2018.
6. Walliman, Nicholas. Research Methods: The Basics. 2nd ed., Routledge, 2017. https://www.routledge.com/Research-Methods-The-Basics/Walliman/p/book/9781138693981
7. Kumar, Ranjit. Research Methodology: A Step-by-Step Guide for Beginners. 5th ed., SAGE Publications, 2022.
8. Neuman, W. Lawrence. Social Research Methods: Qualitative and Quantitative Approaches. 8th ed., Pearson, 2014.
9. Research Methods in Psychology. https://www.saylor.org/courses/psych301/
10. https://onlinecourses.nptel.ac.in/noc23_ge36/preview
11. https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Ph.D. Course Work Common Syllabus

Paper Name: Research and Publication Ethics	Paper Code: PHD-102/RPE	Credits: 2 (2-0-0)
Evaluation (Maximum Marks = 100)	Active participation, group discussion and quizzes (25%); Practical: 40%; and End Semester written examination: 35 %	

Introduction:

This course is designed to create awareness among doctoral students about research and publication ethics and different types of unethical practices and misconduct in publications. This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, Open Access publications, research metrics (citations, h-index, Impact Factor, etc.) and Plagiarism tools will be introduced in this course.

Course Structure

The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE05	Publications Misconduct	4
RPE 06	Databases and Research Metrics	7
	Total	**30**

THEORY

RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions

RPE 02: SCIENTIFIC CONDUCT (5hrs.)

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentations of data.

RPE 03: PUBLICATION ETHICS (7 hrs.)

1. Publication ethics: definition, introduction and importance
2. Best practices/standards setting initiatives and guidelines: CARE, COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE

RPE 04: OPEN ACCESS PUBLISHING (4 hrs.)

1. Open Access Publications and Initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self- archiving policies
3. Software Tools to Identify Predatory Publications
4. Journal Finder/Journal Suggestion Tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

RPE 05: PUBLICATION MISCONDUCT (4 hrs.)

A. Group Discussions (2 hrs.)

1. Subject specific ethical issues, falsification, fabrication, and plagiarism (FFP), authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

B. Software tools (2hrs.)

- Use of plagiarism software, like, Turnitin, Urkund and open-source software tools.

RPE 06: DATABASES AND RESEARCH METRICS (7 hrs.)

A. Databases (4 hrs.)

1. Indexing Databases
2. Citation Databases: Web of Science, Scopus, etc.

B. Research Metrics (3hrs.)

1 Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPR, Cite Score

2 Metrics: h-index, g-index, i10 index, altmetrics

Essential Readings

- Suber, P. (2012). *Open Access*. Cambridge, MA, USA: MIT Press.
- Resnik, D.B. (2011). What Is Ethics in Research & Why Is it Important. National Institute of Environmental Health Sciences, I-10.
- National Academy of Sciences, National academy of Engineering and Institute of Medicine (2009). *On Being a Scientist: A Guide of Responsible Conduct in Research*: Third Edition, National Academies Press.
- Madalli, D.P. (2015). *Concepts of Openness and Open Access*. UNESCO Curriculum for Researchers, Module 2. Paris: UNESCO.
- MacIntyre, Alasdair (1967). A Short History of Ethics. London.
- Kanjilal, U. & Das, A.K. (2015). *Introduction to Open Access*. UNESCO Curriculum for Library Schools, Module 1. Paris: UNESCO.
- INSA (2019). Ethics in Science Education, Research and Governance, Edited by K. Muralidhar, A. Ghosh, & A.K. Singhvi. New Delhi: Indian National Science Academy. ISBN: 9788193948217.
- Das, A.K. (2015). *Research Evaluation Metrics*. UNESCO Curriculum for Researchers, Module 4. Paris: UNESCO.

- Das, A.K. & Mishra, S. (2014). Genesis of Altmetrics or Article-level Metrics for Measuring Efficacy of Scholarly Communications: Current Perspectives. *Journal of Scientometric Research*, 3(2): 82-92.
- Chaudhari, N. & Baliga, V. (2015). *Intellectual Property Rights*. UNESCO Curriculum for Researchers, Module 3. Paris: UNESCO.
- Chaddah, P. (2018). Ethics in Competitive Research: Do Not Get Scooped; To Not Plagiarized. ISBN: 9789387480865
- Bird, A. (2006). Philosophy of Science. Routledge.

Supplementary Readings

- ICMR (2017). *National Ethical Guidelines for Biomedical and Health Research Involving Human Participants*. New Delhi: Indian Council of Medical Research.
- Indian Sociological Society (2020). *ISS Code of Ethics*. New Delhi: Indian Sociological Society.
- PSA (2019). *Draft National Policy on Academic Ethics*. New Delhi: Principal Scientific Adviser (PSA) to the Government of India.
- The InterAcademy Partnership (2022). *Report: Combatting Predatory Academic Journals and Conferences*. Trieste: The InterAcademy Partnership.
- UGC (2019). *Consortium for Academic Research and Ethics (CARE)*. New Delhi: University Grants Commission.
- UGC (2020). *Good Academic Research Practices*. New Delhi: University Grants Commission.
- UNESCO (2021). *UNESCO Recommendation on Open Science*. Paris: UNESCO.
- Das, A.K. (2008). *Open Access to Knowledge and Information: Scholarly Literature and Digital Library Initiatives - the South Asian Scenario*. New Delhi: UNESCO, ISBN 9788189218218.
- Das, A.K. (2015). *Scholarly Communications*. UNESCO Curriculum for Researchers, Module 1. Paris: UNESCO.
- Das, A.K. (2019). Research Integrity in the Context of Responsible Research and Innovation Framework. *DESIDOC Journal of Library & Information Technology*, 39(2): 82-86.
- Das, A.K. (2020). UNESCO Recommendation on Open Science: An Upcoming Milestone in Global Science. *Science Diplomacy Review*, 2(3): 39- 43.
- Mishra, S. & Das, A.K. (2015). *Sharing your Work in Open Access*. UNESCO Curriculum for Researchers, Module 5. Paris: UNESCO.

- Nisha, F., Das, A.K. & Tripathi, M. (2020). Stemming the Rising Tide of Predatory Journals and Conferences: A Selective Review of Literature. *Annals of Library and Information Studies*, 67(3): 173-182.
- Smith, I. (2015). *Open Access Infrastructure*. UNESCO Curriculum for Library Schools, Module 2. Paris: UNESCO.
- Bealt, J. (2012). Predatory Publishers Are Corrupting Open Access. *Nature*, 489(7415),179-179.

Ph.D. Course Work Common Syllabus

Paper Name: Computer Application	Paper Code: PHD-103/CA	Credits: 4 (4-0-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. To introduce the fundamental concepts, architecture, and classifications of computers along with operating systems like Windows and Linux.
2. To develop proficiency in using Microsoft Office tools (Word, Excel, PowerPoint) for document preparation, data analysis, and presentations.
3. To familiarize students with internet usage, email communication, and basic networking concepts for effective digital connectivity and communication.

Unit	Contents	Lectures
I	Definition and Characteristics of systems-Hardware & Software, Windows and Linux (Latest Version) Microsoft Tools- Definition and Characteristics of Computers: Classification of Computers; Application of Computers; Hardware; Software; Functional Units of a Computer System; Computer Architecture; Bit, Nibble and Byte. Windows: Introduction to Windows Operating System; Windows Features; Starting Windows; Parts of Windows Screen; Shortcuts in Winodows; Windows Applets; Windows : My Computer; Working with files and Folders; what is MS-DOS? Booting Process; The DOS Directory Structure; Referencing Group of files; Command Syntax; Types of Commands; Microsoft Word (Latest Version): Introduction to Microsoft Tools; Starting Word; Mail Merge.	**15**
II	Microsoft Excel; (Latest Version) Excel Features; Entering data into a Cell; Entering Numbers; Spreadsheets Operations; Freezing Window Panes; Excel Offers Several Methods for Selecting Cells; Erasing the Content of A Cell; Formatting Cells from the Home Tab; The Format Painter; Formulas and Functions; Using Logical Functions; Date and Time Functions; Math and Trigonometric Functions; Statistical Functions; Copying Formulas; Charts; Creating a New Embedded Chart; Type of Charts; Formatting Chart Elements from the Format tab.	**15**
III	Microsoft PowerPoint (Latest Version) What is Presentation? Introduction to PowerPoint; Starting PowerPoint; PowerPoint Views; Save a Presentation; Exiting PowerPoint; Working with Slides.	**10**
IV	Introduction to Internet and E-Mail Hardware requirement; to connect to the Internet; Types of Connections; Internet Service Providers; Internet Addressing; Resource Addressing; The World Wide Web; E-Mail.	**10**
V	Networking Concepts What is a Networks?; Uses of Computer Networks; Network Topologies; Network Hardware and Software.	**10**

	Total	**60**

Suggested Readings

1. Rajaraman, V. Fundamentals of Computers. 6th ed., PHI Learning, 2018.
2. Sinha, P. K., and Priti Sinha. Computer Fundamentals. BPB Publications, 2010.
3. Balagurusamy, E. Programming in ANSI C. 8th ed., McGraw Hill Education, 2019.
4. Forouzan, Behrouz A. Data Communications and Networking. 5th ed., McGraw Hill Education, 2017.
5. Tanenbaum, Andrew S., and Herbert Bos. Modern Operating Systems. 4th ed., Pearson, 2014.
6. Stallings, William. Computer Organization and Architecture: Designing for Performance. 10th ed., Pearson, 2016.
7. Riley, David, and Kenny Hunt. Computational Thinking for the Modern Problem Solver. CRC Press, 2014.
8. Rouse, Margaret Z. Information Technology for Management. Wiley, 2020.
9. Evans, Alan, Kendall Martin, and Mary Anne Poatsy. Technology in Action: Introductory. 15th ed., Pearson, 2019.
10. NPTEL. Computer Science and Engineering, https://nptel.ac.in/course.html
11. GeeksforGeeks. Computer Science Portal for Geeks, https://www.geeksforgeeks.org/
12. Coursera. Computer Science Courses, https://www.coursera.org/browse/computer-science
13. TutorialsPoint. Computer Programming and IT Tutorials, https://www.tutorialspoint.com/index.htm
14. https://nptel.ac.in/courses/106106092

Glocal University Pharmacy College
Ph.D. Course Work Pharmacy- Elective

Paper Name: Pharmaceutical Product Development	Paper Code: PHD-104/PH (I)	Credits: 4 (3-1-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. Understand the principles of formulation development and optimization of pharmaceutical dosage forms.
2. Learn the regulatory requirements and quality assurance practices in product development.
3. Apply preformulation, stability, and scale-up strategies in designing market-ready pharmaceutical products.

Unit	Contents	Lectures
I	Bioavailability and bioequivalence studies: Designing of bioavailability and bioequivalence studies and interpretation of results. Physicochemical properties affecting bioavailability, pH partition theory, dissolution, surface area adsorption, complexation, polymorphism and techniques of enhancing dissolution rate. Formulation factors affecting bioavailability of drugs in dosage forms of tablets, capsules, parenteral, liquid orals and topical dosage forms.	**15**
II	Basic concepts of pharmacokinetics: compartment models: One, two and non- compartmental approaches to pharmacokinetics. Recent trends, merits and limitations of these approaches. Application of these models to determine the various pharmacokinetic parameters of ADME.	**10**
III	Applications of computer in Pharmacokinetics, Statistical Quality Control, Validation of processes. Optimization: Statistical methods and factorial design, Quality by Design.	**10**
IV	Clinical Pharmacology and Pharmacodynamics; Clinical trials at Phases I to IV; Design, documentation and interpretation of clinical data. Polymers- Natural and synthetic polymers with respect to their Pharmaceutical applications; Characterization of polymers; elementary aspects of morphology of polymers; properties of polymers; Polymer Drug Interactions.	**15**
V	Novel Drug Delivery Systems (NDDS): Liposomes, Niosomes, Microspheres, Nanoparticle and Resealed erythrocytes. 1. Monoclonal antibodies 2. Drug targeting to particular organs: (a) Problems of drug delivery to the brain and targeting to brain (b) Drug targeting in neoplastic diseases. IPR- Different IPR regulations and their interpretation; compliance of IPR regulations.	**10**
	Total	**60**

Suggested Readings

1. Aulton, Michael E., and Kevin M.G. Taylor, editors. *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*. 5th ed., Elsevier, 2018.
2. Allen, Loyd V. *Remington: The Science and Practice of Pharmacy*. 22nd ed., Pharmaceutical Press, 2012.
3. Lachman, Leon, Herbert A. Lieberman, and Joseph L. Kanig. *The Theory and Practice of Industrial Pharmacy*. 3rd ed., Varghese Publishing House, 1987.
4. Florence, Alexander T., and David Attwood. *Physicochemical Principles of Pharmacy*. 6th ed., Pharmaceutical Press, 2015.
5. Sinko, Patrick J. *Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences*. 6th ed., Wolters Kluwer Health, 2011.
6. Banker, Gilbert S., and Christopher T. Rhodes, editors. *Modern Pharmaceutics*. 5th ed., CRC Press, 2009.

Glocal University Pharmacy College
Ph.D. Course Work Pharmacy- Elective

Paper Name: Pharmaceutical Chemistry	Paper Code: PHD-104/PH(II)	Credits: 4 (3-1-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. Understand modern drug design principles including drug-receptor interactions, molecular modeling, and combinatorial synthesis.
2. Learn classification, synthesis, SAR, and recent advances of key synthetic drugs like NSAIDs, antihistamines, anticancer, and anti-HIV agents.
3. Study the chemistry and pharmacology of natural products including steroids, alkaloids, antibiotics, hormones, glycosides, and prostaglandins.

Unit	Contents	Lectures
I	Modern concept and principles of Drug design, Analogue design, Receptors and Enzymes as drug targets and their characterization, Drug target interactions, Intracellular signalling pathways, Pharmacokinetic parameters in drug design, Modern tools for drug design & drug discovery: Molecular Modelling, Docking X-RD Quantitative Structure-Activity Relationship methods & Combinatorial Synthesis.	**15**
II	Classification, synthesis, mode of action, structure- activity relationship, biosynthesis (wherever applicable) and recent advances of Non – steroidal anti-inflammatory drugs including COX-2 inhibitors, Anti-histamines (H1, H2 & H3), oral hypoglycaemic agents, Antihypertensive, Anxiolytics, Flouroquinolones as antibacterial agents, Anticancer & AntiHIV drugs.	**15**
III	Classification, synthesis, mode of action, structure- activity relationship, biosynthesis (wherever applicable) and recent advances of following categories of Steroids: Sex Steroids and related agents, Alkaloids: Quinine and steroidal alkaloids, Antibiotics: Newer antibiotics and Macrolides.	**15**
IV	Hormones: Oxytocin and Thyroid hormones, Glycosides and Saponins: Cardiac Glycoside, Triterpenoid glycosides (Panax ginseng), Prostaglandins, Thromboxanes and Leukotrienes.	**15**
	Total	**60**

Suggested Readings

1. Silverman, Richard B., and Mark W. Holladay. The Organic Chemistry of Drug Design and Drug Action. 3rd ed., Academic Press, 2014.
2. Foye, William O., Thomas L. Lemke, and David A. Williams. Foye's Principles of Medicinal Chemistry. 7th ed., Wolters Kluwer, 2013.

3. Wilson, Charles O., and Ole Gisvold. Textbook of Organic Medicinal and Pharmaceutical Chemistry. 12th ed., Wolters Kluwer, 2011.
4. Abraham, Donald J., editor. Burger's Medicinal Chemistry and Drug Discovery. 7th ed., Wiley, 2010.
5. Wermuth, Camille G., editor. The Practice of Medicinal Chemistry. 4th ed., Academic Press, 2015.
6. Gringauz, Alex. Introduction to Medicinal Chemistry: How Drugs Act and Why. 2nd ed., Wiley-VCH, 2019.
7. Mann, John, and John S. Mills. Medicinal Chemistry: A Molecular and Biochemical Approach. 3rd ed., Oxford University Press, 2015.
8. Kar, Ashutosh. Medicinal Chemistry. 9th ed., New Age International Publishers, 2022.

Glocal University Pharmacy College
Ph.D. Course Work Pharmacy- Elective

Paper Name: Pharmaceutical Analysis	Paper Code: PHD-104/PH(III)	Credits: 4 (3-1-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. Understand the fundamental principles and techniques of qualitative and quantitative analysis used in pharmaceutical compounds.
2. Develop proficiency in instrumental methods of analysis, including UV-Vis, IR, NMR, chromatography, and electrochemical techniques.
3. Apply analytical methods for quality control and assurance of raw materials and finished pharmaceutical products in compliance with regulatory standards.

Unit	Contents	Lectures
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. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation, Data Interpretation. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation.	**15**
II	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. Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact.	**10**
III	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High-Performance Liquid chromatography h) Affinity chromatography 7 i) Gel Chromatography.	**10**
IV	Electrophoresis: Principle, Instrumentation, working conditions, factors affecting separation and applications: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing X ray Crystallography: Production of X rays, Different X ray methods, Bragg‘s law, Rotating crystal	**15**

	technique, X ray powder technique, Types of crystals and applications of X-ray diffraction. a) Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.	
V	Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.	**10**
	Total	**60**

Suggested Readings

1. Lachman, Leon, Herbert A. Lieberman, and Joseph L. Kanig. *The Theory and Practice of Industrial Pharmacy*. 3rd ed., Varghese Publishing House, 1987.
2. Florence, Alexander T., and David Attwood. *Physicochemical Principles of Pharmacy*. 6th ed., Pharmaceutical Press, 2015.
3. Beckett, A. H., and J. B. Stenlake. Practical Pharmaceutical Chemistry. Vols. 1 & 2, 4th ed., CBS Publishers & Distributors, 2005.
4. Chatten, L. G. Pharmaceutical Chemistry: Volume I—Drug Analysis. 3rd ed., CBS Publishers & Distributors, 2006.
5. Skoog, Douglas A., F. James Holler, and Stanley R. Crouch. Principles of Instrumental Analysis. 7th ed., Cengage Learning, 2017.
6. Pavia, Donald L., Gary M. Lampman, and George S. Kriz. Introduction to Spectroscopy. 5th ed., Cengage Learning, 2015.
7. Sharma, B. K. Instrumental Methods of Chemical Analysis. 25th ed., Goel Publishing House, 2002.
8. Watson, David G. Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists. 3rd ed., Elsevier, 2012.
9. Mahadevan, A., and B. G. Nagavi. Pharmaceutical Analysis: Vol. I & II. 2nd ed., PharmaMed Press, 2020.
10. Kasture, A. V., S. G. Wadodkar, and H. N. Saluja. Pharmaceutical Analysis. Vols. I & II, Nirali Prakashan, 2019.

Glocal University Pharmacy College
Ph.D. Course Work Pharmacy- Elective

Paper Name: Advances in Pharmacology	Paper Code: PHD-104/PH(IV)	Credits: 4 (3-1-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. Understand the latest developments in drug action and receptor pharmacology, including molecular and cellular mechanisms.
2. Explore emerging therapeutic targets and novel drug classes in areas such as oncology, neuropharmacology, and immunopharmacology.
3. Analyze recent research trends and experimental approaches in pharmacodynamics, pharmacokinetics, and drug development.

Unit	Contents	Lectures
I	How drugs act: general principles and molecular aspects, pharmacogenetics, pharmacokinetics and pharmacodynamics.	**10**
II	Chemical transmission and drug action in the CNS and ANS. a. General aspects and steps involved in neurotransmission. Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters- Adrenaline and Acetyl choline). Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters- histamine, serotonin, dopamine, GABA, glutamate and glycine.	**15**
III	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. General principles of preclinical screening. CNS Pharmacology: behavioral and muscle co-ordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti-epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimer's and multiple sclerosis. Drugs acting on Autonomic Nervous System.	**10**
IV	Pharmacology of drugs in Neurodegenerative disorders (mechanism of neurodegeneration, dementia, and Alzhemer's disease, Parkinson's disease. Huntington's disease).	**15**
V	Basic principles of Chemotherapy, Cancer and AIDS, Immunopharmacology. Immunosuppressants and Immunostimulants Psychotropic substances and drugs with potential for addiction: Medical, social and Economical Implications; Metabolite kinetics.	**10**
	Total	**60**

Suggested Readings

1. Gnegy, Margaret E., editor. Advances in Pharmacology: Pharmacological Advances in Central Nervous System Stimulants. Vol. 99, Academic Press, 2024.
2. Slusher, Barbara S., and Diane E. Peters, editors. Advances in Pharmacology: The Discovery of New Medicines in Academia. Vol. 100, Academic Press, 2023.
3. Wong, W. S. Fred, editor. Advances in Pharmacology: Pulmonary Pharmacology. Vol. 98, Academic Press, 2023.
4. Zeldin, Darryl C., and John M. Seubert, editors. Advances in Pharmacology: Bioactive Lipid Mediators in Cardiopulmonary Pharmacology. Vol. 97, Academic Press, 2023.
5. Costa, Max, editor. Advances in Pharmacology: Environmental Carcinogenesis. Vol. 96, Academic Press, 2023.
6. Garattini, Silvio, and Parkhurst A. Shore, editors. Advances in Pharmacology: New Targets for the Treatment of Hypertension and Associated Diseases. Vol. 94, Academic Press, 2021.
7. Garattini, Silvio, and Parkhurst A. Shore, editors. Advances in Pharmacology: Endocrine-Disrupting Chemicals. Vol. 92, Academic Press, 2021.
8. Wikipedia
9. Duman, Ronald S., and John H. Krystal, volume editors. Advances in Pharmacology: Rapid-Acting Antidepressants. Vol. 89, Academic Press, 2020.

Glocal University Pharmacy College
Ph.D. Course Work Pharmacy- Elective

Paper Name: Pharmaceutical Sciences	Paper Code: PHD-104/PH(V)	Credits: 4 (3-1-0)
Evaluation (Maximum Marks = 100)	**Internal = 30**	**External = 70**

Course Objectives

1. Understand the fundamentals of drug development, including formulation, manufacturing, and quality control.
2. Apply principles of pharmacology, pharmaceutics, and medicinal chemistry in drug action and therapy.
3. Develop skills in research, analysis, and regulatory aspects of pharmaceutical product development.

Unit	Contents	Lectures
I	Central Drug Standard Control Organisation (CDSCO) : Functions and responsibilities. Investigational New Drug: Need of an IND, Content and Format of an IND application.	**15**
II	The New Drug Application: Overview, Law regulations and Guidance, new drug development and approval, NDA development preclinical investigation, new drug application (phase I, phase II, phase IV and post marketing surveillance),contents of the NDA (chemistry, manufacturing, testing, packaging, labelling, controls, preclinical, clinical data), Human Pharmaco-kinetic and bioavailability testing requirements.	**10**
III	Oral Controlled drug delivery systems: Design and fabrication of diffusion controlled, dissolution controlled, osmotic, gastro-retentive delivery systems, biodegrable polymeric delivery systems. Controlled drug delivery polymers, roles of polymers in drug delivery, pharmacokinetic/ pharmacodynamic basis of oral controlled drug delivery	**10**
IV	Drug Design: Approaches to drug design, method of variation, biochemical and physiological approaches. Lead compound - Search & Optimization: Search of lead compound from natural products and other sources, selection of test compounds. Methods of lead optimization – synthesis of analogs, variation of substituents, extension of structure, ring versus chain structures, bioisosterism, ring contraction and expansion. Hansch analysis, Free-Wilson analysis, Craig plot, Topliss scheme, CoMFA analysis.	**15**
V	Extraction: Different techniques adopted for the extraction of phytoconstituents like Maceration, percolation, sonication, soxhlet assisted extraction, ultrasound assisted extraction, super critical carbon dioxide extraction and Microwave assisted extraction. Common animal models for selected categories of drugs: anti-hypertensive, antiinflammatory, anti-diabetic, anti-ulcer, anti-oxidants.	**10**

	Total	**60**

Suggested Readings

1. Lachman, Leon, Herbert A. Lieberman, and Joseph L. Kanig. *The Theory and Practice of Industrial Pharmacy*. 3rd ed., Varghese Publishing House, 1987.
2. Florence, Alexander T., and David Attwood. *Physicochemical Principles of Pharmacy*. 6th ed., Pharmaceutical Press, 2015.
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