

**RIMT UNIVERSITY
MANDI GOBINDGARH, PUNJAB**



RIMT

UNIVERSITY

Study Scheme & Syllabus

For

Ph.D. (2021)

RIMT UNIVERSITY
MANDI GOBINDGARH, PUNJAB

VISION

To become one of the most preferred learning places and a centre of excellence to promote and nurture future leaders who would facilitate the desired change in the society.

MISSION

- To impart teaching and learning through cutting-edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

SCHOOL OF PHARMACEUTICAL SCIENCES

VISION

- To enable the learners discover their special talent and develop self-confidence for better adjustment
- To aspire teacher trainees to contribute in nation building
- To help them to become ethical, civic minded and committed leaders
- To enable them to become catalysts in the never-ending process of education.

MISSION

To enable teacher trainees to be exemplary teachers, leaders and models for the society who are caring, committed, competent, efficient and resilient teachers. The institution also instills in them confidence and will to serve the cause of teaching and humanity

ABOUT THE PROGRAM

The program will develop the candidate's independent and reflective knowledge and skills for his/her own research and others as well as the role of research in a broader context. A candidate will achieve the following course outcomes in terms of knowledge, skills, and general competencies, after completing the Ph.D. program.

SCHOOL OF PHARMACEUTICAL SCIENCES

PEO1	To acquaint students with the concept of research and educational research. To develop an understanding of the nature and scope of educational research.
PEO2	Students will be equipped with skills to undertake research work
PEO3	To develop an understanding of the basic framework of the research process and publications
PEO4	To develop the capacity to serve the various higher academic institutions like Colleges, Universities, and National Research Institutes in various fields of apex academic research

Program Outcomes for Ph.D. in Pharmaceutical Sciences

PO 1	Understanding different research methods, Equipping scholars with relevant tools and techniques, Data collection and analysis by using statistical measures, use of conceptual understanding in practical research work, and writing a research report.
PO 2	To identify and critically evaluate research and publication of ethical issues within the area of teacher education
PO 3	Enhance the analytical and interpretation skills of data, Scholars are well trained in using statistical measures, and software- SPSS; MS EXCEL, etc.
PO 4	Use ICT in research perspective, design and develop ICT integrated learning resources, analysis, and interpretation of the research data with the help of ICT.
PO 5	Apply critical, analytical, and communication skills in developing professional presentations and writing.
PO 6	To access and extract the desired information from the different scientific databases and resources
PO 7	Develop the analytical and reflective skills for resolving the critical educational issues
PO 8	Students will be acquainted with the statistical techniques in research

PROGRAM SPECIFIC OUTCOME

PSO 1	To bring together theory and research from education and other related disciplines to facilitate effective teaching and learning.
PSO 2	To develop an understanding and appreciation for the various kinds of research as well as their aspects.
PSO 3	To disseminate educational research at recognized national and international level

RIMT UNIVERSITY
COURSE Ph.D PROGRAM YEAR (2021-22)
Pharmaceutical sciences
Scheme and Syllabus

FIRST SEMESTER (COURSE WORK)

Subject Code	Subject	Theory	Duration Of Examination	Maximum Marks	Passing Marks
RMS 5011	Research Methodology & Statistical Techniques	6 Hr/Wk	3 Hours	100	50
CAR 502M	Computer Applications in Research	6hr/Wk	3 Hours	100	50
Core Subjects					
PHA 5031	Pharmacognosy	6hr/Wk	3 Hours	100	50
PHA 5032	Pharmaceutical Analysis				
PHA 5033	Pharmacology				
PHA 5034	Pharmaceutical Chemistry				
PHA 5035	Pharmaceutics				
RPE505M	Research & Publication Ethics	6hr/Wk	3 Hours	100	50

Note:

- 1. In paper I, II, III and IV (theory), there shall be 40 marks for internal assessment and 60 marks in main examination.**
- 2. A candidate is declared pass if he/she obtain 50% marks individually in each subject and 50%marks in aggregate.**

Director

RIMT UNIVERSITY
COURSE PhD PROGRAM YEAR (2021-22)
SYLLABUS: PHARMACOGNOSY
Paper Code (PHA 5031)

TIME: 3 HOURS

MARKS: 100

INTERNAL: 40

EXTERNAL: 60

Course Outcomes: On completion of this course, the students will be able to:

PHDPH R 1103A.1	Understand potential of natural products as synthones, templates and sources of novel drug in the process of drug discovery.
PHDPH R 1103A.2	Gain comprehensive knowledge of plants used for treatment of liver diseases, inflammatory diseases, diabetes, cardiovascular diseases, viral diseases and cancer.
PHDPH R 1103A.3	Understand the role of plants as adaptogens and immunomodulators role in general well being and holistic health.

Module -A

Drug discovery and development from natural products with special emphasis on drugs derived from atropine, morphine, quinine, cocaine, podophyllotoxin and paclitaxel

Module -B

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Hepatoprotective plants-*Andrographis paniculata*, *Glycyrrhiza glabra*, *Picrorrhiza kurroa*, *Silybum marianum* and *Swertia chirata*.

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Anti inflammatory plants- *Aesculus hippocastanum*, *Boswellia serrata*, *Commiphora mukul*, *Curcuma longa*, *Pluchea lanceolata* and *Vitex negundo*.

Module -C

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Antidiabetic plants- *Allium cepa*, *Azadirachta indica*, *Cyamopsis tetragonolobus*, *Gymnema sylvestris*, *Momordica charantia*, *Pterocarpus marsupium*, *Syzygium cuminii* and *Trigonella foenum graecum*.

Module -D

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Plants used in cardiovascular disorders- *Digitalis*, *Coleus forskohli*, *Garcinia cambogia*, *Terminalia arjuna*, *Thevetia nerrifolia*, *Viscum album*, *Veratrum* and *Allium sp.*

Module -E

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Antiviral plants- *Echinaceae purpurea*, *Sambucus nigra*, *Saponaria officinalis*, *Rhizophora* species and *Thuja occidentalis*;

Anticancer drugs-*Camptotheca acuminata*, *Catharanthus roseus*, *Podophyllum* species and *Taxus* species

Module -F

Pharmacognostic characteristics, chemical constituents and pharmacological basis of therapeutic uses of the Plants used as adaptogens and immunomodulators-*Allium sativum*, *Asparagus racemosus*, *Ganoderma* species, *Ocimum sanctum*, *Panax ginseng*, *Phyllanthus emblica*, *Tinospora cordifolia* and *Withania somnifera*.

Reading Material Recommended

1. W.C. Evans, Trease and Evans Pharmacognosy, 15th edition, W.B. Saunders &Co., London, 2002.
2. S.S. Handa and M.L. Kaul, Supplement to cultivation and utilization of medicinal plants, R.R.L Jammu, India, 1996.
3. Ram P Rastogi, Compendium of Indian Medicinal Plants Vol. I-V, CSIR, Lucknow & NISCOM, New Delhi, 1998.
4. T. Fleming, PDR for Herbal Medicine, 2nd edition Medical Economics compant, Mountvale, New Jersy, 2000.

5. M.J. Cupp, Toxicology and Clinical Pharmacology of Herbal Products, Humana Press, New Jersy, 2000

Course Outcomes: On completion of this course, the students will be able to:

PHDPH R 1103B.1	Understand the methods of purification of drug substances, food products and identification of unknown compounds.
PHDPH R 1103B.2	Identify the flow of cations and anions in the blood sample.
PHDPH R 1103B.3	Perform the isolation of liquid samples and separation of plasma from blood samples.
PHDPH R 1103B.4	Identify the sequence of genes.

Module -A

Basic Techniques

Buffers; Methods of cell disintegration, Dialysis, Ultrafiltration (principle, method and application)

Module -B

Spectroscopy Techniques

Theory and Principle of UV and Visible, Circular Dichroism; Fluorescence; MS (MS-MS, MALD-TOF), NMR spectroscopy.

Module -C

Chromatography Techniques

Theory, Principle and application of TLC, Paper chromatography, Gel permeation, Ion exchange and Affinity chromatography; HPLC and GLC

Module -D

Electrophoresis techniques

Theory and application of Polyacrylamide and Agarose gel electrophoresis, 2DElectrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis

Module -E

Centrifugation

Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc); Types of centrifuge - Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation, Applications (Isolation of cell components)

Module -F

Other basic techniques

Theory, Principle & application of Flow Cytometry, ELISA, Southern, Northern Blotting, western blotting, RFLP, RAPD, AFLP, DNA sequencing, New GEN sequencing,

Microarray.

Suggested Readings

1. Thomas G.M. Schalkhammer. *Methods & Tools in Biotechnology, Analytical Biotechnology*, Bertelsmann Springer Publishing Group
2. Donald L. Pavia, Gary M. Lampman, *Introduction to Spectroscopy IV Edition*, Brooks/Cole Cengage Learning
3. Frank C. Hay, Olwyn M.R. Westwood, *Practical Immunology, Fourth Edition*, Blackwell Science
4. Jack G. Chirikjian, *Biotechnology: theory and techniques, Vol 1-5, 1995*, Jones and Bartlett Publishers
5. Freifelder D., *Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition*, W.H. Freeman & Company, San Fransisco, 1982.
6. Keith Wilson and John Walker, *Principles and Techniques of Practical Biochemistry, 5th Edition*, Cambridge.

RIMT UNIVERSITY
COURSE Ph.D PROGRAM YEAR (2021-22)
SYLLABUS: Pharmaceutical Chemistry
Paper Code PHA 5034

TIME: 3 HOURS

MARKS: 100

INTERNAL: 40

EXTERNAL: 60

Course Outcomes: On completion of this course, the students will be able to:

PHDPHR 1103C.1	Design various types of drug molecules and new chemical compounds.
PHDPHR 1103C.2	Understand the maintenance of pH in pharmaceutical preparations.
PHDPHR 1103C.3	Understand the reactions between different compounds.

Module A

Reaction Intermediates:

Reaction Intermediates Formation, structure, stability and reactions of Carbocation, Carbanions, Free radicals, Nitrenes, Carbenes, Benzynes.

Module B

Concept of Acids and bases Hard and soft acids and bases, effect of structure and medium on strength of acids and bases. pH, pKa, pKb, Henderson- Hassenbelch equation, buffer solutions.

Module C

Name reactions; their mechanism : Grignard , Mannich , Witting , Knorr Pyrazole synthesis , Reformatsky , Strecker amino acid synthesis , Claisen Schmidt , Perkin , Knoevenagel , Wolf Kishner reduction , Darzen, Meerwein Ponndorf- verley reduction

Module D

Stereochemistry: Stereochemistry , Basic concepts in stereochemistry – optical activity, specific rotation, , the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, Fischers D and L notation, cis-trans isomerism, E and Z notation

Module E

Pericyclic Reactions Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction □ Sigmatropic rearrangement reactions with examples

Module F

Heterocyclic Chemistry: methods of preparation and reaction of following compounds: Furan, Pyrrole, Thiophene, pyridine, quinoline, isoquinoline

Suggested Readings

1. M. E. Wolff, Burger's Medicinal Chemistry and Drug discovery, Principle and Practice, John Wiley & Sons, New York. (Latest edition).
2. Nogrady, Medicinal Chemistry, A Bio Chemical Approach, Oxford University Press, Oxford.
3. J. March, Advanced Organic Chemistry, Reactions, Mechanism and Structures, John Wiley & Sons, New York. (Latest edition).
4. Eliel and H. Samuel, Stereochemistry of Organic compounds, John Wiley & Sons, New York. (Latest edition).
5. Carey FA and Sundberg RJ. Advanced Organic Chemistry. Part B: Reactions and Synthesis. Plenum Press, London. Latest Edition.

RIMIT UNIVERSITY
COURSE Ph.D. PROGRAMME YEAR (2021-22)
SYLLABUS: PHARMACOLOGY
Paper Code (PHA 5033)

TIME: 3 HOURS
INTERNAL: 40

MARKS: 100
EXTERNAL: 60

Course Outcomes: On completion of this course, the students will be able to:

PHDPHR 1103D.1	Understand the drug discovery process.
PHDPHR 1103D.2	Understand the various guidelines for handling and care of animals.
PHDPHR 1103D.3	Understand the basic concepts of cell and molecular pharmacology.

Module: A

Drug Discovery & Clinical pharmacology and pharmacodynamics: Drug discovery Phases and evaluation through advanced pharmacological methods. Clinical studies, design documentation, presentation and interpretation, statistical analysis of clinical data, factorial design, guidelines as per Indian and other regulatory authorities. Pharmacovigilance

Module: B

Laboratory Animals: Common laboratory animals and Alternatives to animal experimentation. Guidelines according to official compendia (CPCSEA, OECD, ICH, GLP, ICMR). Bioassay- Principle, scope and limitations and methods

Module: C

Bioavailability and Bioequivalence Studies of Drug Products & Importance of Studies.

Module: D

Autocoid Pharmacology- A study of the mechanisms involved in the formation, release, pharmacological actions and possible physiological role of histamine, serotonin, kinins, prostaglandins, opioid autocoids and cyclic 3' -5' AMP. Systemic pharmacology of drugs acting as agonists and antagonist to the autocoids.

Module: E

Immunopharmacology- Cell and biochemical mediators involved in allergy, immunomodulation and inflammation. Classification of hypersensitivity reactions and diseases involved. Therapeutic agents for allergy, asthma, COPD and other immunological diseases with emphasis on immunomodulators.

Module: F

CELLULAR AND MOLECULAR PHARMACOLOGY: Concept of gene therapy and recent development in the treatment of various hereditary diseases. Human genome mapping and its potential in drug research. Techniques for the study of Molecular Pharmacology. Receptor occupancy, cellular signaling systems and Endogenous bioactive molecules. Generation & Role of

Free Radicals in etiopathology of various diseases.

Reference Books:

1. Basic & Clinical Pharmacology by Bertram G. Katzung
2. Clinical Pharmacology by Laurance and Bennett
3. Clinical Trials. Bio-informatics Institute of India
4. **Screening methods in Pharmacology by Robert Turner. A**
5. **Evaluation of drugs activities by Laurence and Bachrach.**
6. **Fundamentals of experimental Pharmacology by M.N.Ghosh.**
7. **Pharmacological experiment on intact preparations by Churchill Livingstone.**
8. **Encyclopedic Reference Of Molecular Pharmacology 2nd Edition (English, Hardcover, Walter Rosenthal Stefan Offermanns)**
9. **Text Book of Receptor Pharmacology, Edited by John C. Foreman & Torben Johansen**

RIMT UNIVERSITY COURSE Ph.D PROGRAM YEAR (2021-22)

SYLLABUS: PHARMACEUTICS

Paper Code (PHA 5035)

TIME: 3 HOURS

INTERNAL: 40

MARKS: 100

EXTERNAL: 60

Course Outcomes: On completion of this course, the students will be able to:

PHDPH R 1103E.1	Understand the physicochemical characteristics of drug substance.
PHDPH R 1103E.2	Understand various pharmacokinetic parameters to describe the kinetics of ADME.
PHDPH R 1103E.3	Gain basic knowledge of novel drug delivery systems, various methods, technologies and kinetics of drug release.
PHDPH R 1103E.4	Understand the stability studies according to ICH guidelines.

Module – A

Preformulation Studies: Preformulation studies of drug substances, Proteins and Peptides, Preformulation Work sheet.

Module-B

ADME, Pharmacokinetic Characterization of drugs: Absorption rate constants (Wagner-Nelson, Loo-Reigelman methods), Limitations, Lag Time, P'cokinetics in presence of lag-time, Flip-flop model.

Module-C

Stability studies: Stability of dosage forms as per ICH Guidelines.

Module – D

The Concept of Bioavailability and Bioequivalence, In Vitro and In vivo methods in Establishment of Bioequivalence.

Module – E

Novel Drug Delivery System:

Microencapsulation & Microspheres: Methods of encapsulation, Kinetics of drug release from microcapsules, technology and applications.

Basic Techniques for development Neosomes , Nanoparticles.

Module – F

Implants and Inserts: Types , design and Evaluation Methods.

Mechanism of drug release from Implants, Implantable Infusion Pumps, Implantable Mini Osmotic Pumps. Evaluation of Implanted Polymeric materials.

Reading Resources:

1. Remington's " Pharmaceutical Sciences" 19th edition.
2. Lachman" The theory and Practice of Industrial Pharmacy" 3rd edition.
3. Pharmaceutics "The Science of Dosage form Design" by Aulton.
4. Drug Stability (Principles and Practices) by Jens T. Carstensen.
5. Microencapsulation: Methods and Industrial Applications, Second edition, edited by Simon Bentia.
6. The theory & Practice of Industrial Pharmacy by L. Lachman, J.L. Kanning 3rd edition.
New Drug Approval Process, Fifth Edition, edited by Richard A. Guarino.
7. United State Pharmacopia.

8. **Lachman L., Liberman H.A., Kanig J. L., The theory & Practice of Industrial Pharmacy.**
2nd Edition 1991, Varghese Publishing house.

Additional Resources:

- ❖ **Latest information regarding to NDDS updates are available on <http://www.pharmainfo.net>**
- ❖ **Soft Copies of books title bearing Novel Drug Delivery Systems are available on <http://www.pharmatext.org>**