K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF MEDICAL & ALLIED SCIENCES

(SMAS)

Programme Handbook

ACADEMIC YEAR

2024-2026

MASTER OF PHARMACY (PHARMACEUTICS)

Programme Code: 65

TWO YEAR POSTGRADUATE PROGRAMME

TABLE OF CONTENTS

1. Preface

The KRMU envisions all its programs in the best interest of their students and in this endeavour it offers a new vision to all its courses. Through its programs it aims to provide a focused, student-centric syllabus with an agenda to structure the teaching-learning experiences experientially. The curriculum strengthens student's experiences and prepares the students for, academia and employability, sustainability and life-long learning. Each program reflects the promise to accomplish the learning outcomes by studying the courses. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for entrepreneurship. The K.R. Mangalam University hopes the curriculum will help students in making an informed decision at the time of working in the field of pharmacy.

2. University Vision and Mission

Vision

K.R. Mangalam University aspires to become an internationally recognized institution of higher learning through excellence in inter-disciplinary education, research, and innovation, preparing socially responsible life-long learners contributing to nation building.

Mission

- Foster employability and entrepreneurship through futuristic curriculum and progressive Pedagogy with cutting-edge technology
- Instill notion of lifelong learning through stimulating research, Outcomes-based education, and innovative thinking
- Integrate global needs and expectations through collaborative programs with premier universities, research centers, industries, and professional bodies.
- Enhance leadership qualities among the youth having understanding of ethical values and environmental realities

3. About the School of Medical & Allied Sciences

School of Medical and Allied Sciences mainly focused on training to students for various subjects and practical aspects related to drug formulation and testing along with co-curricular development. School offers Diploma, undergraduate, post graduate courses in pharmacy and Bachelor degree in physiotherapy post. We provide an extra edge to our students by teaching and training by leading pharma industry experts to facilitate industry academia interaction, participation in conferences / workshops / skill development programs, carrier guidance, coaching for GPAT and other competitive examinations. We encourage students to participate in various health camps organized by School of

Medical and Allied Sciences to make general awareness amongst people regarding various diseases like diabetes, hypertension, communicable and non-communicable diseases. We provide placement assistance to students for getting jobs in various government and private laboratories. We have tie up with various pharmaceutical industries like Dabur Research Foundation, Sun Pharma, Arbro Pharma, Indian Pharmacopoeial Commission, Catalyst Clinical Services, Suraksha Pharma, Medicamen Biotech , Mankind Pharma etc. which provide various carrier opportunities in pharmaceutical production, pharmaceutical quality control, quality assurance, pharmaceutical sales & distribution, drug information services, health insurance, medical coding, supply chain management, forensic sciences, Pharmacovigilance, product management team, clinical trials, clinical data management and in Indian Pharmacopeia Commission.

4. School Vision and Mission

Vision

To become a premier educational institution dedicated to empowering students with the knowledge and skills needed to lead in pharmaceutical field and enhance healthcare access, thereby making a positive impact on society in India and globally.

Mission

- To empower students to become self-motivated, self-reliant, and socially aware healthcare professionals, effectively addressing the needs of academia, industry, and research.
- To establish a dynamic centre of excellence for learning and research in pharmaceutical and allied health sciences, emphasizing interdisciplinary approaches and fostering collaboration between industry and academia.
- To nurture translational research initiatives that benefit society and improve community health outcomes.
- To integrate pharmaceutical and allied health sciences with interdisciplinary life sciences, promoting innovation and collaboration.
- To offer lifelong learning opportunities in healthcare, equipping professionals with the skills to adapt and excel in a rapidly evolving field.

5. About the Programme

Since 2018 the School of Medical and Allied Sciences strives to foster and maintain a creative environment with a deep commitment to inculcate excellence in academics and contribute towards students' development. The Master's programme is designed to provide a sound knowledge and

training to students to prepare students for high-level research and leadership positions in pharmaceutical and biotechnology companies. The School of Medical and Allied Sciences offers Masters Programs in Pharmaceutics and Pharmacology that are designed to prepare exceptional students for productive and successful careers in pharmaceutical industry, academia, and research.

a. Definitions

- **Programme Educational Objectives (PEOs)**

Programme Educational Objectives of a degree are the statements that describe the expected achievements of graduates in their career, and what the graduates are expected to perform, achieve and how will they conduct professionally during the first few years after graduation.

- **Programme Outcomes (POs)**

Programme Outcomes are statements that describe what the students are expected to know and would be able to do upon the graduation. These relate to the skills, knowledge, and behavior that students acquire through the programme.

- **Programme Specific Outcomes (PSOs)**

Programme Specific Outcomes are statements about the various levels of knowledge specific to the given program which the student would be acquiring during the program.

- **Credit**

Credit refers to a unit of contact hours by which the course work is measured. It determines the number of hours of instructions required per week.

b. Programme Educational Objectives (PEOs)

The PEOs are delayed outcomes measured few years after completion of the programme, where the graduates of this program will:

PEO-1: Become professional experts in careers associated to pharmaceutical Sciences, and allied fields, establishing knowhow and compliance.

PEO-2: Emerge as leaders, entrepreneurs, and managers, guiding pharma professionals within the healthcare field.

PEO-3: Maintain morals & ethics in their professional conduct, thereby taking responsible decisions which endorse the reliability of the professional healthcare person.

PEO-4: Support for sustainable practices and engage in environment-friendly methods of dealing with patients in healthcare.

PEO-5: Be as decent citizens with high value attributes towards society, demonstrating extraordinary professionalism, as a contribution towards well-being of the society.

c. Programme Specific Outcomes (PSOs)

After successful completion of the M. Pharm. (Pharmaceutics), the students will be able to:

PSO-1: Understanding theories related pharmaceutics explaining their application towards identification, quantification and formulation development of drugs using modern analytical instrumental techniques.

PSO-2: Applying the advanced principles of drug delivery systems for the preparation of efficacious, economical and eco-friendly dosage forms.

PSO-3: Analysing the collected data/information to further optimise and improvise pharmaceutical production process to yield dosage forms having predetermined quality attributes.

PSO-4: Evaluating drugs and drug products for their safe, efficacy, release and toxicity levels.

PSO-5: Creating newer and advanced concepts/techniques for production of quality dosage forms.

PSO-6: Observing various instrumental analytical processes to develop and optimise the methods of analysis in pharmaceutical formulation development and their validations.

PSO-7: Performing the experiments using instruments to identify and quantify the drug and their formulations.

d. **Career Avenues:** Academics/ Research and development/ Pharmacovigilance/ Clinical Research/ Preclinical data analyst /Medical writing/ Medical coder/ Toxicology/ Analytical R& D/ Formulation Development/ Drug Regulatory affairs/ Product Marketing/ Sales and Marketing/ Drug inspectors/ Drug Safety Associate/Overseas opportunity(GRE)

e. **Duration:** The program of study for M. Pharm. (Pharmaceutics) shall extend over a period of four semesters (two academic years). The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

Name of the Program	Duration
M. Pharm. (Pharmaceutics)	2 Years / 4 Semester

f. Criteria for Award of Degree

A student shall be declared PASS and eligible for getting grade in a course of M. Pharm. programme if he/she secures at least 50% marks in that particular course including internal assessment and end term examination.

All the students shall undertake a project under the supervision of a teacher in Semester III to IV and submit a report. 4 copies of the project report shall be submitted (typed & bound copy not less than 75 pages). The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). The projects shall be evaluated as per the criteria and the class shall be awarded on the basis of CGPA as follows:

First Class with Distinction = CGPA of. 7.50 And above

First Class = CGPA of 6.00 to 7.49

Second Class = CGPA of 5.00 to 5.99

6. Student's Structured Learning Experience from Entry to Exit in the Programme

Education Philosophy and Purpose

- **Learn to Earn Living**

  At KRMU we believe in equipping students with the skills, knowledge, and qualifications necessary to succeed in the job market and achieve financial stability. All the programmes are tailored to meet industry demands, preparing students to enter specific careers and contributing to economic development.

- **Learn to Live**

  The university believes in the holistic development of learners, fostering sensitivity towards society, and promoting a social and emotional understanding of the world. Our aim is to nurture well-rounded individuals who can contribute meaningfully to society, lead fulfilling lives, and engage with the complexities of the human experience.

University Education Objective

- **Focus Employability and Entrepreneurship through Holistic Education Using Bloom's Taxonomy**

  By targeting all levels of Bloom's Taxonomy—remembering, understanding, applying, analysing, evaluating, and creating—students are equipped with the knowledge, skills, and attitudes necessary for the workforce and entrepreneurial success. At KRMU we emphasize on learners critical thinking, problem-solving, and innovation, ensuring application of theoretical knowledge in practical settings.

This approach nurtures adaptability, creativity, and ethical decision-making, enabling graduates to excel in diverse professional environments and to innovate in entrepreneurial endeavours, contributing to economic growth and societal well-being.

- **Importance of Structured Learning Experiences**

Structured learning experiences in a Pharmacy programs are essential as they provide a systematic framework for acquiring comprehensive knowledge and practical skills essential for professional practice. By integrating theoretical coursework with hands-on labs, simulations, and clinical rotations, these experiences ensure students develop a thorough understanding of pharmacology, patient care, and professional ethics. This structured approach not only promotes consistency and standardization in education but also enhances critical thinking, problem-solving abilities, and preparedness for licensure exams. Ultimately, it equips future pharmacists with the competence and confidence needed to excel in a dynamic and demanding field.

- **Educational Planning and Execution**

As per the norms laid by Pharmacy Council of India< New Delhi

- **Academic Journey**
- **Curriculum Structure and Degree Requirements**

The minimum credit points required for the award of M. Pharm. degree is 95. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 100 credit points. These credits are divided into Theory courses, Practical, Seminars, Assignments, Research work, Discussions with the supervisor, Journal club and Co-Curricular activities over the duration of four semesters. The credits are distributed semester-wise. Courses generally progress in sequence, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester wise schedule of courses given in the syllabus.

- **Course Registration and Scheduling**

As university academic calendar

- Major and Minor Selection
- Internships/Projects/Dissertations/Apprenticeships
- Academic Support Services (Slow & Advanced Learners)

- **Student Support Services**

- Mentor-Mentee

- Counselling and Wellness Services
- Career Services and Training

➢ **Learning and Development Opportunities**

- Laboratories and Practical Learning
- Experiential Learning
- Case-Based Learning/Problem-Based Learning/Project Based Learning
- Workshops, Seminars, Guest Lectures
- Inside & Outside Classroom Learning
- Holistic Education

➢ **Assessment and Evaluation**

- Grading Policies and Procedures for theory courses, practical courses, projects, Internships, Dissertation

% of marks	Letter grade	Grade point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

- Feedback and Continuous Improvement Mechanisms

  Feedback analysis from different stake holders (Students, faculty, parents, and alumni) will be collected and analysed for finding the gap and improving teaching pedagogy.

- Academic Integrity and Ethics

In postgraduate pharmacy programs, academic integrity and ethics are paramount to ensure the credibility and professionalism of future practitioners. Upholding these principles involves rigorous adherence to standards of honesty and transparency in research, coursework, and clinical practice.

Students are expected to avoid plagiarism, falsification of data, and any form of academic dishonesty, while also embracing ethical considerations related to patient care, drug development, and professional conduct. An environment that fosters academic integrity not only enhances the quality of education but also prepares students to make ethical decisions in their professional careers, reinforcing the trust and reliability that are essential in the field of pharmacy.

- Examination and Evaluation Methods

The schemes for internal assessment and end semester examinations are given in

The End Semester Examinations for each theory and practical course through semesters I to IV shall be conducted by the subject experts at school level and the marks/grades shall be submitted to the university.

SCHEMES FOR INTERNAL ASSESSMENTS AND END SEMESTER EXAMINATIONS

(SEMESTER I& II)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPH101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPH102T	Drug Delivery Systems	10	15	1 Hr	25	75	3 Hrs	100
MPH103T	Modern Pharmaceutics	10	15	1 Hr	25	75	3 Hrs	100
MPH104T	Regulatory Affairs	10	15	1 Hr	25	75	3 Hrs	100
MPH105P	Pharmaceutics Practical-I	20	30	6 Hrs	50	100	6 Hrs	150
MPH106S	Seminar /Assignment	-	-	-	-	-	-	100
Total								**650**
SEMESTER II								
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	10	15	1 Hr	25	75	3 Hrs	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	10	15	1 Hr	25	75	3 Hrs	100
MPH203T	Computer Aided Drug Delivery System	10	15	1 Hr	25	75	3 Hrs	100
MPH204T	Cosmetics & Cosmoceuticals	10	15	1 Hr	25	75	3 Hrs	100
MPH205P	Pharmaceutics Practical-II	20	30	6 Hrs	50	100	6 Hrs	150
MPH206S	Seminar /Assignment	-	-	-	-	-	-	100

Total	**650**

SCHEMES FOR INTERNAL ASSESSMENTS AND END SEMESTER EXAMINATIONS (SEMESTER III& IV)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER III								
MRM101T	Research Methodology and Biostatistics*	10	15	1 Hr	25	75	3 Hrs	100
MPH302S	Journal club	-	-	-	25	-	-	25
MPH303S	Discussion / Presentation (Proposal Presentation)	-	-	-	50	-	-	50
MPH304P	Research work*	-	-	-	-	350	1 Hr	350
Total								**525**
SEMESTER IV								
MPH401S	Journal club	-	-	-	25	-	-	25
MPH402P	Discussion / Presentation (Proposal Presentation)	-	-	-	75	-	-	75
MPH403S	Research work and Colloquium	-	-	-	-	400	1 Hr	400
Total								**500**

Programme Study (Semester I & II)

Semester I				
S. No.	**Course Code**	**Course Title**	**Credits**	**Hours /week**
1	MPH101T	Modern Pharmaceutical Analytical Techniques	4	4
2	MPH102T	Drug Delivery Systems	4	4
3	MPH103T	Modern Pharmaceutics	4	4
4	MPH104T	Regulatory Affairs	4	4
5	MPH105P	Pharmaceutics Practical-I	6	12
6	MPH106S	Seminar /Assignment	4	7
		TOTAL	**26**	**35**

Semester II				
S. No.	**Course Code**	**Course Title**	**Credits**	**Hours /week**
1	MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4
2	MPH 202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4
3	MPH203T	Computer Aided Drug Delivery System	4	4
4	MPH204T	Cosmetics & Cosmoceuticals	4	4
5	MPH205P	Pharmaceutics Practical-II	6	12
6	MPH206S	Seminar /Assignment	4	7
		TOTAL	**26**	**35**

Programme Study (Semester III & IV)

Semester III				
S. No.	**Course Code**	**Course Title**	**Credits**	**Hours /week**
1	MRM101T	Research Methodology and Biostatistics	4	4
2	MPH302S	Journal Club	1	1
3	MPH303S	Discussion / Presentation (Proposal Presentation)	2	2
4	MPH304P	Research Work	14	28
		TOTAL	**21**	**35**

Semester IV				
S. No.	**Course Code**	**Course Title**	**Credits**	**Hours /week**
1	MPH401S	Journal Club	1	1
2	MPH402P	Research Work	16	31
3	MPH403S	Discussion / Final Presentation	3	3
		TOTAL	**20**	**35**

Total Credits: 93

SEMESTER-I

MPH 101T	Modern Pharmaceutical Analytical Techniques	L	T	P	C
Version ___		4	-	-	4
Category of Course	Core				
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Instrumental method of analysis				

Course Perspective

The course emphasizes the application of various analytical methods like spectroscopy, spectrometry, and chromatography in ensuring the safety, efficacy and quality of pharmaceuticals. This course is important for pursuing career in quality control, assurance, research and development departments of chemical and pharmaceutical industries.

Course Outcomes

Upon completion of the course student:

CO-1: Understanding the basic concept and instrumentation of chromatography, spectroscopy and spectrometric techniques for qualitative and quantitative validation of pharmaceuticals.

CO-2: Application of various analytical techniques for the standardization and identification of organic and inorganic compounds.

CO-3: Analysing the data from experiment to identify impurities present in the samples.

CO-4: Evaluating the standards for various products/formulation by understanding different analytical techniques.

CO-5: Devising the analytical standards for identification and development of new chemical moieties.

Course Content

Unit 1 **11 hrs**

a) UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV Visible spectroscopy.

b) 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.

c) Spectroflourimetry: Theory of Fluorescence, Factors affecting fluorescence, Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

d) Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.

Unit 2 **11 hrs**

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, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy.

Unit 3 **11 hrs**

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 Quadruple and Time of Flight, Mass fragmentation and its rules,

Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.

Unit 4 **11 hrs**

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

Unit 5 **11 hrs**

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) Iso electric focusing

X ray Crystallography: Production of X rays, Different X ray diffraction methods, Bragg‘s law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of Xray diffraction.

Unit 6 **5 hrs**

Immunological assays: RIA (Radioimmuno assay), ELISA, Bioluminescence assays.

Learning Experience

The modern pharmaceutical analytical techniques course will integrate lectures, interactive discussions, and theoretical readings to offer a thorough understanding of advanced analytical techniques. Students will explore concepts through case studies, group discussions, and critical analysis of scientific literature. Assignments and peer reviews will encourage deeper engagement and collaborative learning. Additionally, E-notes videos links will provide on LMs. Assessments will include quizzes, written assignments, sessional and end term exams to measure students' grasp of theoretical knowledge.

Textbooks

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.

2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler.

3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.

4. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.

5. Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998

6. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume Marcel Dekker Series

7. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.

8. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.

Suggested Readings

Open Educational Resources (OER)

1. https://www.slideshare.net/Santachem/uv-visible-spectroscopy

2. https://personal.utdallas.edu/~scortes/ochem/OChem_Lab1/recit_notes/ir_presentation.pdf

3.https://www.chem.uci.edu/~dmitryf/manuals/Fundamentals/Fluorescence%20Spectroscopy.pd

4. https://soe.unipune.ac.in/studymaterial/ashwiniWadegaonkarSelf/621%20Unit%206.pdf

5.https://www.researchgate.net/publication/338622124_Atomic_Absorption_Spectrophotometer_AAS/link/5e200e1d299bf1e1fab4e2cd/download

6. https://www.ru.nl › ms_lecture_notes_161003_mcf
7.http://nvi.ddc.moph.go.th/Download/eCTD/Module%201/8%20Mar/4_Immunoassay_surasukdi.pdf
8.https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/X%20RAY%20crystallography.pdf
9. https://www.brown.edu/academics/chemistry/sites/academics-chemistry/files/NMR_Introductory_Lecture.pdf
10. https://gacbe.ac.in/pdf/ematerial/18MCH42E-U2.pdf
11. https://uomustansiriyah.edu.iq/media/lectures/4/4_2021_09_14!07_58_34_PM.pdf

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
3	End Term Examination (Written Examination)	180 minutes	75	
Total			**100**	

MPH 102T	Drug Delivery Systems	L	T	P	C
Version ___		4	-	-	4
Category of Course	Core Subject				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Industrial Pharmacy				

Course Perspective

This course provides the students with fundamental concepts, techniques and methods about formulation & development of various drug delivery systems. Students will learn about different drug delivery systems, such as their preparation, and characterization. This will also update their learning about the use of excipients in the formulation, particularly the polymers used in novel drug delivery systems. The students will be able to differentiate between modified drug release systems like Sustained Release (SR) and Controlled Release (CR) formulations, Gastro-Retentive Drug Delivery Systems, Ocular Drug Delivery Systems. The course also brings sense of knowledge among the students about various advanced & atypical modes of drug manufacturing, dispensing etc.

Course Outcomes

Upon completion of the course the student will be able to:

CO-1: Understanding theories, concepts to prepare various economical and eco-friendly dosage forms of drugs to cure various diseases.

CO-2: Appling different methods to formulate dosage forms.

CO-3: Analysing the procured data about dosage forms to optimise the various process parameters towards successful production of final drug product.

CO-4: Evaluating the prepared dosage forms for their safety, efficacy & zero toxicity by conducting their appropriate testing on instruments, animals, stability studies and comparative studies.

CO-5: Creating best final formulation among different formulations of a drug as per the design of experiment.

Course Content

Unit No: 1 **No. of Hours 10**

Sustained Release (SR) and Controlled Release (CR) formulations:

Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.

Unit No: 2 **No. of Hours 10**

Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals

Unit No: 3 **No. of Hours 10**

Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations

Unit No: 4 **No. of Hours 06**

Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.

Unit No: 5 **No. of Hours 10**

Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation

Unit No: 6 **No. of Hours 08**

Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.

Unit No: 7 **No. of Hours 06**

Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.

Learning Experience

The said course delivers an important learning experience for students, equipping them with essential skills in advanced formulation techniques, evaluation & characterization methods. Both during academic and professional career in the pharmaceutical industry. By grasping these areas, students can improve innovative drug delivery systems enhance to enhance drug bioavailability, improved stability and better efficacy, etc. So the students should be able to know the concepts like:-

- Understand the principles behind various drug delivery systems and their preparation.
- Evaluate and characterize different dosage forms using appropriate techniques.
- Select and utilize excipients effectively in formulation development.
- Develop and assess novel drug delivery systems with advanced applications.
- Apply knowledge to real-world scenarios through case studies and emerging technologies.

Reference Books

1. Novel Drug Delivery Systems. **Y W. Chien**
2. Controlled Drug Delivery Systems. **Robinson, J. R., Lee V. H. L**
3. Encyclopeadia of controlled delivery. **Edith Mathiowitz**
4. Controlled and Novel Drug Delivery. **N.K. Jain**
5. Controlled Drug Delivery-Concepts and Advances. **S.P. Vyas and R.K. Khar**

Suggested Readings

1. https://ijpras.com/storage/models/article/TeYOGN6dBciE6RSaYCvW8hR2FcFAQVag5S1dwxVGo5yZrYaTt4UG4Qf5nKWQ/gastroretentive-drug-delivery-system-a-review.pdf
2. https://www.tandfonline.com/doi/abs/10.1517/17425247.3.2.217

Open Educational Resources (OER)

1. https://www.slideshare.net/slideshow/drug-delivery-systems/58042802
2. https://www.slideshare.net/slideshow/drug-formulations-drug-delivery-systems/254040968
3. https://www.sketchbubble.com/en/presentation-drug-delivery-systems.html
4. https://doi.org/10.1016/j.ajps.2016.04.007

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
3	End Term Examination (Written Examination)	180 minutes	75	
Total			100	

MPH 103T	Modern Pharmaceutics	L	T	P	C
Version ___	2.0	4	-	-	4
Category of Course					
Total Contact Hours	60				
Pre-Requisites/ Co-Requisites	Industrial Pharmacy				

Course Perspective:

In this course, students will gain a comprehensive understanding of the principles and practices essential for developing and managing pharmaceutical products. They will enhance their analytical skills, enabling them to assess various factors that influence formulation and production processes. Students will learn to implement effective strategies for quality assurance and compliance, preparing them for real-world challenges in the pharmaceutical industry. Ultimately, they will develop a holistic approach to product development that emphasizes safety, efficacy, and optimal performance.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding the principles of drug-excipient interactions and stability testing methods in formulations.

CO-2: Appling optimization techniques and statistical designs to enhance pharmaceutical formulation processes.

CO-3: Analysing the procure data about to optimise and validated the formation by different methods to get maximum effect of final formulation.

CO-4: Evaluating the optimize/final formulation and impact of cGMP practices on production management and overall product quality of formulation.

CO-5: Creating an optimize formulations by using above parameters.

Course Content

Unit 1: Preformation Concepts & Optimization techniques in Pharmaceutical Formulation **No. of Hours: 20**

a. Preformation Concepts – Drug Excipient interactions - 1different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small

volume parental – physiological and formulation consideration, Manufacturing and evaluation.

b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation

Unit 2: Validation **No. of Hours: 10**

- Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipment's, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.

Unit 3: cGMP & Industrial Management **No. of Hours: 10**

- Objectives and policies of current good manufacturing practices, layout of buildings, Hrs services, equipment's and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.

Unit 4: Compression and compaction **No. of Hours: 10**

- Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles. Solubility.

Unit 5: Study of consolidation parameters **No. of Hours: 10**

- Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckel plots, Similarity factors – f2 and f1, Higuchi and Peppa's plot, Linearity Concept of significance, Standard deviation , Chi square test, students T-test , ANOVA test.

Learning Experience: The course provides an invaluable learning experience for students, equipping them with essential skills in advanced formulation techniques, optimization methods, and regulatory compliance within the pharmaceutical industry. By mastering these areas, students can develop innovative drug delivery systems like nanoparticles to enhance drug bioavailability and optimize biopharmaceutical formulations for stability and efficacy. Additionally, they gain the expertise to navigate regulatory requirements, ensuring that new drug applications are thoroughly prepared for successful approval. This knowledge positions

students to contribute significantly to both industry and academic research, driving advancements in pharmaceutical science.

Textbooks/Reference book

1. Theory and Practice of Industrial Pharmacy By Lachmann and Libermann.
2. Pharmaceutical dosage forms:TabletsVol.1-3by Leon Lachmann.
3. Pharmaceutical Dosage forms: Disperse systems, Vol, 1-2; By Leon Lachmann.
4. Pharmaceutical Dosage forms: Parenteral medications Vol. 1-2; By Leon Lachmann.
5. Modern Pharmaceutics; By Gillbert and S. Banker.
6. Remington's Pharmaceutical Sciences.
7. Advances in Pharmaceutical Sciences Vol. 1-5; By H.S. Bean & A.H.B eckett.
8. Physical Pharmacy; By Alfred martin
9. Bentley's Textbook of Pharmaceutics–by Rawlins.
10. Good manufacturing practices for Pharmaceuticals: A plan for total quality control, Second edition; By Sidney H. Willig.
11. Quality Assurance Guide; By Organization of Pharmaceutical producers of India.
12. Drug formulation manual; By D.P.S. Kohli and D.H.Shah. Eastern publishers, New Delhi.
13. How to practice GMPs; By P .P .Sharma. Vandhana Publications, Agra.
14. Pharmaceutical Process Validation; By Fra. R. Berry and Robert A. Nash. 15. Pharmaceutical Preformulation; By J .J . Wells.
15. Applied production and operations management; By Evans, Anderson, Sweeneyand Williams.
16. Encyclopaedia of Pharmaceutical technology, Vol I – III.

Suggested Readings

doi: 10.17305/bjbms.2004.3421

https://www.researchgate.net/publication/351107633_Drug-Excipient_Interactions_An_Overview_on_Mechanisms_and_Effects_on_Drug_Stability_and_Bioavailability

doi: 10.1208/s12249-023-02573-0

DOI:10.13140/RG.2.2.24248.19204

DOI : 10.36106/ijar

DOI:10.22159/ijap.2018v10i2.24482

https://www.ema.europa.eu/en/documents/scientific-guideline/ich-guideline-q2r2-validation-analytical-procedures-step-2b_en.pdf

Open Educational Resources (OER)

https://www.youtube.com/watch?v=ctD6j_sjM3k

https://www.youtube.com/watch?v=xfWPCNWgHT0

https://www.youtube.com/watch?v=2kvfCJ41jGc

https://www.youtube.com/watch?v=QrjHs0-LGjg

https://www.youtube.com/watch?v=TWjFi4oP0js

https://www.youtube.com/watch?v=2ytTORn_CX0

https://www.youtube.com/watch?v=ZqKvV67ntaQ

https://www.youtube.com/watch?v=VIoucBnjDGs

Evaluation Scheme:

Evaluation Scheme:				
S. No.	**Evaluation Component**	**Duration**	**Weightage (%)**	**Date**
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
3	End Term Examination (Written Examination)	180 minutes	75	
		Total	**100**	

MPH 104T	Regulatory Affairs	L	T	P	C
Version ___		4	-	-	4
Category of Course					
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Industrial Pharmacy-II				

Course Perspective

In this course, students will develop a understanding of the regulatory landscape governing pharmaceutical products. They will learn to navigate the complexities of documentation and approval processes, equipping them with the skills to manage drug development effectively. Emphasis will be placed on ethical considerations in clinical research and the importance of safety monitoring. Ultimately, students will be prepared to contribute to the pharmaceutical industry with a strong foundation in regulatory affairs and compliance.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding regulatory documentation and approval processes for pharmaceutical products.

CO-2: Applying the principle of regulatory requirements for product approval, including NDA and ANDA submissions.

CO-3: Analysing the regulatory requirements and its impact on global regulations on drug development and approval process.

CO-4: Evaluating clinical trial protocols and ethical considerations in research.

CO-5: Creating the protocols for Pharmacovigilance and post-marketing surveillance.

Course Content

Unit No:1 **No. of Hours12**

a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO.

b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs 12 Hrs

Unit No:2 **No. of Hours12**

CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.

Unit No:3 **No. of Hours12**

Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).

Unit No:4 **No. of Hours12**

Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials.

Learning Experience

This course will be conducted through a blend of interactive lectures, hands-on laboratory sessions, and group projects to ensure a comprehensive learning experience. Students will engage in case studies, problem-based learning, and practical experiments to apply theoretical knowledge in real-world scenarios. Technology, including virtual labs and e-learning platforms, will enhance understanding, while workshops, seminars, and field visits provide industry insights. Assessments will include quizzes, lab reports, practical exams, and group presentations. Continuous feedback will be provided, and the instructor will be available for additional support. Peer collaboration will be encouraged through group activities and peer reviews, fostering a supportive and interactive learning environment.

Textbooks

1. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and IsaderKaufer,Marcel Dekker series, Vol.143

2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P.Martin, Drugs and the Pharmaceutical Sciences,Vol.185, Informa Health care Publishers.

3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD,5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.

4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.

5. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.

6. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams

Suggested Readings

Open Educational Resources (OER)

1. www.ich.org/
2. www.fda.gov/
3. europa.eu/index_en.htm
4. https://www.tga.gov.au/tga-basics

Evaluation Scheme

.	Evaluation Component	Duration	Weightage (%)	Date
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
3	End Term Examination (Written Examination)	180 minutes	75	
Total			100	

MPH 105P	Pharmaceutics Practical-I	L	T	P	C
Version ___		-	-	12	6
Category of Course	Core Subject				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Pharmaceutics				

Course Perspective This course will enhance the practical skills about formulation development and analysis of various drug delivery systems. Students will learn about different instruments and equipments to be used in these practicals. The students will get knowhow about the various practical concepts, which will help and prepare them for future research project, etc.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Observing the working of the different instruments like UV, HPLC, tablet punching machine in laboratory to conduct the formulation experiments.

CO-2: Performing experiments by using instruments to identify and quantify the drug and their formulations.

Course Content

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. To perform In-vitro dissolution profile of CR/ SR marketed formulation
8. Formulation and evaluation of sustained release matrix tablets
9. Formulation and evaluation osmotically controlled DDS
10. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS
11. Formulation and evaluation of Muco adhesive tablets.
12. Formulation and evaluation of transdermal patches.

13. To carry out Preformulation studies of tablets.
14. To study the effect of compressional force on tablets disintegration time.
15. To study Micromeritic properties of powders and granulation.
16. To study the effect of particle size on dissolution of a tablet.
17. To study the effect of binders on dissolution of a tablet.
18. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.

Reference Books

Text books

1. Controlled and Novel Drug Delivery, N.K. Jain, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. Controlled Drug Delivery - concepts and advances, S.P. Vyas and R.K. Khar, Vallabh Prakashan, New Delhi, First edition 2002.

Reference books

1. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
2. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4thedition, CBS Publishers, New Delhi, 1997.

Suggested Readings

1. **https://ijpras.com/storage/models/article/TeYOGN6dBciE6RSaYCvW8hR2FcFAQVag5S1dwxVGo5yZrYaTt4UG4Qf5nKWQ/gastroretentive-drug-delivery-system-a-review.pdf**
2. **https://www.tandfonline.com/doi/abs/10.1517/17425247.3.2.217**

Open Educational Resources (OER)

1. **https://www.slideshare.net/slideshow/drug-delivery-systems/58042802**
2. **https://www.slideshare.net/slideshow/drug-formulations-drug-delivery-systems/254040968**
3. **https://www.sketchbubble.com/en/presentation-drug-delivery-systems.html**
4. **https://doi.org/10.1016/j.ajps.2016.04.007**

Evaluation Scheme

	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	Sessionals	4 hrs	50	
4	End Term Examination	3 hrs	100	
Total			150	

MPH 106S	Seminar and Assignments	L	T	P	C
Version 1.0		0	0	7	4
Total Contact Hours	105 Hrs				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: The seminar promotes profound understanding and critical analysis of core concepts through interactive deliberations and presentations. Students apply theoretical knowledge to real-world scenarios, enhancing their research and communication skills.

Course Outcomes

Upon completion of the course, students will

CO-1: Understand core concepts and theories of the seminar.

CO-2: Appling the seminar content to develop better drug delivery systems.

CO-3: Analyse various perspectives related to the seminar topics.

CO-4: Effectively conduct and present research related to the seminar theme.

CO-5: Demonstrate effective oral and written communication skills.

Evaluation Scheme

Course code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous mode	Sessional Marks		Total	Marks	Duration	
			Marks	Duration				
MPL106S	Seminar / Assignment	-	-	-	-	100	-	100

SEMESTER-II

MPH 201T	Molecular Pharmaceutics	L	T	P	C
Version		4	-	-	4
Category of Course	Core Subject				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Pharmaceutics/NDDS				

Course Perspective

This course provides detailed concepts about formulation development of various Targeted Drug Delivery Systems. Students will learn about Concepts, events and biological process involved in drug targeting by nanoparticles & Liposomes. Also, preparation and evaluation of microcapsules/Microspheres. They will be updated with newer concepts of Monoclonal Antibodies. The course will upgrade the knowledge about Pulmonary Drug Delivery Systems, like aerosols, propellants, containers types.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding basic theories, concepts and biological process involved in drug targeting of various drugs for their selective delivery in various diseases.

CO-2: Applying different methods to formulate various targeted drug delivery systems.

CO-3: Analysing the various mechanisms for drug targeting and routes for better delivery other than oral and parenteral, like pulmonary etc.

CO-4: Evaluating the prepared dosage forms for their safety, efficacy & zero toxicity by conducting their appropriate testing on instruments, animals, stability studies and comparative studies.

CO-5: Creating best final formulation among different formulations of a drug as per the design of experiment.

Course Content

Unit No: 1 **No. of Hours 12**

Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery

Unit No: 2 **No. of Hours 12**

Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.

Unit No: 3 **No. of Hours 12**

Micro Capsules / Micro Spheres: Types, preparation and evaluation , Monoclonal Antibodies ; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes

Unit No: 4 **No. of Hours 12**

Pulmonary Drug Delivery Systems: Aerosols, propellents, ContainersTypes, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.

Unit No: 5 **No. of Hours 12**

Nucleic acid based therapeutic delivery system: Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic
antisense molecules and aptamers as drugs of future

Learning Experience

The said course delivers an important learning experience for students, equipping them with essential skills in advanced formulation techniques, evaluation & characterization methods. Both during academic and professional career in the pharmaceutical industry. By grasping these areas, students can improve innovative drug delivery systems enhance to enhance drug bioavailability, improved stability and better efficacy, etc. So the students should be able to know the concepts like:-

- Understand the principles behind various drug delivery systems and their preparation.
- Evaluate and characterize different dosage forms using appropriate techniques.
- Select and utilize excipients effectively in formulation development.
- Develop and assess novel drug delivery systems with advanced applications.
- Apply knowledge to real-world scenarios through case studies and emerging technologies.

Reference Books

1. Novel Drug Delivery Systems. **Y W. Chien**
2. Controlled Drug Delivery-Concepts and Advances. **S.P. Vyas and R.K. Khar**
3. Controlled and Novel Drug Delivery. **N.K. Jain**

Suggested Readings

5. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/drug-delivery-system#:~:text=Targeted%20drug%20delivery%20can%20be,%2C%20peptides%2C%20and%20charged%20polymers.
6. https://www.slideshare.net/slideshow/targeted-drug-delivery-systems/23191915
7. https://www.slideshare.net/slideshow/targeted-drug-delivery-system-133811737/133811737
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8275483/
9. https://www.slideshare.net/slideshow/tumour-targeting-and-brain-specific-drug-delivery/249954285

Open Educational Resources (OER)

10. **https://www.slideshare.net/slideshow/tumour-targeting/153093497**
11. https://www.slideshare.net/slideshow/tumor-targeting-drug-delivery-140076137/140076137

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
4	End Term Examination (Written Examination)	180 minutes	75	
		Total	**100**	

MPH 202T	Advanced Biopharmaceutics & Pharmacokinetics	L	T	P	C
Version ___		4	-	-	4
Category of Course	Core Subject				
Total Contact Hours	60 hrs				
Pre-Requisites/ Co-Requisites	Pharmaceutics/Clinical Pharmacokinetics				

Course Perspective

This course provides fundamental concepts about absorption, distribution, metabolism and elimination of drugs when taken through different routes as well as in the form of different dosage forms. This will also update the knowledge among the students about the factors influencing the ADME process while formulating a new dosage form for the drug. The students will get brushing knowhow about the bioavailability and bioequivalence. The concepts of compartmentalization will improvise their technical queries regarding the selection of various biological parameters while designing the final dose and dosing frequency of the specific drug and its drug product.

Course Outcomes

CO-1: Understanding theories, concepts of biopharmaceutics and pharmacokinetics.

CO-2: Appling basic knowledge for necessary for dose calculations and dose adjustments.

CO-3: Analysing the in-vitro and in-vivo data about the absorption, distribution, metabolism and elimination of specific dosage forms to generate correlations.

CO-4: Evaluating the prepared dosage forms for their safety, efficacy & zero toxicity by conducting their appropriate testing on instruments, animals, stability studies and comparative studies.

CO-5: Creating formulation with enhanced bioavailability.

Course Content

Unit No: 1 **Hours 12**

Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal

absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form ,Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form ,Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data.

Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction complex.

Unit No: 2 **Hours 12**

Biopharmaceutics considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing,meeting dissolution requirements,problems of variable control in dissolution testingperformance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability,considerations in the design of a drug product

Unit No: 3 **Hours 12**

Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion, extra-vascular. Multi compartment model:two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of kmax and vmax. Drug interactions: introduction, the effect of protein-binding interactions,the effect of tissue-binding interactions,cytochrome p450-based drug interactions,drug interactions linked to transporters

Unit No: 4 **Hours 12**

Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. Biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods.generic biologics (biosimilar drug products),clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.

Unit No: 5 **Hours 12**

Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.

Learning Experience

The said course delivers an important learning experience for students, equipping them with essential skills in advanced formulation techniques, evaluation & characterization methods. Both during academic and professional career in the pharmaceutical industry. By grasping these areas, students can improve innovative drug delivery systems enhance to enhance drug bioavailability, improved stability and better efficacy, etc. So the students should be able to know the concepts like:-

- Understand the principles behind various drug delivery systems and their preparation.
- Evaluate and characterize different dosage forms using appropriate techniques.
- Select and utilize excipients effectively in formulation development.
- Develop and assess novel drug delivery systems with advanced applications.
- Apply knowledge to real-world scenarios through case studies and emerging technologies.

Reference Books

1. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition, Philadelphia, Lea and Febiger, 1991
2. Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmankar and Sunil B. Jaiswal., VallabPrakashan, Pitampura, Delhi
3. Applied Biopharmaceutics and Pharmacokinetics by Shargel. Land YuABC, 2ndedition, Connecticut Appleton Century Crofts, 1985

Suggested Readings

- **https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/gastrointestinal-absorption#:~:text=Orally%20administered%20drugs%20absorbed%20from,resulting%20in%20a%20decreased%20bioavailability.**
- **https://www.ncbi.nlm.nih.gov/books/NBK557405/**
- **https://www.sciencedirect.com/topics/engineering/pharmacokinetic-model#:~:text=A%20pharmacokinetic%20model%20describes%20the%20movement%20of%20a%20drug%20or,have%20three%20or%20fewer%20compartments.**

Open Educational Resources (OER)

1. https://www.slideshare.net/slideshow/pharmacokinetics-basic-consideration-pharmacokinetic-models/231009074
2. https://www.slideshare.net/slideshow/basic-pharmacokinetics-and-compartment-modelling/84781604

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
4	End Term Examination (Written Examination)	180 minutes	75	
Total			**100**	

MPH 203T	COMPUTER AIDED DRUG DELIVERY	L	T	P	C
Version		**4**	**0**	**0**	**4**
Category of Course	Core				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Applications of computers in pharmacy and Medicinal Chemistry				

Course perspective

This course provides a comprehensive understanding of computational tools and techniques used in designing and optimizing drug delivery systems. It emphasizes theoretical knowledge and demonstration of software and tools relevant to the pharmaceutical industry. By the end of the course, students will be equipped with the skills to utilize computer-aided modelling to enhance the efficacy and precision of drug delivery systems.

Course Outcomes

Upon completion of the course student:

CO-1: Understanding the role of molecular modeling and dynamics in pharmaceutical formulation design.

CO-2: Applying computational modeling techniques for the design of experiments and optimization of drug formulations.

CO-3: Analyzing the parameters with the help of molecular modeling and artificial intelligence (AI) for formulation design.

Course Content

UNIT I **12 hours**

Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modelling in pharmaceutical research and development: Descriptive versus Mechanistic Modelling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modelling

Quality-by-Design In Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.

UNIT II **12 hours**

Computational Modelling Of Drug Disposition: Introduction, Modelling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.

UNITIII **12hours**

Computer-aided formulation development: Concept of 12 optimization, Optimization parameters, Factorial design, Hrs Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, micro-emulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis

UNIT IV **12 hours**

Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical Hrs background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in vitro-in vivo correlation, Biowaiver considerations. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems

UNIT V **12 hours**

Artificial Intelligence, robotics and computational fluid dynamics: General overview, pharmaceutical automation and pharmaceuticals applications, advantages, disadvantages. Current challenges and future directions.

Learning Experiences

The "Computer-Aided Drug Delivery" course offers a dynamic learning experience through a mix of lectures, demonstration-on software training, and case studies. Students will engage in real-world scenarios to understand and apply computational techniques like molecular

modelling and simulation in optimizing drug delivery systems, fostering critical thinking and innovation in pharmaceutical development.

Textbooks

1. Introduction to Biostatistics & Computer Science, By Mr. Y. I. Shah Dr. A. R. Paradkar, Mr. M. G. Dhayagude. NiraliPrakashan.
2. Computer Applications in Pharmaceutical Research and Development, Sean Ekins, 2006, John Wiley & Sons.
3. Computer-Aided Applications in Pharmaceutical Technology, 1st Edition, Jelena Djuris, Woodhead Publishing
4. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.
5. Computer-applications-in-pharmaceutical-research-and-development-2006.

Suggested Readings

Factorial design (https://www.youtube.com/watch?v=edtCSm84rPg&list=TLPQMDcwNzIwMjGFByRpnhI2aA&index=2)

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10
2	Sessional (Written Examination)	60 minutes	15
4	End Term Examination (Written Examination)	180 minutes	75
Total			**100**

MPH 204T	Cosmetic and Cosmoceuticals	L	T	P	C
Version ___	2.0	4	-	-	4
Category of Course					
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Cosmetic				

Course Perspective:

In this course, students will gain a comprehensive understanding of the standards and regulations governing cosmetic products. They will explore the biological factors that influence skin and hair health, enabling them to address common concerns effectively. Students will also learn the foundational principles of product formulation, equipping them with the skills to create safe and effective cosmetic solutions. Ultimately, this knowledge will empower them to navigate the complexities of the cosmetic industry with confidence.

Course Outcomes:

CO-1: Understanding the regulatory framework for cosmetic and Cosmoceuticals products in India.

CO-2: Analysing biological aspects related to skin and hair care issues in cosmetic and Cosmoceuticals.

CO-3: Applying formulation principles to develop effective cosmetic and cosmoceutical products.

CO4-: Evaluating the cosmetic formulations and impact of controversial ingredients in cosmetics and Cosmoceuticals.

Course Content

Unit I:

12 Hour

Cosmetics – Regulatory: Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labelling of cosmetics Regulatory provisions relating to import of cosmetics. Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.

Unit II: Cosmetics - Biological aspects: Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odour. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet,

Unit III: **12 Hours**

Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants –Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste.Soaps and syndetbars.
Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.

Unit IV: **12 Hours**

Design of cosmeceutical products: Sun protection, sunscreens. classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor, dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.

Unit V: **12 Hours**

Herbal Cosmetics: Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.

Text Books

1. Cosmetics - Formulation, Manufacture and quality control, PP.Sharma, Vandama Publications.

Reference Books/Materials

1. Harry's Cosmeticology. 8 edition.

2. Poucher's perfume cosmetics and Soaps,10 edition.

3. Cosmetics -Formulation, Manufacture and quality control, PP.Sharma,4

4. Handbook of cosmetic science and Technology A. O. Barel, M. Paye and H.I. 3rd edition

5. Cosmetic and Toiletries recent suppliers catalogue.

6. CTFA directory.

Suggested Readings

1. https://gyansanchay.csjmu.ac.in/wp-content/uploads/2022/04/Unit-1-1.pdf

2. https://cliniexperts.com/cosmetic-regulatory-affairs/

3.https://cdsco.gov.in/opencms/export/sites/CDSCO_WEB/Pdf-documents/cosmetics/Guidance-Document-on-Registration-and-Import-of-cosmetics-into-India-converted.pdf

Open Educational Resources (OER)

https://www.youtube.com/watch?v=ctD6j_sjM3k

https://www.youtube.com/watch?v=xfWPCNWgHT0

Evaluation Scheme:

Evaluation Scheme:				
S. No.	**Evaluation Component**	**Duration**	**Weightage (%)**	**Date**
1	Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	60 minutes	10	
2	Sessional (Written Examination)	60 minutes	15	
4	End Term Examination (Written Examination)	180 minutes	75	
		Total	**100**	

MPH 205P	Pharmaceutics Practical-II	L	T	P	C
Version ___		-	-	12	6
Category of Course	Core Subject				
Total Contact Hours	60 Hrs				
Pre-Requisites/ Co-Requisites	Pharmaceutics				

Course Perspective This course will enhance the practical skills about formulation development and analysis of various drug delivery systems. Students will learn about different instruments and equipments to be used in these practicals. The students will get knowhow about the various practical concepts, which will help and prepare them for future research project, etc.

Course Outcomes

CO-1: Observing the working of the different instruments like UV, HPLC, tablet punching machine in laboratory to conduct the formulation experiments.

CO-2: Performing experiments by using instruments to identify and quantify the drug and their formulations.

Upon completion of the course the learner will be able to:

Course Content

1. To study the effect of temperature change, non-solvent addition, incompatible polymer addition in microcapsules preparation
2. Preparation and evaluation of Alginate beads.
3. Formulation and evaluation of gelatin /albumin microspheres
4. Formulation and evaluation of liposomes/niosomes.
5. Formulation and evaluation of spherules
6. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
7. Comparison of dissolution of two different marketed products /brands
8. Protein binding studies of a highly protein bound drug & poorly protein bound drug
9. Bioavailability studies of Paracetamol in animals.
10. Pharmacokinetic and IVIVC data analysis by WinnolineR software
11. In vitro cell studies for permeability and metabolism
12. DoE Using Design Expert® Software

13. Formulation data analysis Using Design Expert® Software
14. Quality-by-Design in Pharmaceutical Development
15. Computer Simulations in Pharmacokinetics and Pharmacodynamics
16. Computational Modeling Of Drug Disposition
17. To develop Clinical Data Collection manual
18. To carry out Sensitivity Analysis, and Population Modeling.
19. Development and evaluation of Creams
20. Development and evaluation of Shampoo and Toothpaste base
21. To incorporate herbal and chemical actives to develop products
22. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff

Reference Books

Text books

3. Controlled and Novel Drug Delivery, N.K. Jain, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
4. Controlled Drug Delivery - concepts and advances, S.P. Vyas and R.K. Khar, Vallabh Prakashan, New Delhi, First edition 2002.

Reference books

3. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.

Suggested Readings

1. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4thedition, CBS Publishers, New Delhi, 1997.

Open Educational Resources (OER)

1. **https://www.researchgate.net/publication/8096528_Effect_of_Preparation_Temperature_in_Solvent_Evaporation_Process_on_Eudragit_RS_Microsphere_Properties**
2. **https://ijpsr.com/bft-article/microencapsulation-of-isoniazid-by-temperature-change-method-preparation-and-characterization/**
3. **https://www.researchgate.net/profile/Sheryhan-Farghaly/publication/270106258_Preparation_and_Evaluation_of_Ketoprofen-loaded_Calcium_alginate_beads/links/54a0d94c0cf256bf8bae1ceb/Preparation-and-Evaluation-of-Ketoprofen-loaded-Calcium-alginate-beads.pdf**

4. https://www.researchgate.net/publication/268371749_Formulation_and_evaluation_of_albumin_microspheres_containing_aceclofenac

Evaluation Scheme

	Evaluation Component	Duration	Weightage (%)	Date
1	Sessionals	4 hrs	50	
4	End Term Examination	3 hrs	100	
Total			150	

MPH 206S	Seminar and Assignments	L	T	P	C
Version 1.0		-	-	7	4
Total Contact Hours	105 hrs				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: The seminar promotes profound understanding and critical analysis of core concepts through interactive deliberations and presentations. Students apply theoretical knowledge to real-world scenarios, enhancing their research and communication skills.

Course Outcomes

Upon completion of the course, students will

CO-1: Understand core concepts and theories of the seminar.

CO-2: Appling the seminar content to develop better drug delivery systems.

CO-3: Analyse various perspectives related to the seminar topics.

CO-4: Effectively conduct and present research related to the seminar theme.

CO-5: Demonstrate effective oral and written communication skills.

Evaluation Scheme

Course code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous mode	Sessional Marks		Total	Marks	Duration	
			Marks	Duration				
MPL106S	Seminar / Assignment	-	-	-	-	100	-	100

SEMESTER-III

MRM301T	Research Methodology and Biostatistics	L	T	P	C
Version 2.0		4	0	0	4
Total Contact Hours	60				
Pre-requisites/Exposure	Biostatistics & clinical Regulatory				
Co-requisites	Biostatistics & clinical Regulatory				

Course Perspective

Research Methodology focuses on the principles and procedures for designing, conducting, and analysing research, ensuring scientific rigor and validity. Biostatistics applies statistical methods to biological and health-related data, aiding in the interpretation of experimental results and drawing meaningful conclusions. Together, they provide a foundation for rigorous and reliable research in various fields, particularly in the field of pharmaceutical sciences.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding the significance of ethical considerations in research and articulate the steps involved in the research process.

CO-2: Applying the ability to select appropriate research methods and tools to address specific research questions or hypotheses.

CO-3: Analysing research studies to assess their design, methodology, and findings, identifying strengths and weaknesses in the approaches used.

CO-4: Evaluating the research proposals and existing studies, providing constructive feedback on methodology, data analysis, and interpretation of results.

Course Content

UNIT – I **12 hrs.**

General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques

UNIT – II **12 hrs.**

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxan rank tests, analysis ofvariance, correlation, chi square test), null hypothesis, P values,degree of freedom, interpretation of P values.

UNIT – III **12 hrs.**

Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.

UNIT – IV **12 hrs.**

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V **12 hrs.**

Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.

Learning Experience: Learning Research Methodology equips you with skills to design robust studies and critically evaluate research findings. Mastering Biostatistics enhances your ability to analyse and interpret complex data, revealing insights and guiding decision-making. Together, these disciplines build a strong foundation for conducting and assessing research with scientific accuracy.

Reading of and amazing raw data using statistical software.

Reference Books/Materials

1. Remington"s Pharmaceutical Sciences
2. Theory & Practice of Industrial Pharmacy by Lachman
3. Statistics for business and economics 3rd edition by Vikas books publications
4. Biostatistics & Computer applications by GN Rao and NK Tiwari

5. Sokal, R.R. and Rohlf, F.J. 1987. An Introduction to Biostatistics. W.H. Freeman and Company.
6. Bailey, N.T.J. 1981. Statistical Methods in Biology. English University Press.

Online Reference

1: https://pharmacyinfoline.com/laboratory-animals-cpcsea-guidelines/

2: https://ijcrt.org/papers/IJCRT2106825.pdf

3. https://eduvoice.in/types-research-methodology/

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	10	
2	Sessional Examination (Written Examination)	60Minutes	15	
3	Attendance			
4	End Term Examination (Written Examination)	180 Minutes	75	
Total			**100**	

MPH 302S	Journal club	L	T	P	C
Version 1.0		0	0	1	1
Total Contact Hours	15 Hrs				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Journal club discussions offer a platform to critically evaluate research findings, promoting profound understanding of scientific methodologies and implications. Participants benefit from diverse perspectives, enhancing their ability to assess the validity and impact of studies. This collaborative approach encourages learning of on-going research skills.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding the ability to critically evaluate research methodologies, data interpretation, and study validity, leading to more informed and nuanced scientific discussions.

CO-2: Applying research skills to articulate complex scientific concepts clearly and effectively, both in written and verbal formats, through presentations and group discussions.

CO-3: Analysing current trends and advancements in the field, fostering the ability to apply new knowledge to your own research or professional practice.

Evaluation Scheme

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)			
2	Sessional Examination (Written Examination)		25	
3	Attendance			
4	End Term Examination (Written Examination)			

MPH 303S	Discussion/ Presentation	L	T	P	C
Version 1.0		0	0	7	4
Total Contact Hours					
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Discussions and presentations foster a collaborative environment for scrutinizing research, allowing participants to articulate insights and raise critical questions. They provide an opportunity to clarify complex concepts and debate findings, enhancing collective understanding. This interactive process not only sharpens analytical skills but also hones the ability to communicate scientific ideas effectively.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding research findings, identifying strengths, limitations, and implications through active discussion and presentation.

CO-2: Applying scientific ideas clearly and persuasively, both in oral presentations and written formats, while engaging in constructive dialogue with peers.

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-		
2	Sessional Examination (Written Examination)		50	
3	Attendance			
4	End Term Examination (Written Examination)			

MPH 304P	Research Work	L	T	P	C
Version 1.0		0	0	28	14
Total Contact Hours	-				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Research work comprises scientifically exploring a specific question or problem to create novel facts or understandings. It requires severe methodology, critical analysis, and findings to contribute eloquently to the field.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Develop expertise in designing, conducting, and analysing research using appropriate methodologies, ensuring rigor and reliability in generating valid results.

CO-2: Enhance the ability to critically evaluate research findings and apply them effectively to address practical problems or advance theoretical understanding within the field.

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-		
2	Sessional Examination (Written Examination)			
3	Attendance			
4	End Term Examination (Written Examination)		350	

SEMESTER-IV

MPH 401S	Journal club	L	T	P	C
Version 1.0		0	0	1	1
Total Contact Hours	-				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Journal club discussions offer a platform to critically evaluate research findings, promoting profound understanding of scientific methodologies and implications. Participants benefit from diverse perspectives, enhancing their ability to assess the validity and impact of studies. This collaborative approach encourages learning of on-going research skills.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Understanding the ability to critically evaluate research methodologies, data interpretation, and study validity, leading to more informed and nuanced scientific discussions.

CO2-: Applying research skills to articulate complex scientific concepts clearly and effectively, both in written and verbal formats, through presentations and group discussions.

CO-3: Analysing current trends and advancements in the field, fostering the ability to apply new knowledge to your own research or professional practice.

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-		
2	Sessional Examination (Written Examination)		25	
3	Attendance			
4	End Term Examination (Written Examination)			

MPH 402P	Research Work	L	T	P	C
Version 1.0		0	0	28	14
Total Contact Hours	-				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Research work comprises scientifically exploring a specific question or problem to create novel facts or understandings. It requires severe methodology, critical analysis, and findings to contribute eloquently to the field.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Develop expertise in designing, conducting, and analysing research using appropriate methodologies, ensuring rigor and reliability in generating valid results.

CO-2: Enhance the ability to critically evaluate research findings and apply them effectively to address practical problems or advance theoretical understanding within the field.

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)			
2	Sessional Examination (Written Examination)			
3	Attendance			
4	End Term Examination (Written Examination)		400	

MPH 403S	Discussion/ Presentation	L	T	P	C
Version 1.0		0	0	2	2
Total Contact Hours	-				
Pre-requisites/Exposure	Pharmaceutics				
Co-requisites	Pharmaceutics				

Course Perspective: Discussions and presentations foster a collaborative environment for scrutinizing research, allowing participants to articulate insights and raise critical questions. They provide an opportunity to clarify complex concepts and debate findings, enhancing collective understanding. This interactive process not only sharpens analytical skills but also hones the ability to communicate scientific ideas effectively.

Course Outcomes

Upon completion of the course the learner will be able to:

CO-1: Develop the ability to critically analyse and interpret research findings, identifying strengths, limitations, and implications through active discussion and presentation.

CO-2: Improve the ability to convey complex scientific ideas clearly and persuasively, both in oral presentations and written formats, while engaging in constructive dialogue with peers.

Evaluation Scheme

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-		
2	Sessional Examination (Written Examination)		75	
3	Attendance			
4	End Term Examination (Written Examination)			