Academic Programme Guide

of

Master of Pharmacy

Pharmaceutics

(2 Year Course)

Based on Choice Based Credit System (CBCS) / Elective Course System

w.e.f.
Academic Year: 2024-2025

Approved by the 26th Academic Council vide agenda item AC 26.4a dated 10th August 2024

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Chitkara University
Vision and Mission

Vision	To be a globally recognized organization promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.
Mission	• To carry out the academic processes in accordance with global standards through active teacher-student-industry participation.
	• To promote research, innovation and entrepreneurship in collaboration with industry, research laboratories and academic institutions of global repute.
	• To inculcate high moral, ethical and professional values amongst our students, faculty & staff.
	• To contribute in building skilful society.

Institute Vision and Mission

Vision	To excel as a premiere Centre of Excellence in Pharmaceutical Education, Research, Development & Innovation with Global Interaction.
Mission	• To contribute in building skilful society by preparing competent pharmacist.
	• To prepare globally recognized pharmaceutical professionals who can effectively contribute in new molecule research, formulation, preclinical and clinical growth and regulatory submissions.
	• To prepare efficient leaders providing academic and other interactions in various stages of pharmaceutical operations, marketing and distribution.
	• To provide applied, industry relevant pharmaceutical education relevant globally.
	• To enhance and impart innovation, entrepreneurship, and social skills.

1. General Information

The academic program Guide is a comprehensive document detailing course scheme, associated credits per course and the distribution of each course in lecture, tutorial and Practical hours. It also details the eligibility criteria for admission, for award of degree, the assessment and evaluation procedures along with a glimpse of the pedagogical aspects of the programs. This Guide is to be used in association with the Academic Regulations of the University to make a complete rule set. The course schemes given in this document are approved by respective Board of Studies in line with regulations of Pharmacy council of India and the Academic Council of Chitkara University, Punjab.

Programme Objectives:

Objective of M. Pharm. Pharmaceutics programme is to develop professionals who can play a key intermediary role in coordinating the research & development, filing of regulatory applications, production and marketing activities in a pharmaceuticals organization.

2. Programme Outcomes (PO's) M. Pharm (Pharmaceutics)

The proposed outcomes for the M. Pharmacy Pharmaceutics program focus on the ability of a graduating student to develop himself/herself as a competent professional with appropriate scientific innovative skills in drug discovery and development, Pharma operations management skills.

The student outcomes for the M. Pharmacy Pharmaceutics Program are the following:

PO1: To develop appropriate knowledge of various pharmaceutical and physicochemical properties of the different pharmaceutical ingredients (API and Excipients) and the factors influencing them for pharmaceutical dosage form design. To enable the students to learn about different packaging materials used in pharmaceutical industry and the factors governing their use.

PO2: To acquire excellence in the basic unit operations in pharmaceutical industry for large and small scale drug product development in pharmaceutical industry.

PO3: To acquire skills for the development of various pharmaceutical dosages and entrepreneurship skills.

PO4: The basic information on various dosage forms like tablets and capsules (solid dosage forms) and liquid dosage forms, their formulation and quality control serves as an important perquisite for dosage form design. Preformulation studies, Pilot scale up and large-scale development of dosage form are a major part of process development.

PO5: The course helps the students to acquire the concepts of validation, Quality assurance, regulatory affairs in pharmaceutical industry and its relevance; stability testing of various dosage forms.

PO6: To acquire biopharmaceutical and pharmacokinetic skills through different compartment models, multiple dosage regimens, non-linear pharmacokinetics, and

assessment of bioavailability and bio-equivalence. The knowledge of biopharmaceutical aspects enables the students to visualize the effect of various pharmacokinetic (ADME) parameters on the biological activity (in vivo efficacy) of the drug.

PO7: To inculcate the ethical responsibilities and help maintaining professional working atmosphere while working in laboratories which are a part of regulatory practice.

PO8: Designed course will be able to assist students to write and comprehend critical reviews of scientific articles and peer evaluation; manage information effectively by competently undertaking research tasks and train students in using suitable statistical methods for interpretation of results and use a full range of learning resources in making literature searches via the library, PubMed, Science direct, Sci hub and in using on-line teaching material, word processors, spreadsheets, and databases.

PO9: Self-directed and Life-long Learning: To motivate the students to work in team for better outcomes and simultaneously to develop competence, confidence and analytical approach to work effectively with in a group or individually.

PO10: To help students in developing communication skills to effectively communicate their ideas and information; also to demonstrate problem solving skills by data interpretation and the designing of quality experimental protocols.

PO11: To acquire research aptitude: to acquire advanced skills in development, conduct & outcomes of research projects in optimized formulation development & standardization

Mission:

M1: To carry out the academic processes in accordance with global standards through active teacher-student-industry participation.

M2: To promote research, innovation and entrepreneurship in collaboration with industry, research laboratories and academic institutions of global repute.

M3: To inculcate high moral, ethical and professional values amongst our students, faculty & staff.

M4: To contribute in building skilful society by preparing competent pharmacist.

M5: To prepare globally recognized pharmaceutical professional who can effectively contribute in new molecule research, formulation, preclinical and clinical growth and regulatory submissions.

M6: To become efficient leaders providing academic and other interactions in various stages of pharmaceutical operations, marketing and distribution.

Table 1: Mapping of POs with University Mission

PO No.	PO Statement	Mission Statement	Vision Statement
PO1	To develop appropriate knowledge of various pharmaceutical and physicochemical properties of the different pharmaceutical ingredients (API and Excipients) and the factors influencing them for pharmaceutical dosage form design. To enable the students to learn about different packaging materials used in pharmaceutical industry and the factors governing their use.	M1, M4	To be a globally recognized organization promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.
PO2	To acquire excellence in the basic unit operations in pharmaceutical industry for large and small scale drug product development in pharmaceutical industry.	M2, M4, M5	
PO3	To acquire skills for the development of various pharmaceutical dosages and entrepreneurship skills.	M4, M5	
PO4	The basic information on various dosage forms like tablets and capsules (solid dosage forms) and liquid dosage forms, their formulation and quality control serves as an important perquisite for dosage form design. Preformulation studies, Pilot scale up and large scale development of dosage form is a major part of process development.	M4, M5	
PO5	The course helps the students to acquire the concepts of validation, Quality assurance, regulatory affairs in pharmaceutical industry and its relevance; stability testing of various dosage forms.	M4, M5, M6	
PO6	To acquire biopharmaceutical and pharmacokinetic skills through different compartment models, multiple dosage regimens, non-linear pharmacokinetics, and assessment of bioavailability and bio-equivalence. The knowledge of biopharmaceutical aspects enables the students to visualize the effect of various pharmacokinetic (ADME) parameters on the biological activity (in vivo efficacy) of the drug.	M4	
PO7	To inculcate the ethical responsibilities and help maintaining professional working atmosphere while working in laboratories which are a part of regulatory practice.	M2, M3	

PO8	Designed course will be able to assist students to write and comprehend critical reviews of scientific articles and peer evaluation; manage information effectively by competently undertaking research tasks and train students in using suitable statistical methods for interpretation of results and use a full range of learning resources in making literature searches via the library, PubMed, Science direct, Sci hub and in using on-line teaching material, word processors, spreadsheets, and databases.	M1, M2, M4	
PO9	Self-directed and Life-long Learning: To motivate the students to work in team for better outcomes and simultaneously to develop competence, confidence and analytical approach to work effectively with in a group or individually.	M2, M4, M6	
PO10	To help students in developing communication skills to effectively communicate their ideas and information; also to demonstrate problem solving skills by data interpretation and the designing of quality experimental protocols.	M1, M2	
PO11	To acquire research aptitude: to acquire advanced skills in development, conduct & outcomes of research projects in optimized formulation development & standardization	M1, M2, M4, M5	

The graduating students are prepared for demonstrating knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative sciences, health policy and legal issues in the practice of pharmacy. Each year, experts from different universities and pharmaceutical industry across the globe visits Chitkara College of Pharmacy, Chitkara University, Punjab to provide international exposure to students.
Aiming at developing student's personality through community service, NSS activities are offered to students to in still the idea of social welfare and to provide service to society without bias. To enrich student's interpersonal skills, variety of extracurricular activities have been inculcated in the course curriculum in the form of national level technical and cultural festivals such as Pharma-fest, International Pharmacist Day and National Pharmacy Week respectively on a yearly basis under the student club CHAMP (Chitkara House of Aspirants and Multitalented Pharmacists). A vital role is played by CHAMP for overall progress & grooming of the student through organizing industrial visits, workshops, debate, technical quizzes and research project paper presentation competitions in events like Pharma tech Trends, Pharmacy Practice Module and international conferences. The students are motivated to participate or organize such events. These value-added activities have been designed taken into account various Programme Objectives (POs) such as PO3, PO8, PO9, PO10 and PO11.

The main aim of service training with focus on good health and well-being is accomplished by delivering sport-related events, NSS and NCC. The programme also aims to develop professional with awareness of international standards as of global health has transcended beyond the idea of confining the pharmacist's work to a specific geographical location and broadened it to the global level. PO1, PO2, PO3, PO4, PO5, PO6 and PO7 promotes development of skills in graduates for pharmaceutical formulations, analytical experts, regulatory and dispensing skills for good practices in global health system.

Pharmacists have the opportunity to play an important role in both public health and global health. In particular, pharmacists can look at the varied global health practices established in medicine and use this as a framework to understand the potential role of the pharmacist within global health practice and program delivery, research, and policy. According to the Consortium of Universities for Global Health, global health should refer to the scope of a wider problem rather than a geographical location. The scope of work of pharmacists in diverse settings faces challenges of global health such as self-care & self-medication, management of diseases through medication therapy management, resistance to existing drugs or recreational drugs being abused, medicines supplied through unregistered online pharmacies, online advertising of prescription drugs, direct-to-consumer websites and the distribution of substandard & spurious, falsely-labeled, falsified or counterfeit medicines. PEOs and POs are designed and oriented to meet the mission of university in professional ethics. The PEOs ensure that the graduating students are well equipped with strong fundamental concepts and high technical competence in pharmaceutical sciences who shall be able to use the tools in pharmaceutical arena for success. PEOs and POs helps to develop a sense of teamwork and awareness amongst students towards the importance of interdisciplinary approach for developing competence in solving complex problems in the area of Pharmaceutical Sciences. The POs helps to train the students to contribute towards health care system and encourage the students to participate in life-long learning process for a highly productive career, and to relate the concepts of Pharmaceutical Sciences towards serving the betterment of the society.

3. Eligibility for Admission

3.1 A. Pass in the following examinations

B. Pharm Degree examination of an Indian university established by law in India from an institution approved by Pharmacy Council of India and has scored not less than 55 % of the maximum marks (aggregate of 4 years of B. Pharm.). Every student, selected for admission to post graduate pharmacy program in any PCI approved institution should have obtained registration with the State Pharmacy Council or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.

Note: It is mandatory to submit a migration certificate obtained from the respective university where the candidate had passed his/her qualifying degree (B. Pharm.)

3.2 Migration/Credit Transfer Policy

The following procedures will be followed for credit transfer for student under migration, studied in other Universities in India and Abroad:

"The credits earned by the student from the other universities in India or abroad shall be transferred as such. The Degree shall only be awarded to candidate subject to the condition that student earned

the minimum no. of credit defined by Academic Regulation/APG of the Programme run by the Chitkara University." In case a student undergoes international exchange programme or internship for 1 semester/ 1 year, then the courses, credits and grades earned by the student in abroad during that period should be reflected on the grade card issued by the Chitkara University. The courses will be marked as (*) on the grade card/transcript. The description of the (*) will be "credits and grades as adopted university/institute name . . . . . during international exchange programme. The minimum credit points required for the award of M. Pharm. degree is 100. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 105 credit points. If consolidated credits are less than 100 credits, then the student has to earn extra credits to attain minimum credits requirement for M. Pharmacy degree. The instructions regarding this will be informed to the students by the department from time to time.

4. Programme Duration

The program of study for M. Pharmacy 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.

4.1. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

4.2. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from the month of December/January to May/June in every calendar year.

5. Pedagogical Aspects

Each course will be taught for 52-65 hrs. Everyday there will be three to four lecture sessions of three to four courses of 1 hours each and twelve hour practical divided into two days (pre-lunch and post-lunch). Activity and project hours will be other than these lecture hours depending upon the subject and relevance of the project. At least one week prior to the commencement of a particular course, the concerned faculty member or the course coordinator will circulate among the students the following pertaining to the course:

a) The course outlines containing the syllabus along with text books, reference books and other study material.
b) Day-to-day schedule to be followed-detailing the pace, coverage, prior reading assignments, case studies, home assignments to be perused by the students etc.
c) Various components of evaluation, such as quizzes (announced or unannounced), assignment, open book test, field work, group discussion, seminar, assignments, tests/examinations, class participation, mid-term and end term grading with relative weightage etc.
d) Other matters found desirable and relevant.

6. **Apprenticeship/Internship embedded degree programs (AEDP)**
The apprenticeship or internship is optional for M. Pharm students during their research work in Semester III & IV. The primary aim of the internship is to provide hands-on experience in a real-world setting. The internship is typically conducted in approved pharmacy institutions, hospitals, or pharmaceutical industries, where students can apply their academic knowledge to practical scenarios. The duration of the internship is usually specified by the university or institution in alignment with PCI guidelines.

7. Programme structure
As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, practical classes, seminars, assignments, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week/per activity.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses
Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having four lectures per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2. The contact hours of seminars, assignments and research work shall be treated as that of practical courses for the purpose of calculating credits. i.e., the contact hours shall be multiplied by 1/2. Similarly, the contact hours of journal club, research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1.

7.2. Minimum credit requirements
The minimum credit points required for the award of M. Pharm. degree is 100. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 105 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 as shown in Table 7. 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.

7.3. Academic work
A regular record of attendance both in Theory, Practical, Seminar, Assignment, Journal club, Discussion with the supervisor, Research work presentation and Dissertation shall be maintained by the department / teaching staff of respective courses.

7.4. Course of study

The specialisation in M. Pharm Pharmaceutics program code is MPH. The course of study for M. Pharm Pharmaceutics shall include Semester wise Theory & Practical as given **in Table 2 and 3**. The number of hours to be devoted to each theory and practical course in any semester shall not be less than that shown in **Table 4 to5.**

Table – 2: Course of study for M. Pharm. (Pharmaceutics)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPH101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH102T	Drug Delivery System	4	4	4	100
MPH103T	Modern Pharmaceutics	4	4	4	100
MPH104T	Regulatory Affair	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
MPH106S	Seminar/Assignment	7	4	7	100
	Total	**35**	**26**	**35**	**650**
Semester II					
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4	4	100
MPH203T	Computer Aided Drug Delivery System	4	4	4	100
MPH204T	Cosmetic and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical I	12	6	12	150
MPH206S	Seminar/Assignment	7	4	7	100
DM 101	Disaster Management	3	3	3	50
	Total	**38**	**29**	**38**	**700**

Table – 3: Course of study for M. Pharm. III Semester (Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
MPR 302J	Journal club	1	1
MPR 302P	Discussion / Presentation (Proposal Presentation)	2	2
MPR302R	Research Work	28	14
HR 101	Human Values and Professional Ethics	2	2
Total		**37**	**23**

* Non University Exam

Table – 4: Course of study for M. Pharm. IV Semester

MPR 401J	Journal Club	1	1
MPR 401R	Research Work and Colloquium	31	16
MPR 401D	Discussion/ Final Presentation	3	3
MPR401C	Co-Curricular Activities	--	7*
Total		**35**	**20**

Table – 5: Semester wise credits distribution

	Semester		Credit Points
	I		26
	II		29
	III		23
	IV		20
Co-curricular Activities			Minimum=02
(Attending Conference, Scientific Presentations and			Maximum=07*
Total Credit Points			Maximum=105*

*Credit Points for Co-curricular Activities

Table – 6: Guidelines for Awarding Credit Points for Co-curricular Activities

Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/Training Programs (related to the specialization of the student)	01
Participation in international Level Seminar/Conference/Workshop/Symposium/Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science)	02
Note: International Conference: Held Outside India International Journal: The Editorial Board Outside India	

* The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

7.5 Program Committee

The M. Pharm. programme shall have a Programme Committee constituted by the Head of the institution in consultation with all the Heads of the departments.
The composition of the Programme Committee shall be as follows:
A teacher at the cadre of Professor shall be the Chairperson; One Teacher from each M. Pharm specialization and four student representatives (two from each academic year), nominated by the Head of the institution.

7.5.1 Duties of the Programme Committee:

Periodically reviewing the progress of the classes.

Discussing the problems concerning curriculum, syllabus and the conduct of classes.
Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.
Communicating its recommendation to the Head of the institution on academic matters.
The Programme Committee shall meet at least twice in a semester preferably at the end of each sessional exam and before the end semester exam.

8. **Assessment & Evaluation**

The schemes for internal assessment and end semester examinations are given in Table 7 and 8.

8.1.End semester examination

Table – 7: Scheme for internal assessment and End term examination (Sem I & II)

Course Code	Course	Internal Assessment				End Semester Exams		Total
		Continuous Mode	Sessional Exams		Total	Marks	Duration	Marks
			Marks	Duration				
SEMESTER I								
MPH101T	Moder Pharmaceutical Analytical Techniques	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH102T	Drug Delivery System	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH103T	Modern Pharmaceutics	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH104T	Regulatory Affair	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH105P	Pharmaceutics Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPH 106S	Seminar/Assignment	-	-	-	-	-	-	100
Total								**650**
SEMESTER II								
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH202T	Pharmacotherapeutics II Advanced Biopharmaceutics & Pharmacokinetics	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH203T	Computer Aided Drug Delivery	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH204T	Cosmetic and Cosmeceuticals	10	15	1.5 Hrs	25	75	3 Hrs	100
MPH205P	Pharmaceutics Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPH 206S	Seminar/Assignment	-	-	-	-	-	-	100
DM 101	Disaster Management	05	10	1 Hr	15	35	1.5 Hrs	50
Total								**700**

Table – 8: Scheme for internal assessment and End term examination (semester III & IV)

Course Code	Course	Internal Assessment				End Semester Exams		Total
		Continuous Mode	Sessional Exams		Total	Marks	Duration	Marks
			Marks	Duration				
SEMESTER III								
MRM301T	Research Methodology and Biostatistics*	10	15	1.5 Hrs	25	75	3 Hrs	100
MPR 302J	Journal club	-	-	-	25	-	-	25
MPR 302 P	Discussion / Presentation (Proposal Presentation)	-	-	-	50	-	-	50
MPR 302R	Research work*	-	-	-	-	350	1 Hr	350
HR 101	Human Values and Professional Ethics	05	10	1 Hr	15	35	1.5 Hrs	50
							Total	**575**
SEMESTER IV								
MPR 401J	Journal club	-	-	-	25	-	-	25
MPR 401D	Discussion / Final Presentation	-	-	-	75	-	-	75
MPR 401R	Research Work and Colloquium	-	-	-	-	400	1 Hr	400
							Total	**500**

*Non-University Examination

8.2 Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table – 9: Scheme for awarding internal assessment: Continuous mode

Theory	
Criteria	**Maximum Marks**
Attendance (Refer Table 9)	8
Student – Teacher interaction	2
Total	**10**
Practical	
Attendance (Refer Table 9)	10
Based on Practical Records, Regular viva voce, etc.	10
Total	**20**

Table – 10: Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	8	10
90 – 94	6	7.5
85 – 89	4	5
80 – 84	2	2.5
Less than 80	0	0

9. Rules for Attendance

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

The End Semester Examinations for each theory and practical course through semesters I to IV shall be conducted by the respective university except for the subject with asterix symbol (*) in **Table 7**and **8** for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

10. Promotion & Award of grades

The Pharmacy Council of India (PCI) has established guidelines to ensure uniformity in the promotion and grading of M. Pharm students across PCI-approved institutions. These guidelines emphasize the importance of internal assessments, which are mandatory and contribute significantly to the final grades. Assessments include both formative (continuous evaluation) and summative (end-semester exams) components, aligned with the PCI syllabus. To be promoted to the next semester, students must secure a minimum of 50% marks in both internal assessments and end-semester examinations. Those failing to meet this criterion must reappear for supplementary exams conducted by their institution, with all subjects required to be cleared within the stipulated time frame outlined by PCI regulations. The grading system follows a credit-based semester system (CBSS), awarding grades from "O" (Outstanding) for scores 90% and above to "F" (Fail) for scores below 50%, with students needing at least a "B" grade (50%-59%) to pass. Additionally, students must maintain a minimum of 75% attendance in theory and practical sessions, with exceptions granted only under exceptional circumstances like medical emergencies, subject to academic council approval. M. Pharm programs also require students to undertake research projects or dissertations in their final year, evaluated through internal assessments by supervisors and external viva voce examinations conducted by PCI-appointed examiners, with significant weightage given to project work in determining final grades. Students who fail any subject are allowed supplementary examinations, with a maximum number of attempts specified by PCI guidelines, typically within twice the duration of the program. Migration between PCI-approved institutions is permitted only under exceptional circumstances and requires fulfilment of academic requirements at the current institution along with approvals from both institutions involved. These guidelines ensure standardization in academic progression while maintaining rigorous evaluation standards for postgraduate pharmacy education.

11. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However, his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

12. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the sessional exam component of the internal assessment. The re-conduct of the sessional exam shall be completed before the commencement of next end semester theory examinations.

13. Re-examination of end semester examinations

Re-examination of end semester examination shall be conducted as per the schedule given in **Table 11.** The exact dates of examinations shall be notified from time to time.

Table – 11: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I and III	November / December	May / June
II and IV	May / June	November / December

Question paper pattern for end semester theory examinations
For 75 marks paper

I. Short Answer Questions (3 out of 4)	= 5x3 = 15
II. Long Answers (Answer 6 out of 7)	= 6x10 = 60
Total	= 75 marks

Question paper pattern for end semester practical examinations

I. Synopsis	= 10
II. Major Experiments	= 35
III. Minor Experimentation	= 25
IV. Viva voce + File	= 30
Total	= 100 marks

14. Allowed to keep terms (ATKT)

The Pharmacy Council of India (PCI) has reiterated its guidelines regarding the "allowed to keep terms" policy for pharmacy students. This policy is crucial for ensuring that students maintain the necessary academic standards to progress through their respective programs. According to the latest updates, institutions must adhere strictly to the Education Regulations set forth by the PCI, which include maintaining adequate faculty qualifications, infrastructure, and equipment.

Students are generally allowed to keep terms if they meet specific criteria, such as maintaining a minimum attendance percentage and achieving passing marks in internal assessments. Institutions are responsible for monitoring these criteria closely and must report any non-compliance to the PCI.

Additionally, the PCI has emphasized that institutions must apply through the DIGI-PHARMed portal for any approvals related to course continuations or admissions, ensuring that all processes are transparent and standardized. Institutions failing to comply with these guidelines risk not being included in the approved list for future admissions, which could lead to a "No Admission Year" scenario for them.

To summarize, adherence to PCI regulations is essential for pharmacy institutions and students alike, ensuring that educational standards are upheld and that students are given fair opportunities to progress in their studies.

15. Grading System

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.

15.1. Grading of Performances

15.1.1 Letter grades and grade points allocations

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in **Table 12.**

Table – 12: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	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

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

16. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C1, C2, C3 and C4 and the student's grade points in these courses are G1, G2, G3 and G4, respectively, and then students' SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4}{C_1 + C_2 + C_3 + C_4}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO}}{C_1 + C_2 + C_3 + C_4}$$

17. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the IV semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all IV semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s)

the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4}{C_1 + C_2 + C_3 + C_4}$$

where C_1, C_2, C_3,.... is the total number of credits for semester I,II,III,…. and S_1,S_2, S_3,...is the SGPA of semester I,II,III,…. .

18. Declaration of class

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

19. Project work

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.

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 given below.

Evaluation of Dissertation Book:

Objective(s) of the work done	50	Marks
Methodology adopted	150	Marks
Results and Discussions	250	Marks
Conclusions and Outcomes	50	Marks
Total	**500**	**Marks**

Evaluation of Presentation:

Presentation of work	100	Marks
Communication skills	50	Marks
Question and answer skills	100	Marks
Total	**250**	**Marks**

20. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the M.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the M. Pharm program in minimum prescribed number of years, (two years) for the award of Ranks.

21. Award of degree Candidates

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

22. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

23. Revaluation / Retotalling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for retotalling by paying prescribed fee.

24. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

25. Promotion and Registration

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

26. Provision of Grace-Marks

The following rule for the award of grace marks to the students was approved by the Academic Council:
The University shall award grace-marks as per following:
"One percent of the total marks of theory examination of all the semesters may be given for improving the division of a candidate. Grace marks given to a candidate in semester examination may be deducted from total grace marks to be given for improvement of the division."

A maximum of One percent of the total marks of theory examination as grace marks at the end of the each semester/year, provided that a student secures a minimum of 15% marks in the respective subject/s of the End Semester/yearly Examination.

OR

The remainder or part there of the 1% grace marks of first semester/year plus 1 percent grace-marks of second year, provided that a student secures a minimum of 15% marks in the respective subject/s of the End Semester Examination, similarly for next semesters/years.

For internal Examination:

Carry forward of marks in case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However, his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

Note: Grade AB should be considered as failed and treated as one head for deciding ATKT. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

27. Placement opportunities:

1. R&D – drug delivery system innovation, stability studies, bioavailability enhancement.
2. Production/Manufacturing – large-scale formulation manufacturing in plants.
3. Quality Control (QC) – testing raw materials, intermediates, and final products.
4. Quality Assurance (QA) – documentation, audits, GMP compliance.
5. Regulatory Affairs – preparing dossiers, handling approvals (USFDA, EMA, CDSCO, etc.).
6. Clinical Research/Pharmacovigilance – trials, safety reporting, and medical writing.

28. Program Overview: M. Pharmacy (Pharmaceutics)

The Program consists of subjects under the following categories:

Table 13: Program Scheme: **M. Pharmacy (Pharmaceutics)**

S. No.	Course Name	Course Code	Level	Category (Type of Course)	Credits (Course wise)	Hours per Week			Marks Distribution			Total Credits (Semester wise)
						L	T	P	I	E	TL	
Year 1 Sem 1												
1.	**Modern Pharmaceutical Analytical Techniques**	MPH 101T	500-599	DC	4	4			25	75	100	**26**
2.	**Drug Delivery System**	MPH102T	500-599	DC	4	4			25	75	100	
3.	**Modern Pharmaceutics**	MPH103T	500-599	DC	4	4			25	75	100	
4.	**Regulatory Affair**	MPH104T	500-599	DC	4	4			25	75	100	
5.	**Pharmaceutics Practical I**	MPH105P	500-599	DC	6			12	50	100	150	
6.	**Seminar /Assignment**	MPH 106S	500-599	DC	4	7			100		100	
Year 1 Sem 2												
7.	**Molecular Pharmaceutics(Nano Tech and Targeted DDS)**	MPH201T	500-599	DC	4	4			25	75	100	**29**
8.	**Advanced Biopharmaceutics & Pharmacokinetics**	MPH202T	500-599	DC	4	4			25	75	100	
9.	**Computer Aided Drug Delivery System**	MPH203T	500-599	DC	4	4			25	75	100	
10.	**Cosmetic and**	MPH204	500-	DC	4	4			25	75	100	

	Cosmeceuticals	T	599									
11.	**Pharmaceutics Practical I**	MPH205 P	500-599	DC	6			12	50	100	150	
12.	**Seminar/Assignment**	MPH 206S	500-599	DC	4	7			100		100	
13.	**Disaster Management**	DM 101	500-599	UNI	3	3			15	35	50	
Year 2 Sem 3												
	Research Methodology and Biostatistics*	MRM 301T	500-599	DC	4	4			25	75	100	**23**
	Journal club	MPR 302J	500-599	DC	1	1			25		25	
	Discussion / Presentation (Proposal Presentation)	MPR 302P	500-599	DC	2	2			50		50	
	Research Work	MPR302 R	500-599	DC	14	28				350	350	
	Human Values and Professional Ethics	HR 101	500-599	UNI	2	2			15	35	50	
Year 2 Sem 4												
	Journal Club	MPR 401J	500-599	DC	1	1			25		25	
	Research Work & Colloquium	MPR 401R	500-599	DC	16	31				400	400	**20**
	Discussion/ Final Presentation	MPR 401D	500-599	DC	3	3			75		75	

1st SEMESTER

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPH 101T)

SCOPE

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

OBJECTIVES

After completion of course student is able to know, Chemicals and Excipients. The analysis of various drugs in single and combination dosage forms Theoretical and practical skills of the instruments.

COURSE OUTCOMES

CO 01: Develop the basic theoretical education of the instrumentation techniques available.

CO 02: Compare and contrast the various method of analysis and their outcomes

CO 03: Demonstrate Practical skills for the analysis of drugs and excipients using various instrumentation techniques.

CO 04: Interpret analytical data, prepare analytical reports, and communicate results in a clear and concise manner.

CO 05: Understand the ethical considerations and professional conduct in pharmaceutical analytical research.

THEORY **60 hrs**

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

IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy.

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

Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and applications. (11hrs)

2. 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. (11hrs)

3. 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 quadrupole and time of flight, mass fragmentation and its rules, meta stable ions, isotropic peaks and applications of mass spectroscopy. (11hrs)

4. 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. (11hrs)

5. 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) Isoelectric focusing.

X ray crystallography : production of X rays , different X ray diffraction, diffraction methods, Bragg's law, Rotating crystal technique , X ray powder technique, types of crystals and applications of X- ray diffraction. (11hrs)

6. Immunological assays: RIA (Radio immuno assay), ELISA, Bioluminescence assays. (5hrs)

REFERENCES

- Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
- Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
- Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
- Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
- Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
- Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
- Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

DRUG DELIVERY SYSTEMS (MPH 102T)

SCOPE

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

OBJECTIVES

Upon completion of the course, student shall be able to understand. The various approaches for development of novel drug delivery systems. The criteria for selection of drugs and polymers for the development of delivering system. The formulation and evaluation of Novel drug delivery systems.

COURSE OUTCOMES

CO 1: Understand the basic fundamentals regarding the anatomy and physiology of specific organ (skin, eye, buccal cavity, GIT) which we help in designing of sustained and controlled drug delivery for various routes.
CO 2: Assess the approaches for the design of various drug delivery systems
CO 3: Select drug and polymers for the specific drug delivery system.
CO 4: Obtain learning opportunities to design various drug delivery systems and their further evaluation.
CO 5: Understand latest drug delivery systems and critically assess to develop new formulations

THEORY **(60 hrs)**

1. **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 and Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy. (10 hrs)
2. **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. (10hrs)
3. **Gastro retentive drug delivery systems:** Principle, concepts, advantages and disadvantages, modulation of GI transit time a 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. (10hrs)
4. **Occular drug delivery systems:** Barriers of drug permeation, methods to overcome barriers.
5. **Transdermal Drug Delivery Systems:** Structure of skin and barriers, Penetration Enhancers, Transdermal drug delivery systems, Formulation and evaluation. (10hrs)
6. **Protein and Peptide Delivery:** Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules. (8hrs)
7. **Vaccine delivery systems:** Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines. (6hrs)

REFERENCES

➢ Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
➢ Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.

➢ Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York! Chichester/Weinheim
➢ N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
➢ S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

JOURNALS

➢ Indian Journal of Pharmaceutical Sciences (IPA)
➢ Indian drugs (IDMA)
➢ Journal of controlled release (Elsevier Sciences) desirable
➢ Drug Development and Industrial Pharmacy (Marcel & Decker) desirable

MODERN PHARMACEUTICS (MPH 103T)

SCOPE

Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.

OBJECTIVES

Upon completion of the course, student shall be able to understand. The elements of preformulation studies. The Active Pharmaceutical Ingredients and Generic drug Product development Industrial Management and GMP Considerations. Optimization Techniques & Pilot Plant Scale Up Techniques Stability Testing, sterilization process & packaging of dosage forms.

COURSE OUTCOMES

CO 01: Understand the concept and applications of preformulation studies in pharmaceutical product development
CO 02: Recognize theories of pharmaceutical dispersions and formulation/evaluation of parenterals
CO 03: Critically assess and implement the concepts of pharmaceutical validation and optimization
CO 04: Discern the applications and operational significance of current good manufacturing guidelines
CO 05: Understand of tablet compression, diffusion/dissolution processes and statistical techniques in pharmaceutical product development

THEORY **(60hrs)**

Preformation Concepts – Drug Excipients interactions different 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.

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.

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

2. **cGMP & Industrial Management:** Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments 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.
3. **Compression and compaction:** Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles. Solubility.
4. **Study of consolidation parameters** Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckel plots, Similarity factors – f2 and f1, Higuchi and Peppas plot,

Linearity Concept of significance, Standard deviation , Chi square test, students T-test , ANOVA test.

REFERENCES

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

REGULATORY AFFAIRS (MPH 104T)

SCOPE

Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA.

- To know the approval process
- To know the chemistry, manufacturing controls and their regulatory importance
- To learn the documentation requirements for To learn the importance

OBJECTIVES:

- Upon completion of the course, it is expected that the students will be able to understand The Concepts of innovator and generic drugs, drug development process.
- The Regulatory guidance's and guidelines for filing and approval process.
- Preparation of Dossiers and their submission to regulatory agencies in different countries.
- Post approval regulatory requirements for actives and drug products Submission of global documents in CTD/ eCTD formats.
- Clinical trials requirements for approvals for conducting clinical trials Pharmacovigilence and process of monitoring in clinical trials.

COURSE OUTCOMES

CO 1: Understand the documentation and guidelines pertaining to pharmaceutical industries
CO 2: Demonste the regiatration of IND, NDA,ANDA, medical devices application and approval processes
CO 3: Assess and compare drug approval, regulatory requirements, structure, functioning of EU, MHRA, TGA, ROW countries
CO 4: Discern the objective, scope, general principles of ICH Q,S,E,M guidelines
CO 5: Analyse the overview, contents and components of GCP guidelines and pharmacovigilance system

THEORY **(60hrs)**

1. **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.

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

2. **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. (12hrs)
3. **Non clinical drug development:** Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB). (12hrs)

4. 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. (12hrs)

REFERENCES

- Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer , Marcel Dekker series, Vol.143
- 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.
- New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD,5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
- Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.
- FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.
- Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A.Rozovsky and Rodney K. Adams
- www.ich.org/
- www.fda.gov/
- europa.eu/index_en.htm
- https://www.tga.gov.au/tga-basics

PHARMACEUTICS PRACTICALS – I (MPH 105P)

COURSE OUTCOMES

CO 01: Obtain learning opportunities for the understanding of theoretical and practical knowledge of the instrumentation techniques available in labs

CO 02: Demonstrate the different aspects of separation for multi components.

CO 03: Analyze different drugs and excipients using various instrumentation techniques and their application in industries.

CO 04: Understand various CR/SR formuation and evaluation approaches.

CO 04: Learn the various documentation required for reporting the observations for research. Analysis of pharmacopoeial compounds and their formulations by UV Vis spectrophotometer.

1. Simultaneous estimation of multi component containing formulations by UV spectrophotometry.
2. Experiments based on HPLC.
3. Experiments based on Gas Chromatography.
4. Estimation of riboflavin/quinine sulphate by fluorimetry.
5. Estimation of sodium/potassium by flame photometry.
6. To perform In-vitro dissolution profile of CR/ SR marketed formulation.
7. Formulation and evaluation of sustained release matrix tablets.
8. Formulation and evaluation osmotically controlled DDS.
9. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS.
10. Formulation and evaluation of Muco adhesive tablets.
11. Formulation and evaluation of trans dermal patches.
12. To carry out preformulation studies of tablets.
13. To study the effect of compressional force on tablets disintegration time.
14. To study Micromeritic properties of powders and granulation.
15. To study the effect of particle size on dissolution of a tablet.
16. To study the effect of binders on dissolution of a tablet.
17. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.

M. PHARMACY PHARMACEUTICS (MPH) 2nd SEMESTER

MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY &TARGETED DDS) (NTDS) (MPH 201T)

SCOPE

This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

OBJECTIVES

Upon completion of the course student shall be able to understand The various approaches for development of novel drug delivery systems. The criteria for selection of drugs and polymers for the development of NTDS. The formulation and evaluation of novel drug delivery systems.

COURSE OUTCOMES

CO 01: Understand the concept and applications of brain and tumor targeted drug delivery systems
CO 02: Investigate the preparation, evaluation, applications of nanoparticles, liposomes,niosomes,aquasomes, phytosomes and electrosomes
CO 03: Conceptualy understand the developmen, characterization and therapeutic applications of monoclonal antibodies and microspheres
CO 04: Assess of preparation methods, QC testing procedures and applications of aerosols and intranasal drug delivery systems
CO 05: Demonstrate the concept and applications of gene therapy for treating various diseases

THEORY **(60Hrs)**

1. **Targeted Drug Delivery Systems:** Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery**.** (12hrs)
2. **Targeting Methods:** Introduction, preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation. (12hrs)
3. **Micro Capsules / Micro Spheres:** Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes. (12hrs)
4. **Pulmonary Drug Delivery Systems:** Aerosols, propellents, Containers Types, preparation and evaluation, Intra nasal route delivery system; types, preparation and evaluation. (12hrs)
5. **Nucleic acid based therapeutic delivery system:** gene therapy, introduction (ex-vivo and 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. (12hrs)

REFERENCES

- Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
- S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, VallabhPrakashan, New Delhi, First edition 2002.
- N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001).

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH 202T)

SCOPE

This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students' to clarify the concepts.

OBJECTIVES

Upon completion of this course it is expected that students will be able understand, The basic concepts in biopharmaceutics and pharmacokinetics. The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination. The critical evaluation of biopharmaceutic studies involving drug product equivalency. The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters. The potential clinical pharmacokinetic problems and application of basics of pharmacokinetic.

COURSE OUTCOMES

CO 01: Understand the basic concepts in biopharmaceutics and pharmacokinetics
CO 02: Utilize raw data and derive the pharmacokinetic models and parameters that best describe the process of drug absorption, distribution, metabolism and elimination
CO 03: Critically evaluate biopharmaceutical studies involving drug product equivalency and understand bioequivalence study designs and their protocol preparations.
CO 04: Impart learning opportunities to design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutics parameters.
CO 05: Apply basics of pharmacokinetic in solving potential clinical pharmacokinetic problems.

THEORY **(60hrs)**

1. 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. **(12Hrs)**

2. Biopharmaceutic 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 testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product**. (12Hrs)**

3. 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. **(12Hrs)**

4. **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. **(12Hrs)**

5. **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. **(12Hrs)**

REFERENCES

- Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi, 4th edition, Philadelphia, Lea and Febiger, 1991.
- Biopharmaceutics and Pharmacokinetics, A. Treatise, D .M. Brahmankar and Sunil B. Jaiswal., Vallab Prakashan, Pitampura, Delhi.
- Applied Biopharmaceutics and Pharmacokinetics by Shargel. Land YuABC, 2nd edition, Connecticut Appleton Century Crofts, 1985.
- Textbook of Biopharmaceutics and Pharmacokinetics, Dr. Shobha Rani R. Hiremath , Prism Book.
- Pharmacokinetics by Milo Gibaldi and D. Perrier, 2nd edition, Marcel Dekker Inc.,New York, 1982.
- Current Concepts in Pharmaceutical Sciences: Biopharmaceutics, Swarbrick. J, Leaand Febiger, Philadelphia, 1970.
- Clinical Pharmacokinetics, Concepts and Applications 3rd edition by Malcolm Rowland and Thom~ N. Tozer, Lea and Febiger, Philadelphia, 1995.
- Dissolution, Bioavailability and Bioequivalence, Abdou. H.M, Mack Publishing Company, Pennsylvania 1989.
- Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, revised and expande by Robert. E. Notari, Marcel Dekker Inc, New York and Basel, 1987.
- Biopharmaceutics and Relevant Pharmacokinetics by John. G Wagner and M.Pemarowski, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
- Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.
- Basic Pharmacokinetics,1st edition, Sunil S Jambhekar and Philip J Breen , pharmaceutical press, RPS Publishing,2009.
- Absorption and Drug Development- Solubility, Permeability, and Charge State, Alex Avdeef, John Wiley & Sons, Inc,2003.

COMPUTER AIDED DRUG DEVELOPMENT (MPH 203T)

SCOPE

This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

OBJECTIVES

Upon completion of this course it is expected that students will be able to understand, History of Computers in Pharmaceutical Research and Development Computational Modeling of Drug Disposition Computers in Preclinical Development Optimization Techniques in Pharmaceutical Formulation Computers in Market Analysis, Computers in Clinical Development, Artificial Intelligence (AI) and Robotics Computational fluid dynamics (CFD).

COURSE OUTCOMES

CO 01: Understand various computational modelling techniques for pharmaceutical product development and optimization.
CO 02: Conceptualize and implement of Quality by Design (QbD) and optimization techniques.
CO 03: Understand the concept and applications of clinical data management, artificial neural networks, computational fluid dynamics, robotics and automation.
CO 04: Impart learning opportunities to understand the concept and applications of physiologically based pharmacokinetic models.
CO 05: Implement Artificial Intelligence (AI) and Robotics in Pharmaceutical Research.the concept and applications of physiologically based pharmacokinetic models.

THEORY **(60hrs)**

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

Quality-by-Design in Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, scientifically based QbD - examples of application. **(12hrs)**

2. Computational Modeling of Drug Disposition: Introduction Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution ,Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter. **(12hrs)**

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

4. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical 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**.** **(12hrs)**

5. Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions. **(12hrs)**

REFERENCES

- Computer Applications in Pharmaceutical Research and Development, Sean Ekins, 2006, John Wiley & Sons.
- Computer-Aided Applications in Pharmaceutical Technology, 1st Edition, Jelena Djuris, Woodhead Publishing
- Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James. G.Boylan, Marcel Dekker Inc, New York, 1996.

COSMETICS AND COSMECEUTICALS (MPH 204T)

SCOPE

This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmaceuticals products.

OBJECTIVES

Upon completion of the course, the students shall be able to understand. Key ingredients used in cosmetics and cosmaceuticals. Key building blocks for various formulations. Current technologies in the market. Various key ingredients and basic science to develop cosmetics and cosmeceuticals. Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

COURSE OUTCOMES

CO 01: identify the key ingredients used in formulation of cosmetics and cosmeceuticals.
CO 02: Acquire the knowledge to design cosmeceutical products to address common skin, oral and hair problems
CO 03: Understand basic science to develop cosmetics and cosmeceuticals.
CO 04: Understand various regulatory aspects of cosmetics manufacturing, labelling, import and sales"
CO 05: Apply knowledge of herbal ingredients to formulate effective herbal cosmetics for hair, skin, and oral care, while understanding the associated challenges.

THEORY **(60hrs)**

1. **Cosmetics –** Regulatory: Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling 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. (12hrs)
2. **Cosmetics - Biological aspects:** Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm. (12Hrs)
3. **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 syndet bars. **Perfumes:** Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. **Controversial ingredients:** Parabens, formaldehyde liberators, dioxane. (12Hrs)
4. **Design of cosmeceutical products:** Sun protection, sunscreen 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. (12Hrs)
5. **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. (12Hrs)

REFERENCES

- Harry's Cosmeticology. 8th edition.
- Poucher'sperfumecosmeticsandSoaps, 10th edition.
- Cosmetics - Formulation, Manufacture and quality control, PP.Sharma,4th edition
- Handbook of cosmetic science and Technology A.O.Barel, M.Paye and H.I. Maibach. 3rd edition.
- Cosmetic and Toiletries recent suppliers catalogue.
- CTFA directory

PHARMACEUTICS PRACTICALS – II (MPH 205P)

COURSE OUTCOMES

CO :1 Develop and evaluate NDDS
CO :2 Aquire know how to use in vitro and ex vivo methods in research to carry out evaluation of NDDS
CO :3 Prepare and evalute of cosmetic formulations
CO :4 Understand the effect of changes of excipient in the outcomes of tablets quality parameters.
CO :5 Study the applications of some commonly employed softwares in pharmaceutical product development

1. Study the applications of some commonly employed softwares in pharmaceutical product development
2. To study the effect of temperature change, non-solvent addition, incompatible polymer addition in microcapsules preparation.
3. Preparation and evaluation of Alginate beads.
4. Formulation and evaluation of gelatin /albumin microspheres.
5. Formulation and evaluation of liposomes/niosomes.
6. Formulation and evaluation of spherules.
7. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.
8. Comparison of dissolution of two different marketed products /brands.
9. Protein binding studies of a highly protein bound drug & poorly protein bound drug.
10. Bioavailability studies of Paracetamol in animals.
11. Pharmacokinetic and IVIVC data analysis by Winnoline R software.
12. In vitro cell studies for permeability and metabolism.
13. DoE Using Design Expert® Software.
14. Formulation data analysis Using Design Expert® Software.
15. Quality-by-Design in Pharmaceutical Development.
16. Computer Simulations in Pharmacokinetics and Pharmacodynamics.
17. Computational Modeling Of Drug Disposition.
18. To develop Clinical Data Collection manual.
19. To carry out Sensitivity Analysis, and Population Modeling.
20. Development and evaluation of Creams.
21. Development and evaluation of Shampoo and Toothpaste base.
22. To incorporate herbal and chemical actives to develop products.
23. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff.

DM 101 Disaster Management (Theory) 3Hours/week

Scope and Objectives of the Course

1. To provide students an exposure to disasters, their significance and types
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes in the country
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Disasters: Classification, Causes, Impacts

- Introduction to Disasters: Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks)
- Impacts (including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability) Classification of hazards/disasters and causes

Principles of disaster management

- Approaches to Disaster Risk reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness,
- Community based DRR, Components of Disaster Relief: Water, Food, Sanitation, Shelter, and Health,

Structural and non-structural measures.

Hazard Profile (India) , Disaster Risk Management in India

- Hazard and Vulnerability profile of India

Institutional arrangements (Mitigation, Response and Preparedness ,DM Act and Policy, Other related policies, plans, programmes and legislation) ,Role of Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.

Disaster and Development

- Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc. urban disasters, Waste Management

Global trends in disasters & Adaptation: Global Trends, Complex emergencies, Pandemics Climate change and Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources

Research Methodology and Biostatistics
(MRM301T)

Scope:

This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS , R and MINITAB statistical software's , analyzing the statistical data using Excel.

COURSE OUTCOMES:

Upon completion of the course the student shall be able to

CO 01: Develop the ability to apply the statistical techniques and methods while working on a research project work by using softwares.

CO 02: Understand the appropriate statistical methods required for a particular research design.

CO 03: Choose the appropriate research design and develop an appropriate research hypothesis for a research project.

CO 04: Develop a appropriate framework for research studies, study designs and their strengths and limitations.

CO 05: Analyze of statistical results and communicate findings effectively.

Theory Course content: **60 Hours**

UNIT I:

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples

Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples.

UNIT II

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique.

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

UNIT III:

Preview of statistical parameters. Different distributions, fiducial limits, linear regression and correlation analysis, and their significance, parametric tests, type of errors, hypothesis testing, experimental designs, statistics in bioequivalence testing, statistical quality control, in-vitro in-vivo correlation. Probability determination, student T-test and chi square test and wilcoxan's rank sum tests.

UNIT IV:

Application and Methodology of One way, two way, three way and repeated measures ANOVA. With post hoc tests like Fischer LSD test Tukey's multiple range tests, Bonferroni's test, Sheffe's test and Dennett's test.

Unit-VI

Design and Analysis of experiments:

Factorial Design: Definition, 2^2, 2^3 designs. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Recommended Books:

- Clinical Pharmacokinetics Concepts and Applications 3rd edition by Malcolm Rowland and Thomas N. Tozer, Lea and Febiger, Philadelphia, 1987.
- Gupta, S. (2003) Research Methodologies and Statistical Techniques, Deep and Deep Publications Pvt. Ltd., New Delhi.
- Kothari, C.R. (2003) Research Methodologies: Methods and Techniques, Wishwa Prakashan, New Delhi.
- Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
- Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
- Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
- Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

HR 101 Human Values and Professional Ethics
2 Hours/ Week

1. **Scope & Objective of the Course:**
   The course provides a vide scope of learning & understanding of the subject and after completion of the subject the student will have the ability to develop human values and its importance in their professional life. The student will also have good knowledge of human rights.

Course outcomes:
CO 01: Comprehend the motivation and research gap in the published research article
CO 02: Understand the rationale and hypothesis of the research article published
CO 03: Acquire and apply skills on interpretation of data from scientific article
CO 04: Express the novelity of the research from published article
CO 05: Ability to keep abreast of new knowledge and updated with current research findings through journal club.
General Concepts Introduction about human rights and value education, aim of education, concept of human values and its type
Personal development: Self -analysis, gender equality, respect to age, experience, maturity, family member, coworker. Personality development and its importance in professional world
Character formation through human values: Truthfulness, sacrifice, sincerity ,self-control, tolerance, positive attitude, dignity, ethics
National values : Democracy, socialism, secularism , equality, justice, liberty, freedom
Social values : sympathy, universal brother-hood, duty towards our society
Professional Values: Knowledge thirst ,sincerity towards responsibility, ethics, regularity, punctuality, and faith
Religious values: Accept and respect others believes, tolerance, understanding, faith
Fundamental rights: Introduction and importance of fundamental rights of Indian constitution
Right to Equality: Introduction and its importance, types of rights of equality, equality before law, abolition of untouchability, abolition of titles
Rights to freedom: Introduction and its importance, types of rights, freedom of speech ,freedom to reside and settle , freedom to practice any profession
Rights against exploitation and right to freedom of religion: Introduction and its importance and its effect on human life
Cultural and educational rights and rights to constitutional remedies
Right to property and right to education : Introduction and its importance, importance of education on our life
Human rights-general: Concepts of human rights and its Indian and international perspective, evolution of human rights, Universal Declaration of Human Rights, significance of the UDHR, analysis of the declaration
Therapeutic Measures : Control of mind through physical exercise, meditation

Meditation and Yoga: Introduction and its effects on human mind, types of yoga, how to control our thought through yoga and meditation

Human rights of women and children : Social practice and constitutional safeguards, gender discrimination in workplace

Female feticide , physical assault and harassment, domestic violence, condition of working of women, child labour, violation by individuals, nuclear weapons and terrorism safeguard

1. **Recommended Books (Reference Books/Text Books):**
   - ✓ **RB01:** Value Education and Human Rights, R.P. Shukla
   - ✓ **TB01:** Introduction to Human Rights and Duties, Dr. T. S. N. Sastry
   - ✓ **TB02:** Value Education and Education For Human Rights, V.C. Pandey

29. Examples of few questions statements pertaining to different levels of Bloom's Taxonomy

Remember

A lot of emphasis is laid on, so as to make sure that all assessment components are conducted while following different levels of Bloom's Taxonomy as mentioned in figure.

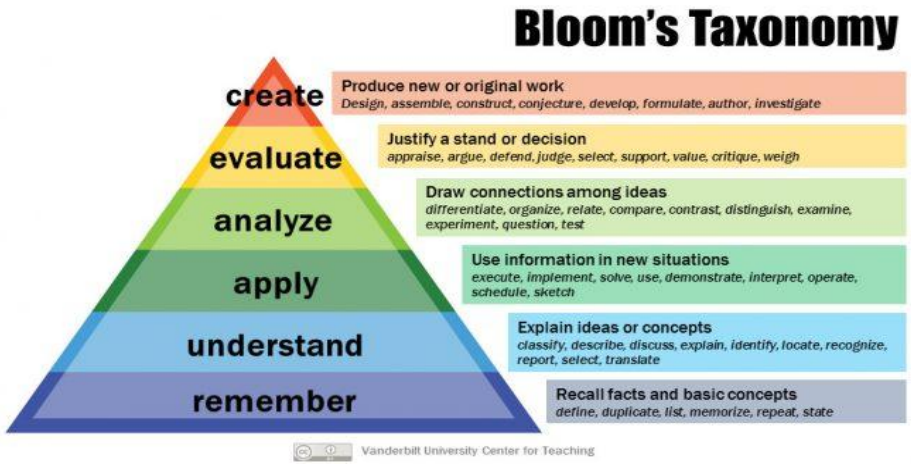

Figure 1. Bloom's Taxonomy [7]

Further a focused effort if also made to align every single Further a focused effort if also made to align every single test item in assessment components with one or the other course learning outcome.

Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

Sample Questions

1. Recall and write any two properties affecting design and performance of a controlled release dosage form.

2. List the enteric coated polymers used in pharmaceutical industry.

Understand

Constructing meaning from oral, written and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing and explaining.

Sample Questions

1. Classify the drug release mechanism for controlled drug deliver system
2. Explain the concept of diffusion controlled release

Applying

Carrying out or using a procedure through executing or implementing.

Sample Questions

1. Exhibit the method of preparation of Aquasomes.
2. Demonstrate the concept of hybridoma technology using a suitable diagram.

Analyzing

Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing and attributing

Sample Questions

1. Compare the advantages, disadvantages and description of different methods for developing drug loaded liposomes..
2. Evaluate the applicability of NLCs over SLNs.

Creating & Evaluating

Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning or producing. Making judgments based on criteria and standards through checking and critiquing

Sample Questions

1. Propose ascites method and fermentation technology for managing the large scale production of monoclonal antibodies**.**
2. Propose the applications of gene therapy for potentially targeting different diseases.

30. Course Handout Specimen:

Institute/School Name			
Department Name			
Programme Name			
Course Name		Session	
Course Code		Semester/Batch	
L-T-P(Per Week)		Course Credits	
Pre-requisite		NHEQF Level[1]	
Course Coordinator			

1. Objectives of the Course

<< Provide a brief overview and objectives of this course in not more than 100 words. >>

2. Course Learning Outcomes (CLOs)

Student should be able to:

	CLOs	Program Outcomes (PO)	NHEQF Level Descriptor[2]	No. of Lectures
CLO01				
CLO02				
CLO03				
CLO04				
CLO05				
CLO06 (Only for lab components)				
Total Contact Hours				

CLO-PO Mapping

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO01												
CLO02												
CLO03												
CLO04												
CLO05												
CLO06												

H=High, M=Medium, L=Low

3. Recommended Books:

B01:

B02:

B03:

[1] National Higher Education Qualification Framework Level, Refer to annexure

[2] NHEQF Level Descriptor, Refer to Annexure & Learning outcomes descriptors for qualification for all levels on the NHEQF

B04:
B05

4. Other readings and relevant websites:

SerialNo	Link of Journals, Magazines, websites and Research Papers
1.	
2.	
3.	
4.	
5.	

5. Recommended Tools and Platforms

<<Mention Tools and Platforms required for the course if required>>

6. Course Plan: Theory+ Lab

Plan Theory Plan

Lect. No.	Topic(s)
ST1	
	ST2
	End Term Exam

Lab Plan

Lab No.	Topic(s)
Continuous Evaluation1 (15marks)	
Continuous Evaluation2 (15Marks)	

7. Delivery/Instructional Resources

Theory Plan:

Lect. No.	Topics	Book No, CH No, Page No	TLM[3]	ALM[4]	Web References	Audio-Video
		B01, CH 1.1-1.5, Page no 3-13				

Lab Plan:

Lab No.	Experiment	TLM	ALM	Web References	Audio-Video

8. Remedial Classes[5]

<<Supplement course handout, which may perhaps include special lectures and discussions that would be planned, and schedule notified accordingly.>>

9. Self-Learning[6]

Assignments to promote self-learning, survey of contents from multiple sources.

[3] Teaching Learning Methods, Refer to Annexure
[4] Active Learning Methods
[5] Refer to Annexure
[6] Refer to Annexure

S.No	Topics	CO	ALM	References/MOOCS

10. Delivery Details of Content Beyond Syllabus[7]

Content beyond syllabus covered (if any) should be delivered to all students that would be planned, and schedule notified accordingly.

S.No	Advanced Topics, Additional Reading, Research papers and any	CO	POs	ALM	References/MOOCS

11. Evaluation Scheme & Components:

Assessment Type[8]	Evaluation Component[9]	Type of Component[10]	No. of Assessments[11]	% Weightage of Component	Max. Marks	Mode of Assessment
Formative	Component1	Continuous Lab Evaluations	02*	30%		Offline
Summative	Component2	Sessional Tests(STs)	02**	20%		Offline
Summative	Component3	End Term Examination	01***	50%		Offline
	Total		**100%**			

Note: Details in above table are sample for the reference, The department decides the assessment policy for each course.

12. Syllabus of the Course:

Subject:			
S.No.	**Topic(s)**	**No. of Lectures**	**Weightage %**

13. Academic Integrityy Policy:

Education at Chitkara University builds on the principle that excellence requires freedom where Honesty and integrity are its prerequisites. Academic honesty in the advancement of knowledge requires that all students and Faculty respect the integrity of one another's work and recognize the importance of acknowledging and safeguarding intellectual property. Any breach of the same will be tantamount to severe academic penalties.

This Document is approved by:

Designation	Name	Signature
Course Coordinator		
Head-Academic Delivery		
Dean		
Date(DD/MM/YYYY)		

[7] Refer to Annexure
[8] Refer to Annexure 2 of NCrF
[9] Refer to Annexure
[10] Refer to Annexure
[11] Refer to Annexure

34. Mapping of Programme Outcomes (POs) with Course Outcomes (COs)

Sr. No.	Course Name	Course Code	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1.	Modern Pharmaceutical Analytical techniques	MPH-101T	CO 1: Develop the basic theoretical education of the instrumentation techniques available.	M	H	L	M							
			CO 2: Compare and contrast the various method of analysis and their outcomes	M	M		L	L						
			CO 3: Demonstrate Practical skills for the analysis of drugs and excipients using various instrumentation techniques.	M		H	H		L					
			CO 4: Interpret analytical data, prepare analytical reports, and communicate results in a clear and concise manner.			L		M		H	H		H	M
			CO 5: Understand the ethical considerations and professional conduct in pharmaceutical analytical research.						L	H		M		M
2.	Drug Delivery Systems	MPH-102T	CO 1: Understand the basic fundamentals regarding the anatomy and physiology of specific organ (skin, eye, buccal cavity, GIT) which we help in designing of sustained and controlled drug delivery for various routes.	H	L		M	L	H				L	L
			CO 2: Assess the approaches for the design of various drug delivery systems	H	H	M	H	M	M	L	L			M
			CO 3: Select drug and polymers for the specific drug delivery system.	H	M	H	H			L		L		M
			CO 4: Obtain learning opportunities to design various drug delivery systems and their further evaluation.	H		H	H	M	L	L				M
			CO 5: Understand latest drug delivery systems and critically assess to develop new formulations	H	M	H			M	L	H	M	M	H
3.	Modern Pharmaceutics	MPH-103T	CO 1: Understand the concept and applications of preformulation studies in pharmaceutical product development	H	H	H	H	M	L	L	L			M
			CO 2: Recognize theories of pharmaceutical dispersions and formulation/evaluation of parenteral	H	M	H	H			M	L			M
			CO 3: Critically assess and implement the concepts of pharmaceutical validation and optimization	M	M		H	H	M	L				M

			CO 4: Discern the applications and operational significance of current good manufacturing guidelines	M	H	H	H	M	M					L
			CO 5: Understand of tablet compression, diffusion/dissolution processes and statistical techniques in pharmaceutical product development	M	M	H	H	L	M	L	L			M
4.	Regulatory Affairs	MPH-104T	CO 1: Understand the documentation and guidelines pertaining to pharmaceutical industries		H	M		H			L		H	
			CO 2: Demonste the registration of IND, NDA, ANDA, medical devices application and approval processes	H			M			H				L
			CO 3: Assess and compare drug approval, regulatory requirements, structure, functioning of EU, MHRA, TGA, ROW countries		M				L		H	H		
			CO 4: Discern the objective, scope, general principles of ICH Q,S,E,M guidelines	M			H					L		H
			CO 5: Analyse the overview, contents and components of GCP guidelines and pharmacovigilance system			H		M	H	L				
5.	Pharmaceutics Practical I	MPH-105P	CO 1: Obtain learning opportunities for the understanding of theoretical and practical knowledge of the instrumentation techniques available in labs	H	H	M	M	H		L	L	L		M
			CO 2: Demonstrate the different aspects of separation for multi components.		H			H		L	L	L		M
			CO 3: Analyze different drugs and excipients using various instrumentation techniques and their application in industries.	L	H	M	L	H		L	L	L		M
			CO 4: Understand various CR/SR formulation and evaluation approaches.	H	H	H	H	H		L	L	L		M
			CO 5: Learn the various documentation required for reporting the observations for research.			H				L	L	L		M
6.	Seminar/assignment	MPH-106S	CO 1: Design, develop, and critically evaluate pharmaceutical formulations for a specific drug or therapeutic category.	L	H	L	L		L	L	H	L	H	M

7.			CO 2:Present research on advanced drug delivery systems, including novel methods such as targeted delivery, controlled release, or nanotechnology.	L	H	L	H			L	H	L	H	M
8.			CO 3: Prepare a comprehensive report on the pharmaceutical manufacturing processes for a selected dosage form, covering aspects such as scale-up, quality assurance, and regulatory requirements.	L	H			H		L	H	L	H	M
9.			CO 4: Analyze and interpret pharmacokinetic and pharmacodynamic data for various drug formulations, using statistical and modeling techniques.	L			H		H	L	H	L	H	M
10.			CO 5: Conduct a thorough review of regulatory guidelines and quality assurance practices applicable to pharmaceutical products.	L			H			L	H	L	H	M
11.	Molecular Pharmaceutics(Nano Tech and Targeted DDS)	MPH 201T	CO 1: Understand the concept and applications of brain and tumor targeted drug delivery systems	M	L	M			M	M				L
			CO 2: Investigate the preparation, evaluation, applications of nanoparticles liposomes, niosomes, aquasomes, phytosomes and electrosomes	M	M	H				L				M
			CO 3: Conceptualy understand the developmen, characterization and therapeutic applications of monoclonal antibodies and microspheres	L	M	M	M	M	H	M	M			L
12.			CO 4: Assess of preparation methods, QC testing procedures and applications of aerosols and intranasal drug delivery systems	M				H			L		L	M
13.			CO 5: Demonstrate the concept and applications of gene therapy for treating various diseases	M	L	M			M	M				L
14.		MPH 202T	CO 1: Understand the basic concepts in biopharmaceutics and pharmacokinetics	M	M	M	H	M	M	M	L	L	L	L

	Advanced Biopharmaceutics & Pharmacokinetics		CO 2: Utilize raw data and derive the pharmacokinetic models and parameters that best describe the process of drug absorption, distribution, metabolism and elimination	L		M	M		H	M				M
			CO 3: Critically evaluate biopharmaceutical studies involving drug product equivalency and understand bioequivalence study designs and their protocol preparations.	L	M	H	H		H	L				H
			CO 4: Impart learning opportunities to design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutics parameters.	L		L	H		H	L		L		M
			CO 5: Apply basics of pharmacokinetic in solving potential clinical pharmacokinetic problems.	M	M	H	H		H	L				H
15.	Computer Aided Drug Development	MPH 203T	CO 1: Understand various computational modelling techniques for pharmaceutical product development and optimization.	L		H	M		H	L				H
			CO 2: Conceptualize and implement of Quality by Design (QbD) and optimization techniques.	L					H	L	L			L
			CO 3: Understand the concept and applications of clinical data management, artificial neural networks, computational fluid dynamics, robotics and automation.	M				H		H				L
			CO 4: Impart learning opportunities to understand the concept and applications of physiologically based pharmacokinetic models.	L	M			L	H	H	H	L	L	L
			CO 5: Implement Artificial Intelligence (AI) and Robotics in Pharmaceutical Research.		M			L	H				L	L
16.	Cosmetic and Cosmeceuticals	MPH 204T	CO 1: identify the key ingredients used in formulation of cosmetics and cosmeceuticals.	H	H	L	H	H	L	L	H	L	M	L
			CO 2: Acquire the knowledge to design cosmeceutical products to address common skin, oral and hair problems	H	M	H	M	M	L					M

			CO 3: Understand basic science to develop cosmetics and cosmeceuticals.	M	H	H	H	M	L					H
			CO 4: Understand various regulatory aspects of cosmetics manufacturing, labelling, import and sales	H	M									L
			CO 5: Apply knowledge of herbal ingredients to formulate effective herbal cosmetics for hair, skin, and oral care, while understanding the associated challenges.	H	M	L		H		H				
17.	Pharmaceutics Practical II	MPH-205P	CO 1: Develop and evaluate NDDS	L	M	H				H		M	M	H
			Co 2: Acquire know how to use in vitro and ex vivo methods in research to carry out evaluation of NDDS	L	L	H	L	M						
			CO 3: Prepare and evalute of cosmetic formulations	L	L	H	L	M						L
			CO 4: Understand the effect of changes of excipient in the outcomes of tablets quality parameters.	L	L	H	L	L	M	L	L			L
			CO 5: Study the applications of some commonly employed softwares in pharmaceutical product development	M	M	H	H	H						L
18.	Seminar/assignment	MPP-206S	CO 1: Design, develop, and critically evaluate pharmaceutical formulations for a specific drug or therapeutic category.				M	L	H					L
			CO 2: Carry out research and present interactively on advanced drug delivery systems, including novel methods such as targeted delivery, controlled release, or nanotechnology.	M	H	H	H	H		L	L	L		M
			CO 3: Prepare a comprehensive report on the pharmaceutical manufacturing processes for a selected dosage form, covering aspects such as scale-up, quality assurance, and regulatory requirements.				M	H		L	L	L		M
			CO 4: Analyze and interpret pharmacokinetic and pharmacodynamic data for various drug formulations, using statistical and modeling techniques.	M		M	L	H		L	L	L		M
			CO 5: Conduct a thorough review of regulatory guidelines and quality assurance practices applicable to pharmaceutical products.	H	H	H	H	H		L	L	L		M

19.	Research Methodology and Biostatistics	MRM 301T	CO 1: Develop the ability to apply the statistical techniques and methods while working on a research project work by using softwares.								M	H		L
			CO 2: Understand the appropriate statistical methods required for a particular research design.	H							M			L
			CO 3: Choose the appropriate research design and develop an appropriate research hypothesis for a research project.								M	H		
			CO 4: Develop a appropriate framework for research studies, study designs and their strengths and limitations.								M	H		
			CO 5: Analyze of statistical results and communicate findings effectively.								M	H		
20.	Journal club	MPR 302J	CO 1: Comprehend the motivation and research gap in the published research article	H		H	M	L		L	H	M		
			CO 2: Understand the rationale and hypothesis of the research article published		H		H	M		L			M	
			CO 3: Acquire and apply skills on interpretation of data from scientific article	H		H		L	M					M
			CO 4: Express the novelity of the research from published article		H	M	H	L		M				
			CO 5: Ability to keep abreast of new knowledge and updated with current research findings through journal club.	H	M			L	H				M	
21.	Discussion / Presentation	MPR 302P	CO 1: Demonstrate the ability to critically evaluate and synthesize existing literature related to a specific research question in pharmaceutical sciences, identifying key gaps and opportunities for new research.	H			M	L		L	H	M		M
			CO 2: Develop and articulate a comprehensive research design and methodology tailored to address a specific problem in pharmaceutical sciences, including the selection of appropriate experimental techniques, data analysis methods, and ethical considerations	M		H		H		M				M
			CO 3: Present complex scientific concepts and research proposals clearly and effectively, using appropriate visual aids and communication techniques	M			M		M		H		L	

			CO 4: Apply advanced problem-solving skills to develop innovative approaches and solutions within the research proposal, demonstrating creativity and scientific rigor in addressing pharmaceutical science challenges.	M		H		M		H				M
			CO 5: Incorporate constructive feedback from peers and instructors to refine and improve the research proposal, demonstrating an ability to engage in critical self-assessment and iterative development of research plans.				M		L		H		M	
22.	Research Work	MPR 302R	CO 1: Develop and execute detailed experimental protocols, demonstrating proficiency in laboratory techniques and methodologies	H		M		M		L		H		
			CO 2: Collect, analyze, and interpret scientific data using appropriate statistical tools		H	M		L	H	L	H		M	
			CO 3: Apply critical thinking skills to identify research problems, formulate hypotheses, and design experiments to test these hypotheses,		M	H	H	L	H	M				
			CO 4: Effectively communicate research findings through written reports, scientific papers, and oral presentations	M	L	M		L	M		H	H	L	
			CO 5: Demonstrate a thorough understanding of ethical considerations and regulatory requirements in pharmaceutical research, including proper handling of hazardous materials, adherence to protocols for human and animal research, and integrity in data management and reporting.		H	M	M	H		L				
23.	Journal Club	MPR 401J	CO 1: Comprehend the motivation and research gap in the published research article	H		H	M	L		L	H	M		
			CO 2: Understand the rationale and hypothesis of the research article published		H		H	M		L			M	
			CO 3: Acquire and apply skills on interpretation of data from scientific article	H		H		L	M					M
			CO 4: Express the novelity of the research from published article		H	M	H	L		M				
			CO 5: Acquire new knowledge and stay updated with current research findings through journal club.	H	M			L	H				M	
24.	Research Work	MPR 401R	CO 1: Develop and execute detailed experimental protocols, demonstrating proficiency in laboratory techniques and methodologies	H		M		M		L		H		

			CO 2: Collect, analyze, and interpret scientific data using appropriate statistical tools		H	M		L	H	L	H		M	
			CO 3: Apply critical thinking skills to identify research problems, formulate hypotheses, and design experiments to test these hypotheses,		M	H	H	L	H	M				
			CO 4: Effectively communicate research findings through written reports, scientific papers, and oral presentations	M	L	M		L	M		H	H	L	
			CO 5: Demonstrate a thorough understanding of ethical considerations and regulatory requirements in pharmaceutical research, including proper handling of hazardous materials, adherence to protocols for human and animal research, and integrity in data management and reporting.		H	M	M	H		L				
25.	Discussion/Final Presentation	MPR 401D	CO 1: Critically analyze and synthesize scientific literature and current research findings in the field.	H		M	H		M	L		H		
			CO 2: Present research data and findings clearly and concisely, using appropriate scientific terminology and presentation tools.	M	L		M	L			H			H
			CO 3: Justify the choice of research design, methodologies, and analytical techniques employed in the study.	H		H		M		L	M			
			CO 4: Demonstrate the ability to evaluate research methods, data validity, and the robustness of conclusions drawn from the research.	H	H		H	M		L		M		
			CO 5: Exhibit adherence to ethical standards in the conduct of research, including data integrity, authorship, and reporting.	M	M		M	H		L				H
26.	Co-curricular Activities	MPR 401C	CO 1: Develop and enhance key professional skills such as leadership, teamwork, communication, and time management through active participation in co-curricular activities, preparing students for diverse roles in the pharmaceutical industry.	H	H		M			L	M	H		
			CO 2: Apply theoretical knowledge gained in the classroom to real-world scenarios and projects, bridging the gap between academic learning and practical application in pharmaceutical sciences.		H		H	M		L			M	

			CO 3: Build a professional network by engaging with industry professionals, alumni, and peers through participation in workshops, seminars, conferences, and student organizations, facilitating future career opportunities and collaborations.	M		H		M				H		
			CO 4: Participate in community outreach programs and public health initiatives, developing an understanding of the societal impact of pharmaceutical sciences and contributing to public health awareness and education.		H		M	H		L	M			
			CO 5: Foster research and innovation skills by engaging in co-curricular research projects, competitions, and hackathons, encouraging creativity, critical thinking, and a proactive approach to solving pharmaceutical challenges.	M	L	M					H			H