Academic Programme Guide

of

Master of Pharmacy

(Pharmacology)

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 skillful 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 skillful 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 Objective:

1. To develop a deep understanding of pharmacological principles and mechanisms of drug action, including drug-receptor interactions, pharmacokinetics, and pharmacodynamics.
2. To train students in advanced experimental techniques using in vivo and in vitro models for evaluating the efficacy and safety of drugs in preclinical research.
3. To equip students with the knowledge of regulatory requirements for preclinical and clinical drug development, ethical guidelines, and documentation processes relevant to pharmacological research.
4. To enhance critical thinking and problem-solving skills in designing and interpreting pharmacological studies aimed at discovering novel therapeutic agents.
5. To prepare students for multidisciplinary collaboration in academic, industrial, or clinical research settings, bridging roles in R&D, regulatory affairs, and translational pharmacology.

Programme Outcomes (POs) of M. Pharm Pharmaceutics are summarized as below:

2. Programme Outcomes for M. Pharm (Pharmacology)

The proposed outcomes for the M. Pharmacy Pharmacology 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 and preclinical research.

The student outcomes for the M. Pharm (Pharmacology) Program are the following:

PO1: To ensure appropriate competence and knowledge of different aspects of pharmacology and toxicology including theoretical and experimental, as well as developing their analytical and data interpretational skills. Student will be able to critically appraise the pharmacological drugs used in the major disorders and how they interact with the brain at the neuronal and system level; critically assess the use of pharmacological drugs in the clinical management of major immunological disorders, allowing students to build on their knowledge of inflammation and immunology; develop competence, confidence and an enquiring, investigative approach.

PO2: To acquire competence endocrinal and physiological knowledge to critically appraise the role that *in silico, in vitro* and *in vivo* pharmacology plays in drug discovery/development reflecting on the inter-relationship between aspects of biotechnology and industry with respect to processes. The student will have hands-on training in various animal models and will be able to determine the effects of drugs using animal model along with practical inputs in pharmacokinetic studies of various drugs and formulations in animals to establish in-vitro and in-vivo correlations.

PO3: To translate the high-level of understanding of drug action into key stages in preclinical and clinical research studies.

PO4: To enable students to integrate post-genomic molecular biology with biological function and assist students to acquire practical knowledge in various analytical techniques used in molecular biology and to elucidate basic principles of cellular signalling pathways relevant to drug discovery and disease; gain insight into the associated molecular and genetic techniques, and learn about current debates and issues in these fields

P05: The course is designed to teach pharmaceutical regulation to give students a firm grounding in the regulatory framework around the manufacture, distribution, dispensing and use of pharmaceutical products, and place pharmaceuticals in a larger context of health care. The track curriculum provides a comprehensive education in the regulatory framework of pharmaceutical-related topics to uphold all laws, regulations, safety and ethical standards that apply to the experimental procedures in animals and the environment.

P06: To acquire interdisciplinary skills in Pharmacology, integrating pharmacokinetics, pharmacovigilance and pharmacoepidemiology's concepts for Integrated management of drug therapy and pharmacotherapeutics and rational use of drugs.

P07: To acquire entrepreneurial skills for starting and financing a company, the role of intellectual property protection, writing a business plan and communicating business ideas, assessing projects, managing a company and finances, coping with industrial safety legislation and regulatory requirements.

P08: 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 compiling reviews and discussion essays & 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, World Wide Web, University intranet, and in using on-line teaching material, word processors, spreadsheets, and databases.

P09: To assist student to communicate effectively by means of oral, written and poster presentations, using print and electronic resources, reporting information, ideas and actions clearly, autonomously and competently; demonstrate problem solving skills by interpreting data, designing and carrying out experimental work.

P10: To provide the knowledge of professional and ethical responsibilities in clinical and non-clinical laboratory as required by regulatory bodies.

P11: To prepare the students in teamwork, lifelong learning and continuous improvement and develop competence, confidence and an enquiring, investigative approach along with assisting to work effectively with a group as a leader or member, to produce team seminars.

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 skillful 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.

The mapping of POs with University Mission is shown in **Table 1**.

PO No.	PO Statement	Mission Statement	Vision Statement
PO1	To ensure appropriate competence and knowledge of different aspects of pharmacology and toxicology including theoretical and experimental, as well as developing their analytical and data interpretational skills. Student will be able to critically appraise the pharmacological drugs used in the major disorders and how they interact with the brain at the neuronal and system level; critically assess the use of pharmacological drugs in the clinical management of major immunological disorders, allowing students to build on their knowledge of inflammation and immunology; develop competence, confidence and an enquiring, investigative approach.	M1, M2	To be a globally recognized university, promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.
PO2	To acquire competence endocrinal and physiological knowledge to critically appraise the role that in silico, in vitro and in vivo pharmacology plays in drug discovery/development reflecting on the inter-relationship between aspects of biotechnology and industry with respect to processes. The student will have hands-on training in various animal models and will be able to determine the effects of drugs using animal model along with practical inputs in pharmacokinetic studies of various drugs and formulations in animals to establish in-vitro and in-vivo correlations.	M4, M6	
PO3	To translate the high-level of understanding of drug action into key stages in preclinical and clinical research studies.	M3, M5	
PO4	To enable students to integrate post-genomic molecular biology with biological function and assist students to acquire practical knowledge in various analytical techniques used in molecular biology and to elucidate basic principles of cellular signalling pathways relevant to drug discovery and disease; gain insight into the associated molecular and genetic techniques, and learn about current debates and issues in these fields.	M4, M5	
PO5	The course is designed to teach pharmaceutical regulation to give students a firm grounding in the regulatory framework around the manufacture, distribution, dispensing and use of pharmaceutical products, and place pharmaceuticals in a larger context of health care. The track curriculum provides a comprehensive education in the regulatory framework of pharmaceutical-related	M1, M4	

	topics to uphold all laws, regulations, safety and ethical standards that apply to the experimental procedures in animals and the environment.		
PO6	To acquire interdisciplinary skills in Pharmacology, integrating pharmacokinetics, pharmacovigilance and pharmacoepidemiology's concepts for Integrated management of drug therapy and pharmacotherapeutics and rational use of drugs.	M3, M4	
PO7	To acquire entrepreneurial skills for starting and financing a company, the role of intellectual property protection, writing a business plan and communicating business ideas, assessing projects, managing a company and finances, coping with industrial safety legislation and regulatory requirements.	M2, M6	
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 compiling reviews and discussion essays & 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, World Wide Web, University intranet, and in using on-line teaching material, word processors, spreadsheets, and databases.	M3, M5	
PO9	To assist student to communicate effectively by means of oral, written and poster presentations, using print and electronic resources, reporting information, ideas and actions clearly, autonomously and competently; demonstrate problem solving skills by interpreting data, designing and carrying out experimental work.	M1, M5	
PO10	To provide the knowledge of professional and ethical responsibilities in clinical and non-clinical laboratory as required by regulatory bodies.	M4, M5	
PO11	To prepare the students in teamwork, lifelong learning and continuous improvement and develop competence, confidence and an enquiring, investigative approach along with assisting to work effectively with a group as a leader or member, to produce team seminars.	M2, M3	

The graduating students are prepared for demonstrating knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behaviour, 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 PO6, PO7, PO8, PO9 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. POs are designed and oriented to meet the mission of university in professional ethics. The POs helps to produce pharmacy graduates with employable skills and high technical competence in pharmaceutical industry and health care sectors. 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 inculcate research activity and develop passion for discovery and innovations. Pharmacy graduates develop entrepreneurship qualities that support growth of pharmaceutical intellectual property.

3. Eligibility for Admission

3.1. 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 specializations in M. Pharm program Pharmacology is MPL. The course of study for M. Pharm specializations 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 to 5.

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.

Table –2: Course of study for (Pharmacology)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MPL101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPL102 T	Advanced Pharmacology-I	4	4	4	100
MPL103T	Pharmacological and Toxicological Screening Methods-I	4	4	4	100
MPL104T	Cellular and Molecular Pharmacology	4	4	4	100
MPL105P	Pharmacology Practical I	12	6	12	150
MPL106S	Seminar/Assignment	7	4	7	100
Total		**35**	**26**	**35**	**650**
Semester II					
MPL201T	Advanced Pharmacology II	4	4	4	100
MPL202T	Pharmacological and Toxicological Screening Methods-II	4	4	4	100
MPL203T	Principles of Drug Discovery	4	4	4	100
MPL204T	Clinical Research and Pharmacovigilance	4	4	4	100
MPL205P	Pharmacology Practical II	12	6	12	150
MPL206S	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 (Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
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 (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=100 Maximum=105*

*Credit Points for Co-curricular Activities

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.

* 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.

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

8. Assessment & Evaluation

The schemes for internal assessment and end semester examinations are given in Table 6 and 7.

8.1 End semester 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 1 and 2 for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

Tables – 7: Schemes for internal assessments and end semester examinations (Pharmacology)

Course Code	Course	Internal Assessment				End Semester Exams		Total
		Continuous Mode	Sessional Exams		Total	Marks	Duration	Marks
			Marks	Duration				
SEMESTER I								
MPL101T	Modern Pharmaceutical Analytical Techniques	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL102T	Advanced Pharmacology-I	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL103T	Pharmacological and Toxicological Screening Methods-I	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL104T	Cellular and Molecular Pharmacology	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL105P	Pharmacology Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPL 106S	Seminar/ Assignment	-	-	-	-	-	-	100
							Total	**650**
SEMESTER II								
MPL201T	Advanced Pharmacology II	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL202T	Pharmacological and Toxicological Screening Methods-II	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL203T	Principles of Drug Discovery	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL204T	Clinical Research And Pharmacovigilance	10	15	1.5 Hrs	25	75	3 Hrs	100
MPL205P	Pharmacology Practical II	20	30	6 Hrs	50	100	6 Hrs	150
MPL 206S	Seminar /Assignment	-	-	-	-	-	-	100
DM 101	Disaster Management	05	10	1 Hr	15	35	1.5 Hrs	50
							Total	**700**

Tables – 8: Schemes for internal assessments and end semester examinations (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.

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 10. 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 for 100 marks paper

I. Synopsis = 10
II. Major Experiment = 35
III. Minor Experiment = 25
IV. Viva-Voce + File = 30

14. Allowed to keep terms (ATKT)

No student shall be admitted to any examination unless he/she fulfils the norms given in 6. ATKT rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I and II semesters till the III semester examinations. However, he/she shall not be eligible to attend the courses of IV semester until all the courses of I, II and III semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to IV semesters within the stipulated time period as per the norms.

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.

15. Grading System

15.1. 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:

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

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:

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

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:

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

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 (typed & bound copy not less than 75 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). The projects shall be evaluated as per the criteria 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 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 / Retotaling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for retotaling 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 programme 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

a. Research & Formulation Development Executive: Development of new formulations
b. Production Executive: Managing and supervising production of formulations
c. Project Manager: Coordinating the research, production and marketing activities in a Pharmaceutical organization, deciding as to what and how to develop a new product and plan production and marketing activity as per available capacity.
d. Project Manager: coordinating & erection, installation commissioning of production in a new plant / facility and ensuring that all installation and procedures are as per compliance norms laid out by regulatory agencies.
e. Manager (Administration & Finance): in a pharmaceutical organization.
f. Executive / Manager, Regulatory affairs: Helping the research team to compile drug master files for new drug products for registration and approval with the food & Drug authority of different countries.

28. Program Overview: M. Pharmacy Pharmacology (MPL)

The Program consists of subjects under the following categories:
Table 13: Program Scheme: **M. Pharmacy Pharmacology**

Year 1 Sem 1												
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**	
1.	Modern Pharmaceutical Analytical Techniques	MPL101T	500-599	DC	4	4			25	75	100	**26**
2.	Advanced Pharmacology-I	MPL102T	500-599	DC	4	4			25	75	100	
3.	Pharmacological and Toxicological Screening Methods-I	MPL103T	500-599	DC	4	4			25	75	100	
4.	Cellular and Molecular Pharmacology	MPL104T	500-599	DC	4	4			25	75	100	
5.	Pharmacology Practical I	MPL105P	500-599	DC	6			12	50	100	150	
6.	Seminar/Assignment	MPL 106S	500-599	DC	4	7			100		100	
Year 1 Sem 2												
1.	Advanced Pharmacology II	MPL201T	500-599	DC	4	4			25	75	100	**29**
2.	Pharmacological and Toxicological Screening Methods-II	MPL202T	500-599	DC	4	4			25	75	100	

3.	Principles of Drug Discovery	MPL203T	500-599	DC	4	4			25	75	100	
4.	Clinical Research and Pharmacovigilance	MPL204T	500-599	DC	4	4			25	75	100	
5.	Pharmacology Practical II	MPL205P	500-599	DC	6			12	100	50	150	
6.	Seminar/Assignment	MPL 206S	500-599	DC	4	7			100		100	
7.	Disaster Management	DM 101	500-599	UNI	3	3			15	35	50	
Year 2 Sem 3												
1.	Research Methodology and Biostatistics*	MRM 301T	500-599	DC	4	4			25	75	100	**23**
2.	Journal club	MPR 302J	500-599	DC	1	1			25		25	
3.	Discussion / Presentation (Proposal Presentation)	MPR 302P	500-599	DC	2	2			50		50	
4.	Research Work	MPR302R	500-599	DC	14	28				350	350	
5.	Human Values and Professional Ethics	HR 101	500-599	UNI	2	2			15	35	50	
Year 2 Sem 4												
1	Journal Club	MPR 401J	500-599	DC	1	1			25		25	**20**
2	Research Work and Colloquium	MPR 401R	500-599	DC	16	31				400	400	
3	Discussion/Final Presentation	MPR 401D	500-599	DC	3	3			75		75	

1st Semester

MODERN PHARMACEUTICAL ANALYSIS (MPL101T)

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

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**

10 Hrs

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.

10 Hrs

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.

10 Hrs

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, Isotopic peaks and Applications of Mass spectroscopy.

10 Hrs

4. Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factor affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High performance Thin Layer Chromatography
c) Ion exchange chromatography d) Column chromatography
e) Gas chromatography f) High Performance Liquid chromatography
g) High Performance Liquid chromatography h) Affinity chromatography
i) Gel Chromatography

10 Hrs

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) Iso electric focusing

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

10 Hrs

1. **Potentiometry:** Principle, working, Ion selective Electrodes and Application of potentiometry.

Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

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

2. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.

4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.

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

7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED PHARMACOLOGY-I (MPL102T)

Scope

The subject is designed to strengthen the basic knowledge in the field of pharmacology and to impart recent advances in the drugs used for the treatment of various diseases. In addition, this subject helps the students to understand the concepts of drug action and mechanisms involved

Objectives

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

- Discuss the pathophysiology and pharmacotherapy of certain diseases
- Explain the mechanism of drug actions at cellular and molecular level
- Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

Course outcomes

CO 01: Apply foundational pharmacological principles to advance health and well-being through the effective prevention and treatment of diseases.
CO 02: Understand and evaluate the mechanisms of drug action at various biological levels including organ systems, subcellular/macromolecular level, and molecular interactions.
CO 03: Assess the pharmacological actions of different drug categories and their relevance in treating a range of diseases.
CO 04: Gain comprehensive knowledge of pathophysiology & disease mechanisms and corresponding pharmacological therapies to enhance treatment efficacy.
CO 05: Analyze the adverse effects, contraindications, and clinical applications of drugs to ensure safe and effective patient care.

THEORY **60 hours**

UNIT-I

General Pharmacology **12 Hrs**

Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination. Concepts of linear and non-linear compartment models. Significance of Protein binding.

Pharmacodynamic: Mechanism of drug action and the relationship between drug concentration and effect. Receptors, structural and functional families of receptors, quantitation of drug receptors interaction and elicited effects.

UNIT-II **12 Hrs**

Neurotransmission

a. General aspects and steps involved in neurotransmission.

b. Neurohumoral transmission in autonomic nervous system (Detailed study about neurotransmitters- Adrenaline and Acetylcholine).

c. Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters- histamine, serotonin, dopamine, GABA, glutamate and glycine].

d. Non adrenergic non cholinergic transmission (NANC). Co-transmission

Systemic Pharmacology

A detailed study on pathophysiology of diseases, mechanism of action, pharmacology and toxicology of existing as well as novel drugs used in the following systems

a. Autonomic Pharmacology

Parasympathomimetics and lytics, sympathomimetic and lytics, agents affecting neuromuscular junction

UNIT-III **12 Hrs**

Central nervous system Pharmacology

General and local anesthetics

Sedatives and hypnotics, drugs used to treat anxiety.

Depression, psychosis, mania, epilepsy, neurodegenerative diseases.

Narcotic and non-narcotic analgesics.

UNIT-IV

Cardiovascular Pharmacology **12 Hrs**

Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia.

Hematinics, coagulants, anticoagulants, fibrinolytics and anti-platelet drugs

UNIT- V

Autocoid Pharmacology **12 Hrs**

The physiological and pathological role of Histamine, Serotonin, Kinins Prostaglandins

Opioid autocoids.

Pharmacology of antihistamines, 5HT antagonists.

Unit -VI

Drug therapy of Respiratory disorders:

Pathophysiology and drug therapy of asthma.

REFEERENCES

1. The Pharmacological basis of therapeutics- Goodman and Gill man‘s
2. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan Armen H, Tashjian Jr, Ehrin J,Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
3. Basic and Clinical Pharmacology by B.G -Katzung
4. Pharmacology by H.P. Rang and M.M. Dale.
5. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
6. Text book of Therapeutics, drug and disease management by E T. Herfindal and Gourley.
7. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
8. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists
9. Graham Smith. Oxford textbook of Clinical Pharmacology.
10. Avery Drug Treatment
11. Dipiro Pharmacology, Pathophysiological approach.
12. Green Pathophysiology for Pharmacists
13. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
14. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company
15. K D.Tripathi. Essentials of Medical Pharmacology.
16. Modern Pharmacology with Clinical Applications, Craig Charles R. & Stitzel Robert E., Lippincott Publishers.
17. Clinical Pharmacokinetics & Pharmacodynamics : Concepts and Applications – Malcolm Rowland and Thomas N.Tozer, Wolters Kluwer, Lippincott Williams & Wilkins Publishers.
18. Applied biopharmaceutics and Pharmacokinetics, Pharmacodynamics and Drug metabolism for industrial scientists.
19. Modern Pharmacology, Craig CR. & Stitzel RE, Little Brown & Company.

PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS-I (MPL103T)

Scope

This subject is designed to impart the knowledge on preclinical evaluation of drugs and recent experimental techniques in the drug discovery and development. The subject content helps the student to understand the maintenance of laboratory animals as per the guidelines, basic knowledge of various *in-vitro* and *in-vivo* preclinical evaluation processes

Objectives

Upon completion of the course the student shall be able to,

- Appraise the regulations and ethical requirement for the usage of experimental animals.

- Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals

- Describe the various newer screening methods involved in the drug discovery process
- Appreciate and correlate the preclinical data to humans

Course outcomes

CO01: Demonstrate the regulations and ethical requirements for the usage of experimental animals.
CLO02: Understand the various animals used in the drug discovery process.
CO03: Apply good laboratory practices in the maintenance and handling of experimental animals.
CO04: Describe the various newer screening methods involved in the drug discovery process.
CO05: Critically assess and correlate preclinical data to human outcomes.

THEORY **60 Hrs**

Unit-I **12 Hrs**

Laboratory Animals

1. Common laboratory animals: Description, handling and applications of different species and strains of animals.
2. Transgenic animals: Production, maintenance and applications
3. Anaesthesia and euthanasia of experimental animals.
4. Maintenance and breeding of laboratory animals.
5. CPCSEA guidelines to conduct experiments on animals
6. Good laboratory practice.
7. Bioassay-Principle, scope and Limitations and Methods.

Unit-II **12 Hrs**

Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.
General principles of preclinical screening. CNS Pharmacology: behavioral and muscle co ordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimer's and multiple sclerosis. Drugs acting on Autonomic Nervous System.

Unit-III **12 Hrs**

Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.
Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, antiinflammatory and antipyretic agents. Gastrointestinal drugs: anti ulcer, anti -emetic, anti-diarrheal and laxatives.

Unit-IV **12 hrs**

Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.
Cardiovascular Pharmacology: antihypertensives, antiarrythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents, Anti cancer agents, Hepatoprotective Screening Methods.

Unit V **12 hrs**

Preclinical screening of new substances for the pharmacological activity using *in vivo*, *in vitro*, and other possible animal alternative models.
Immunosuppressants, immunemodulators & Immuno stimulants
General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems. Immunoassay methods evaluation; protocol outline, objectives and preparation. Immunoassay for digoxin and insulin.
Limitations of animal experimentation and alternate animal experiments.
Extrapolation of *in vitro* data to preclinical and preclinical to humans.

REFERENCES

1. Biological standardization by J.H. Burn D.J. Finney and I.G. Goodwin
2. Screening methods in Pharmacology by Robert Turner. A
3. Evaluation of drugs activities by Laurence and Bachrach
4. Methods in Pharmacology by Arnold Schwartz.
5. Fundamentals of experimental Pharmacology by M.N.Ghosh
6. Pharmacological experiment on intact preparations by Churchill Livingstone

7. Drug discovery and Evaluation by Vogel H.G.
8. Experimental Pharmacology by R.K.Goyal.
9. Preclinical evaluation of new drugs by S.K. Gupta
10. Handbook of Experimental Pharmacology, S. K. Kulkarni
11. Practical Pharmacology and Clinical Pharmacy, SK.Kulkarni, 3rd Edition.
12. David R. Gross. Animal Models in Cardiovascular Research, 2nd Edition, Kluwer Academic Publishers, London, UK.
13. Screening Methods in Pharmacology, Robert A. Turner.
14. Rodents for Pharmacological Experiments, Dr. Tapan Kumar chatterjee.
15. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash.

CELLULAR AND MOLECULAR PHARMACOLOGY (MPL104T)

Scope:

The subject imparts a fundamental knowledge on the structure and functions of cellular components and help to understand the interaction of these components with drugs. This information will further help the student to apply the knowledge in drug discovery process

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the receptor signal transduction processes.
- Explain the molecular pathways affected by drugs.
- Appreciate the applicability of molecular pharmacology and biomarkers in drug discovery process.
- Demonstrate molecular biology techniques as applicable for pharmacology

Course outcomes

CO 01: Understand the Structure and Function of Cells
CO 02: Comprehend Molecular Genetics and Gene Expression
CO 03: Analyze Cellular Signaling and Communication
CO 04: Apply Techniques in Cellular and Molecular Biology
CO 05: Integrate Cellular and Molecular Concepts in Health and Disease

60 Hrs

Unit I **12 Hrs**

Cell biology

Structure and functions of cell and its organelles
Genome organization. Gene expression and its regulation, importance of siRNA and micro RNA, gene mapping and gene sequencing
Cell cycles and its regulation.
Cell death– events, regulators, intrinsic and extrinsic pathways of apoptosis. Necrosis and autophagy.

Unit II **12Hrs**

Cell signaling

Intercellular and intracellular signaling pathways.
Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors.
Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol 1,4,5-trisphosphate, (IP3), NO, and diacylglycerol.
Detailed study of following intracellular signaling pathways: cyclic AMP signaling pathway, mitogen-activated protein kinase (MAPK) signaling, Janus kinase (JAK)/signal transducer and activator of transcription (STAT) signaling pathway.

Unit III **12Hrs**

Principles and applications of genomic and proteomic tools
DNA electrophoresis, PCR (reverse transcription and real time), Gene sequencing, micro array technique, SDS page, ELISA and western blotting.

Recombinant DNA technology and gene therapy
Basic principles of recombinant DNA technology-Restriction enzymes, various types of vectors. Applications of recombinant DNA technology.
Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy

Unit IV **12Hrs**

Pharmacogenomics
Gene mapping and cloning of disease gene.
Genetic variation and its role in health/ pharmacology
Polymorphisms affecting drug metabolism
Genetic variation in drug transporters
Genetic variation in G protein coupled receptors
Applications of proteomics science: Genomics, proteomics, metabolomics, functionomics, nutrigenomics

Immunotherapies
Types of immunotherapeutics, humanisation antibody therapy, Immunotherapeutics in clinical practice

Unit V **12Hrs**

a. Cell culture techniques

Basic equipments used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of cells and their application.
Principles and applications of cell viability assays, glucose uptake assay, Calcium influx assays
Principles and applications of flow cytometry

b. Biosimilars

References:

1. The Cell, A Molecular Approach. Geoffrey M Cooper.
2. Pharmacogenomics: The Search for Individualized Therapies. Edited by J. Licinio and M-L. Wong
3. Handbook of Cell Signaling (Second Edition) Edited by Ralph A. et.al
4. Molecular Pharmacology: From DNA to Drug Discovery. John Dickenson et.al
5. Basic Cell Culture protocols by Cheril D.Helgason and Cindy L.Miller
6. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
7. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
8. Current porotocols in molecular biology vol I to VI edited by Frederick M.Ausuvel et la.

PHARMACOLOGY PRACTICAL- I (MPL105P)

Scope:

The subject offers hands-on training in essential pharmacological, biochemical, molecular, and analytical techniques for preclinical drug evaluation. It integrates advanced methodologies such as spectrophotometry, chromatography, fluorimetry, flame photometry, and molecular assays to enhance student proficiency in both in vivo and in vitro pharmacological assessments. Students gain practical exposure to regulatory toxicology, bioanalytical quantification, molecular diagnostics, and pharmacokinetic profiling using validated instruments and software tools.

Objectives:

Upon completion of the course, the student shall be able to

- Demonstrate proficiency in handling laboratory animals and executing ethically sound preclinical experiments involving drug administration, sampling, anesthesia, and euthanasia.
- Evaluate pharmacological effects of drugs through standard models for CNS, analgesic, anti-inflammatory, antiulcer, and metabolic disorders.
- Perform biochemical and molecular assays including DNA/RNA isolation, protein quantification, PCR, Western blotting, and enzyme activity assays to understand drug actions at cellular and molecular levels.
- Conduct pharmacokinetic studies using various routes of administration and apply software tools to analyze drug concentration-time profiles.
- Execute extraction and estimation of drugs from biological fluids using spectroscopic (UV-Vis), chromatographic (HPLC, GC), and fluorimetric techniques.
- Apply advanced analytical instrumentation for multi-component formulation analysis, gene amplification, cell viability assays, and studies on apoptosis and genotoxicity.

Course outcomes

CO 01: Explore pre-clinical experimental techniques, including drug administration, blood sampling, anesthesia, and euthanasia, while adhering to ethical guidelines.
CO 02: Access molecular and biochemical assays, focusing on protein and nucleic acid quantification, gene amplification, enzyme assays, and cell viability in disease contexts.
CO 03: Gain knowledge in conducting pharmacokinetic studies, extracting and analyzing drug concentrations in pre-clinical disease models using UV spectroscopy, HPLC, and software tools.
CO 04: Acquire knowledge of advanced molecular biology techniques, such as DNA/RNA isolation, Western Blotting, PCR, and Comet assays, to study drug effects at the molecular level in pre-clinical disease research.

Handling of laboratory animals:

1. Various routes of drug administration.
2. Techniques of blood sampling, anesthesia and euthanasia of experimental animals.
3. Functional observation battery tests (modified Irwin test)
4. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity.
5. Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity.
6. Evaluation of diuretic activity.

7. Evaluation of antiulcer activity by pylorus ligation method.
8. Oral glucose tolerance test.
9. Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver).
10. Isolation of RNA from yeast
11. Estimation of proteins by Braford/Lowry's in biological samples.
12. Estimation of RNA/DNA by UV Spectroscopy
13. Gene amplification by PCR.
14. Protein quantification Western Blotting.
15. Enzyme based *in-vitro* assays (MPO, AChEs, α amylase, α glucosidase).
16. Cell viability assays (MTT/Trypan blue/SRB).
17. DNA fragmentation assay by agarose gel electrophoresis.
18. DNA damage study by Comet assay.
19. Apoptosis determination by fluorescent imaging studies.
20. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using softwares
21. Enzyme inhibition and induction activity
22. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)
23. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (HPLC)

References

1. CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines,
2. Fundamentals of experimental Pharmacology by M.N.Ghosh
3. Handbook of Experimental Pharmacology by S.K. Kulkarni.
4. Drug discovery and Evaluation by Vogel H.G.
5. Spectrometric Identification of Organic compounds - Robert M Silverstein,
6. Principles of Instrumental Analysis - Doglas A Skoog, F. James Holler, Timothy A. Nieman,
7. Vogel's Text book of quantitative chemical analysis - Jeffery, Basset, Mendham, Denney,
8. Basic Cell Culture protocols by Cheril D. Helgason and Cindy L.Mille
9. Basic Cell Culture (Practical Approach) by J. M. Davis (Editor)
10. Animal Cell Culture: A Practical Approach by John R. Masters (Editor)
11. Practical Manual of Ecperimental and Clinical Pharmacology by Bikash Medhi (Author) Jaypee brothers' medical publishers Pvt. ltd

M. PHARMACY PHARMACOLOGY (MPL) 2nd SEMESTER

ADVANCED PHARMACOLOGY-II
(MPL201T)

Scope

The subject is designed to strengthen the basic knowledge in the field of pharmacology and to impart recent advances in the drugs used for the treatment of various diseases. In addition, the subject helps the student to understand the concepts of drug action and mechanism involved

Objectives

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

Explain the mechanism of drug actions at cellular and molecular level
Discuss the Pathophysiology and pharmacotherapy of certain diseases
Understand the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases

Course outcomes

CO 01: Apply foundational pharmacological principles to advance health and well-being through the effective prevention and treatment of diseases.
CO 02: Understand and evaluate the mechanisms of drug action at various biological levels including organ systems, subcellular/macromolecular level, and molecular interactions.
CO 03: Assess the pharmacological actions of different drug categories and their relevance in treating a range of diseases.
CO 04: Gain comprehensive knowledge of pathophysiology & disease mechanisms and corresponding pharmacological therapies to enhance treatment efficacy.
CO 05: Analyze the adverse effects, contraindications, and clinical applications of drugs to ensure safe and effective patient care.

THEORY **60 Hrs**

UNIT-I

Endocrine Pharmacology

12 Hrs

Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones.
Anti-thyroid drugs, Oral hypoglycemic agents, Oral contraceptives, Corticosteroids.
Drugs affecting calcium regulation

UNIT-II

Chemotherapy

12 Hrs

Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as ß-lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral, and anti-TB drugs.

UNIT-III **12 Hrs**

Chemotherapy
Drugs used in Protozoal Infections
Drugs used in the treatment of Helminthiasis
Chemotherapy of cancer

Immunopharmacology
Cellular and biochemical mediators of inflammation and immune response. Allergic or hypersensitivity reactions. Pharmacotherapy of asthma and COPD.
Immunosuppressants and Immunostimulants

UNIT-IV

GIT Pharmacology
Antiulcer drugs, Prokinetics, antiemetics, anti-diarrheals and drugs for constipation and irritable bowel syndrome.

Chronopharmacology
Biological and circadian rhythms, applications of chronotherapy in various diseases like cardiovascular disease, diabetes, asthma and peptic ulcer

UNIT-V

Free radicals Pharmacology
Generation of free radicals, role of free radicals in etiopathology of various diseases such as diabetes, neurodegenerative diseases and cancer.
Protective activity of certain important antioxidant

Recent Advances in Treatment:
Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus

References

1. The Pharmacological basis of therapeutics- Goodman and Gill man‘s
2. Principles of Pharmacology. The Pathophysiologic basis of drug therapy by David E Golan et al.
3. Basic and Clinical Pharmacology by B.G -Katzung
4. Pharmacology by H.P. Rang and M.M. Dale.
5. Hand book of Clinical Pharmacokinetics by Gibaldi and Prescott.
6. Text book of Therapeutics, drug and disease management by E T. Herfindal and Gourley
7. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
8. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists
9. Robbins & Cortan Pathologic Basis of Disease, 9th Ed. (Robbins Pathology)
10. A Complete Textbook of Medical Pharmacology by Dr. S.K Srivastava published by APC Avichal Publishing Company.
11. KD. Tripathi. Essentials of Medical Pharmacology
12. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy by David E Golan, Armen H, Tashjian Jr, Ehrin J, Armstrong, April W, Armstrong, Wolters, Kluwer-Lippincott Williams & Wilkins Publishers

PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS-II (MPL202T)

Scope:

The subject imparts knowledge on the preclinical safety and toxicological evaluation of drug & new chemical entity. This knowledge will make the student competent in regulatory toxicological evaluation.

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the various types of toxicity studies.
- Appreciate the importance of ethical and regulatory requirements for toxicity studies.
- Demonstrate the practical skills required to conduct the preclinical toxicity studies.

Course outcomes

CO 01: Acquire Practical Skills in performing and interpreting Pharmacological and Toxicological Screening methods in various diseases.
CO 02: Critically Evaluate and integrate research findings by various pre-clinical drug screening methods of in-vivo models.
CO 03: Apply Screening Methods in Health and Disease.
C0 04: Implement the principles of toxicology and adhere to OECD guidelines to ensure compliance with international standards.
C0 05: Evaluate adverse drug reaction (ADR) monitoring protocols to ensure drug safety and efficacy in clinical practice.

THEORY **60 Hrs**

Unit I 12 Hrs

Basic definition and types of toxicology (general, mechanistic, regulatory and descriptive) Regulatory guidelines for conducting toxicity studies OECD, ICH, EPA and Schedule Y OECD principles of Good laboratory practice (GLP).
History, concept and its importance in drug development

Unit II **12 Hrs**

Acute, sub-acute and chronic- oral, dermal and inhalational studies as per OECD guidelines.

Acute eye irritation, skin sensitization, dermal irritation & dermal toxicity studies.
Test item characterization- importance and methods in regulatory toxicology studies.

Unit III **12 Hrs**

Reproductive toxicology studies, Male reproductive toxicity studies, female reproductive studies (segment I and segment III), teratogenecity studies (segment II).

Genotoxicity studies (Ames Test*, in vitro* and *in vivo* Micronucleus and Chromosomal aberrations studies).

In vivo carcinogenicity studies

Unit IV **12 Hrs**

IND enabling studies (IND studies)- Definition of IND, importance of IND, industry perspective, list of studies needed for IND submission.

Safety pharmacology studies- origin, concepts and importance of safety pharmacology. Tier1- CVS, CNS and respiratory safety pharmacology, HERG assay. Tier2- GI, renal and other studies.

Unit V **12 Hrs**

Toxicokinetics- Toxicokinetic evaluation in preclinical studies, saturation kinetics Importance and applications of toxicokinetic studies.

Alternative methods to animal toxicity testing.

REFERENCES

1. Hand book on GLP, Quality practices for regulated non-clinical research and development (http://www.who.int/tdr/publications/documents/glp-handbook.pdf).
2. Schedule Y Guideline: drugs and cosmetics (second amendment) rules, 2005, ministry of health and family welfare (department of health) New Delhi
3. Drugs from discovery to approval by Rick NG.
4. Animal Models in Toxicology, 3rd Edition, Lower and Bryan
5. OECD test guidelines.
6. Principles of toxicology by Karen E. Stine, Thomas M. Brown.
7. Guidance for Industry M3(R2) Nonclinical Safety Studies for the Conduct of Human Clinical Trials and Marketing Authorization for Pharmaceuticals

(http://www.fda.gov/downloads/drugs/guidancecomplianceregulatoryinformation/guidances/ucm073246.pdf)

PRINCIPLES OF DRUG DISCOVERY
(MPL203T)

Scope:

The subject imparts basic knowledge of drug discovery process. This information will make the student competent in drug discovery process

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the various stages of drug discovery.
- Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery
- Explain various targets for drug discovery.
- Explain various lead seeking method and lead optimization
- Appreciate the importance of the role of computer aided drug design in drug discovery

Course outcomes

CO 01: Understand the various stages of drug discovery for education in development
CO 02: Demonstrate the importance of the role of genomics, proteomics and bioinformatics in drug discovery
CO 03: Appraise the role of computers in drug discovery process.
CO 04: Analyze various targets for drug discovery.
CO 05: Demonstrate the various lead seeking and lead optimization methods.

THEORY **60 Hrs**

Unit-I **12 Hrs**

An overview of modern drug discovery process: Target identification, target validation, lead identification and lead Optimization. Economics of drug discovery.

Target Discovery and validation-Role of Genomics, Proteomics and Bioinformatics. Role of Nucleic acid microarrays, Protein microarrays, Antisense technologies, siRNAs, antisense oligonucleotides, Zinc finger proteins. Role of transgenic animals in target validation.

Unit-II **12 Hrs**

Lead Identification- combinatorial chemistry & high throughput screening, in silico lead discovery techniques, Assay development for hit identification.

Protein structure.

Levels of protein structure, Domains, motifs, and folds in protein structure. Computational prediction of protein structure: Threading and homology modeling methods. Application of NMR and X-ray crystallography in protein structure prediction.

Unit-III **12 Hrs**

Rational Drug Design.

Traditional vs rational drug design, Methods followed in traditional drug design, High throughput screening, Concepts of Rational Drug Design, Rational Drug Design Methods: Structure and Pharmacophore based approaches. Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening.

Unit-IV **12 Hrs**

Molecular docking: Rigid docking, flexible docking, manual docking; Docking based screening. De novo drug design.

Quantitative analysis of Structure Activity Relationship

History and development of QSAR, SAR versus QSAR, Physicochemical parameters, Hansch analysis, Fee Wilson analysis and relationship between them.

Unit-V **12 Hrs**

QSAR Statistical methods – regression analysis, partial least square analysis (PLS) and other multivariate statistical methods. 3D-QSAR approaches like COMFA and COMSIA

Prodrug design-Basic concept, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design

References

1. Mouldy Sioud. Target Discovery and Validation Reviews and Protocols: Volume 2 Emerging Molecular Targetsand Treatment Options. 2007 Humana Press Inc.
2. Darryl León. Scott MarkelIn. Silico Technologies in Drug Target Identification and Validation. 2006 by Taylor and Francis Group, LLC.
3. Johanna K. DiStefano. Disease Gene Identification. Methods and Protocols. Springer New York Dordrecht Heidelberg London.
4. Hugo Kubiny. QSAR: Hansch Analysis and Related Approaches. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH

5. Klaus Gubernator, Hans-Joachim Böhm. Structure-Based Ligand Design. Methods and Principles in Medicinal Chemistry. Publisher Wiley-VCH

6. Abby L . Parrill. M . Rami Reddy. Rational Drug Design. Novel Methodology and Practical Applications. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.
7. J. Rick Turner. New drug development design, methodology and, analysis. John Wiley & Sons, Inc., Hoboken, New Jeney.

CLINICAL RESEARCH AND PHARMACOVIGILANCE (MPL204T)

Scope:

This subject will provide a value addition and current requirement for the students in clinical research and pharmacovigilance. It will teach the students on conceptualizing, designing, conducting, managing and reporting of clinical trials.

This subject also focuses on global scenario of Pharmacovigilance in different methods that can be used to generate safety data. It will teach the students in developing drug safety data in Pre-clinical, Clinical phases of Drug development and post market surveillance.

Objectives:

Upon completion of the course, the student shall be able to,

- Explain the regulatory requirements for conducting clinical trial
- Demonstrate the types of clinical trial designs
- Explain the responsibilities of key players involved in clinical trials
- Execute safety monitoring, reporting and close-out activities
- Explain the principles of Pharmacovigilance
- Detect new adverse drug reactions and their assessment
- Perform the adverse drug reaction reporting systems and communication in Pharmacovigilance

CO01: Understand the regulatory requirements for conducting clinical trial and pharmacovigilance.
CO 02: Demonstrate the types of clinical trial designs.
CO 03: Comprehend the responsibilities of different stakeholders involved in clinical trials.
CO 04: Execute medical writing for various purposes, safety monitoring, reporting and close-out activities.
CO 05: Explain the principles and detailed plan, requirements and procedures of pharmacovigilance, pharmacoepidemiology and pharmacoeconomics.

THEORY **60 Hrs**

UNIT-I

Regulatory Perspectives of Clinical Trials: **12 Hrs**

Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines

Ethical Committee- Institutional Review Board, Ethical Guidelines for Biomedical Research and Human Participant-Schedule Y, ICMR

Informed Consent Process: Structure and content of an Informed Consent Process Ethical principles governing informed consent process

UNIT- II

12 Hrs

Clinical Trials: Types and Design

Experimental Study- RCT and Non RCT,
Observation Study: Cohort, Case Control, Cross sectional

Clinical Trial Study Team

Roles and responsibilities of Clinical Trial Personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management

UNIT- III

12 Hrs

Clinical Trial Documentation- Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring-Safety Monitoring in CT

Adverse Drug Reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment. Predictability and preventability assessment, Management of adverse drug reactions; Terminologies of ADR.

UNIT-IV

12 Hrs

Basic aspects, terminologies and establishment of pharmacovigilance

History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance. Roles and responsibilities in Pharmacovigilance

UNIT-V **12 Hrs**

Methods, ADR reporting and tools used in Pharmacovigilance

International classification of diseases, International Non-proprietary names for drugs, Passive and Active surveillance, Comparative observational studies, Targeted clinical investigations and Vaccine safety surveillance. Spontaneous reporting system and Reporting to regulatory authorities, Guidelines for ADRs reporting. Argus, Aris G Pharmacovigilance, VigiFlow, Statistical methods for evaluating medication safety data.

UNIT-VI **12 Hrs**

Pharmacoepidemiology, pharmacoeconomics, safety pharmacology

References

1. Central Drugs Standard Control Organization- Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health;2001.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
6. Handbook of clinical Research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone.
7. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.

PHARMACOLOGY PRACTICAL-II
(MPL205P)

Scope:

The subject imparts knowledge on the preclinical safety and toxicological evaluation of drugs and new chemical entities (NCEs). It provides a comprehensive understanding of pharmacological and toxicological screening methods used to assess drug efficacy, safety, and therapeutic potential. This knowledge will make students competent in regulatory toxicological evaluation, ensuring adherence to international guidelines such as OECD, ICH, and FDA standards.

Objectives:

Upon completion of the course, the student shall be able to,

- Understand the mechanisms of drug action and toxicity in various disease models.
- Apply preclinical safety assessment methodologies to evaluate drug candidates.
- Perform bioassays and toxicological screening to determine drug effects on organ systems.
- Analyze pA_2 values to assess the potency of antagonists in disease-relevant models.
- Utilize QSAR modeling and in silico tools to predict biological activity and toxicity.
- Implement regulatory toxicology frameworks to ensure compliance with global drug safety standards.

Course outcomes

CO01: Understand the application of pharmacological and toxicological screening methods in the context of health and disease.
CO 02: Demonstrate concepts and methodologies of different bioassays for drug response effects on organ tissues for studying diseases.
CO 03: Understand the process of assessing pA2 values of various antagonists to screen drug effects relevant to diseases.
CO 04: Apply the concept of toxicology and adhere to OECD guidelines to ensure compliance with international standards.
CO 05: Analyze in silico QSAR (Quantitative Structure-Activity Relationship) studies to predict the biological activity of compounds and guide drug development.

Handling of Laboratory animals:

1. To record the DRC of agonist using suitable isolated tissues preparation.
2. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation.
3. To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation.

4. To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation
5. To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation
6. To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation.
7. Estimation of PA_2 values of various antagonists using suitable isolated tissue preparations.
8. To study the effects of various drugs on isolated heart preparations.
9. Recording of rat BP, heart rate and ECG.
10. Recording of rat ECG
11. Drug absorption studies by averted rat ileum preparation.
12. Acute oral toxicity studies as per OECD guidelines.
13. Acute dermal toxicity studies as per OECD guidelines.
14. Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies.
15. Drug mutagenicity study using mice bone-marrow chromosomal aberration test.
16. Protocol design for clinical trial (3 Nos).
17. Design of ADR monitoring protocol.
18. In silico docking studies (2 Nos).
    In silico pharmacophore based screening.
19. In silico QSAR studies.
20. ADR reporting

References

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. Text book of *in-vitro* practical Pharmacology by Ian Kitchen
4. Bioassay Techniques for Drug Development by Atta-ur-Rahman, Iqbal choudhary and William Thomsen
5. Applied biopharmaceutics and Pharmacokinetics by Leon Shargel and Andrew B.C.Yu.
6. Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists.

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

Course Outcomes

CO01: Understand the relationship between vulnerability, disasters, prevention and disaster.
CO 02: Enhance knowledge on disasters impact on social, economic, political, psychosocial, health etc.
CO 03: Comprehend the significance of disasters and its types.
CO 04: Analyze the global trends of disasters and adaptation.
CO 05: Impart the learning opportunities to understand the vulnerabilities, urban disasters and waste management

Theory Course content: **60 Hrs**

UNIT I:

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

UNIT II: **15 Hrs**

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.

UNIT III: **15 Hrs**

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.

UNIT I: **15 Hrs**

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 (MRM 301T)

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.
C0 04: Develop a appropriate framework for research studies, study designs and their strengths and limitations.
C0 05: Analyze of statistical results and communicate findings effectively.

Theory Course content: **60 Hrs**

UNIT I: **10 Hrs**

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 **10 Hrs**

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: **10 Hrs**

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: **10 Hrs**

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 **10 Hrs**

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. New York.
- 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 **2Hours/ 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.

   The main objectives of the course are:
   - It will highlight specific issues and important of human rights.
   - To understand the importance of personal development and create positive personality.
   - To identify the national, social and professional values, religious values.
   - To understand about national integration and international cooperation.
   - To understand the basic fundamental rights of constitution.
   - Introduction to human rights.

Course outcomes:
Upon completion of the course the student shall be able to
CO 01: Develop critical thinking about character formation, Personal development and value education.
CO 02: Enhance the knowledge in understanding National and Professional Values.
CO 03: Deepen the awareness about Fundamental Rights.
C0 04: Promote compliance with International and National concepts of Human Rights.
C0 05: Nurture respect to women and children by clearing he concept of their human rights.

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):**

    a. **RB01:** Value Education and Human Rights, R.P. Shukla
    b. **TB01:** Introduction to Human Rights and Duties, Dr. T. S. N. Sastry
    c. **TB02:** Value Education and Education For Human Rights, V.C. Pandey

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.

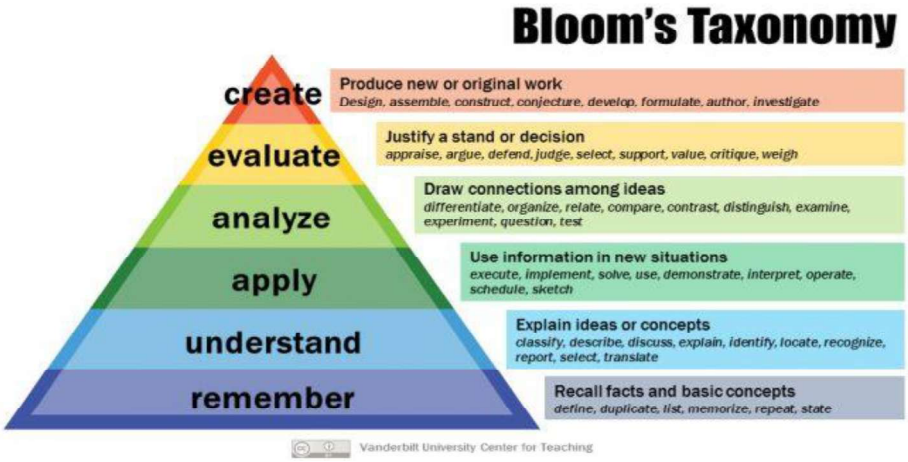

Figure 1. Bloom's Taxonomy [7]

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. Classify antitubercular drugs into first line and second line drugs.

2. Enlist the major classes of antithyroid drugs.

Understand

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

Sample Questions

1. Explain the different types of oral contraceptives.

2. How can an understanding of chronotherapy, which involves timing medication administration based on circadian rhythms, help in the management of these conditions?

Applying

Carrying out or using a procedure through executing or implementing.

Sample Questions

1. Enumerate the different types of oral contraceptives. Mention composition of each. What are the primary mechanisms of action of these oral contraceptives, and what are some common side

effects associated with their use, aiding in a foundational understanding of how these medications prevent pregnancy and their potential risks?

2. What are the main classes of oral hypoglycemic medications, and how do they work to lower blood sugar levels in patients with diabetes, fostering a foundational understanding of their pharmacological mechanisms? Mention the side effect of each drug.

Analysing

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. Compile the main mechanisms of action of antitubercular drugs aiding in the treatment of tuberculosis? Mention briefly the management of tuberculosis emphasizing the main goals of antitubercular chemotherapy.

2. Enumerate the primary mechanisms of action of antithyroid drugs in individuals with hyperthyroidism, facilitating a basic comprehension of their pharmacological effects?

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. Review how corticosteroids exert their pharmacological effects in the body, fostering a basic understanding of their uses. What are the pharmacological actions of these drugs on various organs and site the side effects of these drugs?

2. Define circadian rhythm, and how does it influence various bodily functions and disease processes such as cardiovascular disease, diabetes, asthma, and peptic ulcer?

30. Course Handout

An elaborate document named 'Course Handout' providing details about every single course is shared with students at the beginning of every semester. This document typically has various components like –

Course Handout

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] National Higher Education Qualification Framework Level, Refer to annexure

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:
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

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

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.

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

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

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)		

Faculty members are expected to religiously follow the contents of the course handout in complete letter and spirit.

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

31. Appendix A: Mapping of Programme Outcomes with Course Outcomes

Sr. No.	Course Name	Course Code	Course Outcomes	PO1	PO2	PO3	PO4		PO5	PO6	PO7	PO8	PO9	PO10	PO11
1.	Modern Pharmaceutical Analytical Techniques	MPL-101T	CO 1: The basic theoretical knowledge of the instrumentation techniques available.	M			H		L			L			
			CO 2: Theoretically understand the aspects of separation for multi components.	M	M		H		L			M			
			CO 3: Practical skills for the analysis of drugs and excipients using various instrumentation techniques.	M	M		H		L			M			
			CO 4: To make accurate analysis and report the results in defined formats.						L		M	H	H		
			CO 5: To learn documentation and express the observations with clarity.						H	L	M			H	H
			CO 6: To understand the professional and safety responsibilities for working in the analysis laboratory.	M			H		L			L			
2.	Advanced Pharmacology-I	MPL-102T	CO 1: The students would appreciate the basic knowledge in the field of pharmacology pertaining to the drugs and its therapeutic applications	H		M									
			CO 2: They would have elaborately learnt the recent advances in the drugs used for the treatment of various diseases.	M	H										

			CO 3: They would have understood the concepts of drug action and mechanisms involved.	M		H								
			CO 4: They would have discussed the pathophysiology and pharmacotherapy of certain diseases	H						M				
			CO 5: They would have understood the underlying mechanism of drug actions at cellular and molecular level.		M	H								
			CO 6: They would have learnt the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases	H	M									
3.	Pharmacological and Toxicological Screening Methods-I	MPL-103T	CO 1: Students will appraise the regulations and ethical requirement for the usage of experimental animals.	M					H				H	
			CO 2: Students will understand the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals.	H	H		M							
			CO 3: Students will describe the various newer screening methods involved in the drug discovery process	M	H				H				H	
			CO 4: Students will appreciate and correlate the preclinical data to humans		M	H	H							

4.	Cellular and Molecular Pharmacology	MPL-104T	CO 1: Understand methods used in molecular biology to study molecular pharmacology	H	M									
			CO 2: Describe the current medical conditions involved in molecular pharmacology research including various types of cancer, cardiovascular disease, Alzheimer's and Parkinson's, as well as addiction	H			M							
			CO 3: Focus on cutting edge techniques and approaches, including new methods to quantify biological activities in different systems and ways to interpret and understand pharmacological data.	M	L		M			H	H			L
			CO 4: Highlight advances in pharmacogenomics and explore how an individual's genetic makeup influences their response to therapeutic drugs and the potential for harmful side effects.	L		M	H				H	M		
			CO 5: Understand numerous, real-world examples and a detailed case-study which looks at current and possible future treatment strategies for cystic fibrosis. Appreciate the applicability of molecular pharmacology	L	M		H		M	H		L		

			and biomarkers in drug discovery process												
5.	Pharmacology Practical I	MPL-105P	CO 1: The students would appreciate the basic knowledge in the field of pharmacology pertaining to the drugs and its therapeutic applications	H		M	H			M		L			
			CO 2: They would have elaborately learnt the recent advances in the drugs used for the treatment of various diseases.	H	M	M	H		L						M
			CO 3: They would have understood the concepts of drug action and mechanisms involved.	H		H			L	M		M			
			CO 4: They would have discussed the pathophysiology and pharmacotherapy of certain diseases	H		H			M		L				
			CO 5: They would have understood the underlying mechanism of drug actions at cellular and molecular level.	H		H			M		M				
			CO 6: They would have learnt the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases	H		M	H			M		L			
6.	Advanced Pharmacology II	MPL 201T	CO 1: The students would appreciate the basic knowledge in the field of pharmacology pertaining to	H		M	L								

			the drugs and its therapeutic applications												
			CO 2: They would have elaborately learnt the recent advances in the drugs used for the treatment of various diseases.	L		H	M								
			CO 3: They would have understood the concepts of drug action and mechanisms involved.	M		H	L								
			CO 4: They would have studied the pathophysiology and pharmacotherapy of certain diseases	H	M		L								
			CO 5: They would have understood the underlying mechanism of drug actions at cellular and molecular level.		L	H				M					
			CO 6: They would have learnt the adverse effects, contraindications and clinical uses of drugs used in treatment of diseases	H		M	L								
7.	Pharmacological and Toxicological Screening Methods-II	MPL 202T	CO1: Acquire Practical Skills in performing and interpreting Pharmacological and Toxicological Screening methods in various diseases	M		H	H		M			M			
			CO2: Critically Evaluate and integrate research findings by various pre-clinical drug screening methods of in-vivo models	H	H					M					M

			CO3: Apply Screening Methods in Health and Disease.	H		M	H				M				L
			CO4: Implement the principles of toxicology and adhere to OECD guidelines to ensure compliance with international standards.	M		H			H		M				
			CO5: Evaluate adverse drug reaction (ADR) monitoring protocols to ensure drug safety and efficacy in clinical practice.		M		M		H	H					L
8.	Principles of Drug Discovery	MPL 203T	CO 1: To explain the various stages of drug discovery.	M		H									L
			CO 2: Appreciate the importance of the role of genomics, proteomics and bioinformatics in drug discovery	M	L	H									
			CO 3: Appreciate the importance of the role of computer aided drug design in drug discovery	L		H				M					
			CO 4: Explain various targets for drug discovery.	L		H									
			CO 5: Explain various lead seeking method and lead optimization	L			H			M					
9.	Clinical Research And	MPL 204T	CO 1: Understand the regulatory requirements for conducting clinical trial and pharmacovigilance			M	L		H						

	Pharmacovigilance		CO 2: Demonstrate the types of clinical trial designs			M	L		H						
			CO 3: Comprehend the responsibilities of different stakeholders involved in clinical trials						H				L	M	
			CO 4: Execute medical writing for various purposes, safety monitoring, reporting and close-out activities				L			H		M			
			CO 5: Explain the principles and detailed plan, requirements and procedures of pharmacovigilance, pharmacoepidemiology and pharmacoeconomics							H		M		L	
10.	Pharmacology Practical II	MPL-205P	CO1: Understand the application of pharmacological and toxicological screening methods in the context of health and disease.	H	M		H								
			CO 2: Demonstrate concepts and methodologies of different bioassays for drug response effects on organ tissues for studying diseases.	H	H										
			CO3: Understand the process of assessing pA2 values of various antagonists to screen drug effects relevant to diseases.	M	H				H					H	

			CO4: Apply the concept of toxicology and adhere to OECD guidelines to ensure compliance with international standards.	H	M		H			M					
			CO 5: Analyze in silico QSAR (Quantitative Structure-Activity Relationship) studies to predict the biological activity of compounds and guide drug development.	M	H		M			H			M		
11.	Disaster Management	DM 101	C01: Understand the relationship between vulnerability, disasters, prevention and disaster			H							M		L
			CO2: Enhance knowledge on disasters, impact on social, economic, political, psychosocial, health etc.	H					M					L	
			CO3: Comprehend the significance of disasters and their types.	H					M					L	
			CO 4: Analyse the global trends of disasters and adaptation.			H						M			L
			CO5: Impart the learning opportunities to understand the vulnerabilities, urban disasters and waste management						H			M			L

12.	Research Methodology and Biostatistics	MRM 301T	CO1: Develop the ability to apply the statistical techniques and methods while working on a research project work by using softwares.									M	H		
			CO2: Understand the appropriate statistical methods required for a particular research design.									M	H		
			CO3: Choose the appropriate research design and develop an appropriate research hypothesis for a research project.									M	H		
			CO4: Develop a appropriate framework for research studies, study designs and their strengths and limitations.									M	H		
			CO5: Analyze of statistical results and communicate findings effectively.									M	H		
13.	Human Values & Professional Ethics	HR 101	CO1: Develop critical thinking about character formation, Personal development and value education.			L								M	H
			CO2: Enhance the knowledge in understanding National and Professional Values.	H							M				L
			CO3: Deepen awareness about Fundamental Rights.			H						M		L	
			CO4: Promote compliance with International and	H					L						M

			National concepts of Human Rights.												
			CO5: Nurture respect to women and children by clearing the concept of their human rights.		H						M		L		