RAMAIAH UNIVERSITY OF APPLIED SCIENCES

M.S. Ramaiah University of Applied Sciences

Programme Structure and Course Details

of

M. Pharm Pharmacology

2026-2027

Programme Code: 059

Faculty of Pharmacy

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University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamwork in all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technology backed business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programmes

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Faculty's Vision and Mission

Vision

Aspires to create skilled and competent pharmacy professionals by imparting quality education in pharmaceutical sciences to meet the global health challenges for the betterment of mankind

Mission

M1 - To impart quality education to develop pharmacy professionals to lead the progress in global healthcare

M2 - To evolve into center of excellence in pharmaceutical research

M3 - To create entrepreneurs and problem solvers in multi-disciplinary arena

M4 – To inculcate professional ethics and passion for lifelong learning

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Faculty	Pharmacy
Department	Pharmacology
Programme Code	059
Programme Name	M. Pharm. Pharmacology
Dean of Faculty	Dr. S. Bharath
HOD	Dr. J. Anbu

1. **Title of the Award:** M. Pharm. in Pharmacology
2. **Modes of Study:** Full-Time
3. **Awarding Institution /Body:** M.S. Ramaiah University of Applied Sciences – Bangaluru
4. **Joint Award:** Not Applicable
5. **Teaching Institution: Faculty of Pharmacy, M. S. Ramaiah University of Applied Sciences, Bengaluru**
6. **Date of Programme Specifications: July 2024**
7. **Date of Programme Approval by the Academic Council of MSRUAS: April 2017**
8. **Next Review Date: June 2028**
9. **Programme Approving Regulating Body and Date of Approval: Pharmacy Council of India**
10. **Programme Accredited Body and Date of Accreditation: Not Applicable**
11. **Grade Awarded by the Accreditation Body: Not Applicable**
12. **Programme Accreditation Validity: Not Applicable**
13. **Programme Benchmark: Not Applicable**
14. **Rationale for the Programme**

Pharmacology is a branch of Pharmaceutical sciences which is considered as the backbone of rational drug therapy which includes the study of drugs, their sources, mechanism, metabolism, excretion, uses, adverse effects, interactions, and contraindications. Globally, there is a great need for rapid research, discovery, and characterization of chemicals which show biological effects and the elucidation of their function at organ and cellular levels and a post graduate course in Pharmacology provides the requisite man-power towards the pharmacokinetic and dynamic studies; toxicology, preclinical and clinical studies of new drug molecules. Designing the protocol for the pharmacological evaluation of new drugs and the rationale for the usage of animal models or alternatives for animal models augments the requirement of trained professionals in drug discovery. The new drug discovery process needs pharmacokinetic studies of formulations in animals to establish in-vitro and in-vivo correlations by validated procedures are fulfilled by the trained post graduates to introduce newer methods of toxicological and pharmacological drug screening. Pharmacological research help to identify the interaction profile of a drug in the body to support health care providers choose the right medication and the right dosage for patients. These Post-graduates also play a major role in academics to train the students in developing them as future pharmacists.

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The M. S. Ramaiah College of Pharmacy, now a constituent of MSRUAS as Faculty of Pharmacy has been in existence for more than two decades. Over the years, Faculty of Pharmacy of MSRUAS has grown and evolved as one of the Premier Institutions in the state of Karnataka. It has very good infrastructure, noteworthy laboratory facilities, experienced and competent faculty members. During the last two decades it has produced over 1000 graduates and 120 Post graduates. The presence of other Faculties of applied sciences in the University will facilitate the students to have a better experience and exposure in comparison to the conventional training procedures.

Faculty of Pharmacy of MSRUAS offers M. Pharm degree programme in Pharmacology which is featured with semester pattern curriculum is aimed to emphasize critical thinking, analytical and problem-solving skills, outcome-based curriculum. Importance will be given to research projects based on current demands and requirements for the development of a new drug or repurposing of a existing drug related to a particular global health issue. The curriculum is structured to develop the students for taking up independent professional responsibilities and acquire necessary skills to compete with their global counterparts.

15. Programme Mission

The aim of the programme is to produce proficient postgraduates with advanced knowledge and skills in preclinical and clinical research on new drug molecules to determine the safety and effectiveness.

16. Graduate Attributes (GAs)

- **GA-1. Pharmaceutical Knowledge Proficiency**: Strong grounding in core and applied pharmaceutical sciences and practice
- **GA-2. Scientific and Analytical Thinking**: Ability to critically analyze data, processes, and clinical information
- **GA-3. Ethical and professional Integrity**: Commitment to ethical conduct, patient safety and regulatory compliance
- **GA-4. Patient-Centered Orientation**: Sensitivity to patient needs, cultural diversity and healthcare outcomes.
- **GA-5. Industry and Practice Readiness**: Preparedness for roles in industry, hospitals, community pharmacy, research and regulation
- **GA-6. Digital and Technological Awareness**: Familiarity with AI, data analytics, automation, and modern pharmaceutical technologies
- **GA-7. Effective Communication Skills**: Clear, empathetic, and professional interaction across healthcare settings
- **GA-8. Teamwork and Leadership Skills**: Ability to collaborate, lead, and contribute constructively in teams
- **GA-9. Innovation and Problem-Solving Mindset**: Capability to identify problems and develop practical, evidence-based solutions
- **GA-10. Lifelong Learning Orientation**: Motivation for continuous professional development and higher education

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17. Programme Outcomes (POs)

M. Pharm. graduates will be able to:

PO-1. Pharmacy Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.

PO-2. Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO-3. Problem analysis: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

PO-4. Modern tool usage: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO-5. Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well- being.

PO-6. Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

PO-7. Pharmaceutical Ethics: Honor personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO-8. Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO-9. The Pharmacist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO-10. Environment and sustainability: Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-11. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self- assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

18. Programme Goal

The programme goal is to produce proficient postgraduates with good understanding of pharmacological principles and independently to meet higher level expectations of pharmaceutical industry, academics, research or take up entrepreneurial path.

19. Program Educational Objectives (PEOs)

The objectives of the M. Pharm program in Pharmacology are to:

PEO-1. Uphold all laws, regulations, safety and ethical standards that apply to experimental procedures in animals and the environment

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PEO-2. Impart adequate hands-on training with various animal models and determine the toxicological and pharmacological effects of drugs using appropriate models

PEO-3. Provide practical knowledge in various analytical techniques used in molecular biology and screening of formulations in animals to establish *in-vitro* and *in-vivo* correlations in drug discovery process

PEO-4. Train the students in using suitable statistical methods for interpretation of results and prepare the students for teamwork and lifelong learning for the betterment of mankind

20. Programme Specific Outcomes (PSOs)

At the end of the M. Pharm program in Pharmacology, the graduate will be able to:

PSO-1. Apply core and advanced concepts of cellular and molecular pharmacology for target identification, screening and validation to ensure safe and rational pharmacotherapy

PSO-2. Demonstrate leadership, ethical responsibility, and effective professional skills in pharmaceutical sciences by addressing societal healthcare needs, promoting environmentally sustainable practices, and engaging in lifelong learning for continuous professional growth and innovation

21. Programme Structure

Table 1. Programme Structure

Course Code	Courses	Credits	Hours/ Week
SEMESTER – I			
DEPARTMENT COMMON COURSE			
PLF501A	1. Modern Pharmaceutical Analytical Techniques	4	4
PROGRAMME SPECIALIZATION COURSES			
PLC502	1. Advanced Pharmacology-I	4	4
PLC503	Pharmacological and Toxicological Screening Methods-I	4	4
PLC504	3. Cellular and Molecular Pharmacology	4	4
PLL505A	4. Pharmacology Practical I	6	12
PLS506	5. Seminar/Assignment	4	7
SEMESTER – II			
PROGRAMME SPECIALIZATION COURSES			
PLC507	1. Advanced Pharmacology- II	4	4
PLC508	Pharmacological and Toxicological Screening Methods-II	4	4
PLC509	3. Principles of Drug Discovery	4	4
PLC510	4. Clinical Research and Pharmacovigilance	4	4
PLL511	5. Pharmacology Practical II	6	12
PLS512	6. Seminar/Assignment	4	7
SEMESTER – III			
FACULTY COMMON SPECIALIZATION			
PLF613	1. Research Methodology and Biostatistics	4	4
PLL614	2. Journal Club	1	2
PLF615	3. Group project	4	

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PLF616	4. Discussion/synopsis Presentation (Proposal Presentation)	2	2
PLF617	5. Research Work	14	28
SEMESTER – IV			
PROGRAMME COMMON SPECIALIZATION			
PLF618	1. Journal Club	1	1
PLF619	2. Discussion/ Presentation	3	3
PLF620	3. Research Work	16	31
MANDATORY COURSE/S			
PLF621	1. Participation/Presentation: National/International Seminar, Conferences, Workshops	3	-
PLF622	2. Publication : National / International Journals		-
PLF623	3. Academic/Research award: State/National/International Agencies /MOOC		-

22. Course Delivery: As per the Timetable

23. Teaching and Learning Methods

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory work/Field work/Workshop
6. Industry Visit
7. Seminars
8. Group Exercises
9. Project Work
10. Project
11. Exhibitions
12. Technical Festivals
13. Assessment and Grading

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Table 2 Assessment and Grading

SEMESTER - I

Course code	Name of Course	Internal Assessment				Semester End Examination		Total Marks
		Continuous Mode	Sessional Examination		Total	Mark	Duration	
			Marks	Duration				
PLF501A	Modern Pharmaceutical Analytical Techniques	10	15	1h.	25	75	3h.	100
PLC502	Advanced Pharmacology-I	10	15	1h.	25	75	3h.	100
PLC503	Pharmacological and Toxicological Screening Methods-I	10	15	1h.	25	75	3h.	100
PLC504	Cellular and Molecular Pharmacology	10	15	1h.	25	75	3h.	100
PLL505A	Pharmacology Practical- I	20	30	6h.	50	100	6h.	150
PLS506	Seminar/ Assignment	-	-	-	-	-	-	100

SEMESTER II

Course Code	Course	Internal Assessment				Semester End Examination		Total Marks
		Continuous Mode	Sessional Examination		Total	Marks	Duration	
			Marks	Duration				
PLC507	Advanced Pharmacology- II	10	15	1h.	25	75	3h.	100
PLC508	Pharmacological and Toxicological Screening Methods -II	10	15	1h.	25	75	3h.	100
PLC509	Principles of Drug Discovery	10	15	1h.	25	75	3h.	100
PLC510	Clinical Research and Pharmacovigilance	10	15	1h.	25	75	3h.	100
PLL511	Pharmacology Practical- II	20	30	6h.	50	10	6h.	150
PLS512	Seminar/ Assignment	-	-	-	-	-	-	100

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SEMESTER III

Course Code	Course	Internal Assessment				Semester End Examination		Total Marks
		Continuous Mode	Sessional Examination		Total	Marks	Duration	
			Marks	Duration				
PLF613	Research Methodology and Biostatistics	10	15	1h.	25	75	3 h.	100
PLF614	Journal Club	-	-	-	25	-	-	25
PLF616	Discussion / Synopsis Presentation	-	-	-	50	-	-	50
PLF617	Research Work	-	-	-	-	350	1h.	350

SEMESTER IV

Course Code	Course	Internal Assessment				Semester End Examination		Total Marks
		Continuous Mode	Sessional Examination		Total	Marks	Duration	
			Marks	Duration				
PLF618	Journal Club	-	-	-	25	-	-	25
PLF619	Discussion / Presentation	-	-	-	75	-	1h.	75
PLF620	Research Work	-	-	-	-	400	-	400

24.1 Components of Grading

There shall be **two components** of grading in the assessment of each course:

Component 1, Continuous Evaluation (CE): This component involves multiple subcomponents (SC1, SC2, etc.) of learning assessment. The assessment of the subcomponents of CE is conducted during the semester at regular intervals. This subcomponent represents the formative assessment of students' learning.

Component 2, Semester-end Examination (SEE): This component represents the summative assessment carried out in the form an examination conducted at the end of semester.

Marks obtained CE and SEE components have a weightage of 25:75 (CE:25% and SEE: 75%) in determining the final marks obtained by a student in a Course.

The complete details of Grading are given in the Academic Regulations.

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24.2 Continuous Evaluation Policies

Continuous evaluation depends on the type of course as discussed below:

24.2.1 Theory Courses

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent ▶	SC1	SC2	SC3	
Subcomponent Type ▶	Attendance	Student – Teacher Interaction	Sessional Exam	Semester End Examination 75 Marks
Maximum Marks ▶	8	2	15	
CO-1				
CO-2				
CO-3				
CO-4				
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

24.2.2 Laboratory Courses

Focus of Cos on each Component or Subcomponent of Evaluation				
	Component1: CE (25%Weightage)			Component2: SEE (75%Weightage)
Subcomponent ▶	SC1	SC2	SC3	
Subcomponent Type ▶	Attendance	tudent – Teacher Interaction	ssionalExam	emester End Examination100 Marks
Maximum Marks ▶	10	10	30	
CO-1				
CO-2				
CO-3				
The details of SC1,SC2,SC3 are presented in the Programme Specifications Document.				

Theory
(Component -1: 25 Marks + Component-2: 75Marks)
Component - 1: - 25 Marks
It has two sub-components (Part A & B)
Part – A: Continuous Evaluation: 10 Marks
The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

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Table 3. Scheme for awarding Continuous Evaluation-Theory

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction**	2
Total	10

** student will be continuously assessed during theory and practical sessions

Table 4. Guidelines for the allotment of marks for attendance*

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

Part – B: Sessional Examination: 15 Marks

Two sessional examinations (each for 15 Marks with one hour duration) will be conducted. Average marks of the two sessionals will be computed for sessional examination marks.

Component -2 Semester End Theory Examination: 75 Marks

Theory Examination: A theory exam shall be conducted for maximum marks 75 Marks with three hours of duration

Practical – 150 Marks

(Component -1: 50 Marks + Component-2: 100Marks)

Component - 1: - 50 Marks

It has two sub-components (Part A & B)

Part – A: Continuous Evaluation: 20 Marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Scheme for awarding Continuous Evaluation -Practical

Criteria	Maximum Marks
Attendance*	10
Practical Records, Regular viva-voce**	10
Total	20

Guidelines for allotment of marks for attendance*

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

Part – B: Sessional Examination: 30 Marks

Two sessional examinations (each for 30 Marks with six-hour duration) will be conducted. Average marks of the two sessionals will be computed for sessional examination marks.

Component -2 Semester End Practical Examination: 100 Marks

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Practical Examination: 100 Marks with six hours of duration. Practical examination shall also consist of a viva –voce (Oral) examination.

The assessment questions are set to test the learning outcomes. In each component a certain learning outcome is assessed.

Note: For more details on the break-ups, please refer to the Course Specifications

A student is required to score an overall 50% for successful completion of a course and earn the credits.

Note: Final marks awarded in each of the courses will be confirmed only after SAB/PAB as explained in Academic Regulations of M. Pharm. Programme.

Assignment & Seminar

The detailed procedure and evaluation procedure is available in the Operation Manual / Student Handbook/Academic Regulations.

Journal Club

The detailed procedure and evaluation procedure is available in the Operation Manual / Student Handbook/Academic Regulations.

Group Project

The detailed procedure and evaluation procedure is available in the Operation Manual / Student Handbook/Academic Regulations

Mandatory Courses

The credit points assigned for extracurricular and or co-curricular activities shall be given by the Dean of the Faculty and the same shall be submitted to the University.

Name of the Activity	Maximum credit points Eligible /Activity
Participation in National level Seminar/ Conference / Workshop/Symposium/Training Programs	01
Participation in International level outside India 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

Dissertation/Research Work

1. Every candidate shall carry out work on an assigned research project under the guidance of a recognized Postgraduate Teacher, the result of which shall be written up and submitted in the form of a dissertation.
2. Work for writing the Dissertation is aimed at contributing to the development of spirit of enquiry, besides exposing the candidate to the techniques of research, critical analysis, acquaintance with the latest advances in pharmaceutical/medical sciences and the manner of identifying and consulting available literature. Dissertation shall be submitted as per the notified time schedule mentioned in the Academic calendar / student hand book.
3. The Dissertation and viva-voce shall be evaluated by two examiners, one internal and one External examiner appointed by the University.

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Scheme of 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	

Scheme of Evaluation of Presentation:

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

A student is required to score a minimum of 50% overall for successful completion of Dissertation and earn the corresponding credits.

Supplementary/re-registration examination and improvement of sessional marks

The eligibility criteria and procedures for supplementary examination and improvement of sessional marks are as per the Pharmacy Council of India (PCI) norms and as indicated in the Academic Regulations governing this programme.

24. Student Support for Learning

Course Notes
Reference Books in the Library
Magazines and Journals
Internet Facility
Computing Facility
Laboratory Facility
Workshop Facility
Staff Support
Lounges for Discussions
Any other support that enhances their learning

25. Quality Control Measures

Review of Course Notes
Review of Question Papers and Assignment Questions
Student Feedback
Moderation of Assessed Work
Opportunities for students to see their assessed work
Review by external examiners and external examiners reports
Staff Student Consultative Committee meetings
Student exit feedback
Subject Assessment Board (SAB)
Programme Assessment Board (PAB)

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27. Programme Map (Course-PO-PSO Map)

Sem.	Course Title	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
1	Modern Pharmaceutical Analytical Techniques	2		1	2							3	2	2
1	Advanced Pharmacology-I			3						2		2	1	1
1	Pharmacological and Toxicological Screening Methods-I	2		2	2			3			2		2	1
1	Cellular and Molecular Pharmacology			2	3	2							2	
1	Pharmacology Practical- I			3	3			3				2	1	1
1	Seminar/ Assignment			3					3			3	1	2
2	Advanced Pharmacology- II	2		3						2		2	2	1
2	Pharmacological and Toxicological Screening Methods-II	2		3	2			3			2		1	1
2	Principles of Drug Discovery		3	3	3							2	2	1
2	Clinical Research and Pharmacovigilance			3	2		2	3	2				2	1
2	Pharmacology Practical- II			2	2			3					2	1
2	Seminar/ Assignment			3					3			3	2	2
3	Research Methodology and Biostatistics	3	3	2				3		2	1	3	2	2
3	Journal Club	1	1		3				3			1	2	2
3	Discussion / Synopsis Presentation	1	2	3	3	1		3				1	2	2
3	Research Work	2	2	2	2				3			2	2	2
4	Journal Club	1	3	3	2		2	2	3	1	1	1	2	2
4	Discussion / Presentation	1	1		3				3			1	2	2
4	Research Work	1	3	3	2		2	2	3	1	1	1	2	2
4	Participation/Presentation in research forum: National / International Seminar, Conferences, Workshops	1	3	3	2		2	2	3	1	1	1	2	2
4	Publication: National / International Journals			3		3	3		3			3	2	2
4	Academic/Research award: State/National/International Agencies/MOOC			3	3		3	3	3			3	2	2

28. Co-curricular Activities

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposia, paper writing, attending industry exhibitions, project competitions and related activities for enhancing their knowledge and networking.

29. Cultural and Literary Activities

Annual cultural festivals are held to showcase the creative talents in students. They are involved in planning and organizing the activities.

30. Sports and Athletics

Students are encouraged to take part in sports and athletic events regularly. Annual sports meet will be held to demonstrate sportsmanship and competitive spirit.

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RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Course Specifications

M. Pharm in Pharmacology

Programme Code: 059

Faculty of Pharmacy
Batch: 2026-27

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Course Specifications: Modern Pharmaceutical Analytical Techniques

Course Title	Modern Pharmaceutical Analytical Techniques
Course Code	PLF501A
Course Type	Core Theory
Department	Pharmaceutical Chemistry
Faculty	Pharmacy

1. Course Summary

This course is to provide in-depth knowledge of advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery. This course also emphasizes on the strategies as synthon approach and retro-synthesis.

2. Course Size and Credits:

Number of Credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Pharmaceutical Chemistry
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Explain the fundamental principles, theory, instrumentation and applications of UV-visible and IR spectroscopy, fluorimetric analysis, flame emission and atomic absorption spectroscopy
- **CO-2** Elaborate the theory, instrumentation and applications of NMR and Mass spectroscopy
- **CO-3** Discuss the principle, instrumentation and applications of chromatographic and electrophoretic separation techniques
- **CO-4** Summarize the principle, instrumentation and applications of potentiometric methods, X-ray crystallographic methods and thermo-analytical methods

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4. Course Contents

Unit 1 **10 hours**

a. UV-Visible spectroscopy:

Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.

b. IR spectroscopy:

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

c. Spectroflourimetry:

Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analyzed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.

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

Unit 2 **10 hours**

NMR spectroscopy:

Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy

Unit 3 **10 hours**

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.

Unit 4 **10 hours**

Chromatography:

Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:a) Thin Layer chromatography ,b) High Performance Thin Layer Chromatography,c) Ion exchange chromatography,d) Column chromatography,e) Gas chromatography,f) High Performance Liquid chromatography,g) Ultra High-Performance Liquid chromatography,h) Affinity chromatography i) Gel Chromatography,k) Paper Chromatography

Unit 5 **10 hours**

a. 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

b. X ray Crystallography:

Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray

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powder technique, Types of crystals and applications of X-ray diffraction.

Unit 6 **10 hours**

a. Potentiometry:

Principle, working, Ion selective Electrodes and Application of potentiometry.

b. 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.

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	2			2							2	2	1
CO-2	2		1	2							3	2	1
CO-3	2		1	2							3	2	2
CO-4	2		1	2							2	2	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		55
Demonstrations		02
1. Demonstration using Videos	2	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		00
Practical Work		03
Course Laboratory	00	
Computer Laboratory	00	
Engineering Workshop / Course/Workshop / Kitchen	00	
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		
1. Case Study Presentation	00	
2. Guest Lecture	01	

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3. Industry / Field Visit	00	
4. Brain Storming Sessions	01	
5. Group Discussions	01	
6. Discussing Possible Innovations	00	
Written Examination		5
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Student – Teacher Interaction**	**Sessional Exam**	**Semester End Examination 75 Marks**
Maximum Marks	**8**	**2**	**15**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	**Maximum Marks**
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	**Marks**
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

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Component - 2: 75 marks
A 3-hour duration Semester End Examination will be conducted for maximum marks of 75. Both components will be evaluated by a second examiner.

Re-assessment
1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities is limited and as per the academic regulations governing this Programme. The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class Notes

b. Essential Reading

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1. Silverstein, RM. Webster, FX (2004) Spectrometric identification of organic compounds,6thEdition, New York: John Wiley and Sons.
2. Mendham, J. Denny, RC. Barnes, JD. Thomas, M. (2008). Vogel's Textbook of quantitative chemical analysis. 6th Edition, New Delhi: Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in South Asia.
3. Willard, HH. Merritt, LL. Dean, JA. Settle, FA. Instrumental methods of analysis.7thEdition, New Delhi: CBS Publishers and Distributors.
4. Beckett, AH. Stenlake, JB. (2004) Practical Pharmaceutical Chemistry. Vol. I & II. London: The Athlon Press of the University of London.

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5. Kemp, W. (2008) Organic spectroscopy. 3rdEdition. New York: Palgrave.
6. Skoog, DA. West, DM. Hollen, FG. Fundamentals of Analytical chemistry, 6th Edition, USA:
7. Saunders College Publishing.
8. Munson, JW. (2001) Pharmaceutical Analysis-Modern methods-Part B. Vol II Marcel Dekker series. Mumbai, India: International Medical Book Distributors.
9. Sethi, PD. (1997) Quantitative Analysis of Drugs in Pharmaceutical formulation 3rd Edition, New Delhi: CBS Publishers.
10. Connors, KA. (1982) A textbook of pharmaceutical analysis. 3rd Edition, New York: John Wiley and Sons.

c. Recommended Reading

1. Hoffmann,ED. Stroobant,V. (2001) Mass spectrometry: Principles and Applications. 2nd Ed. England: John Wiley and Sons Ltd.
2. Troy, D.B & Beringer, P. (2006) Remington's: The Science and Practice of Pharmacy. 22nd edition. New York: Lipincott Williams and Wilkins.
3. United State of Pharmacopeial Convention, (2004). The United States Pharmacopoeia-27 (NF-22). Rockville: MD
4. Government of India, (2014) Indian Pharmacopoeia. New Delhi: Government of India.

d. Magazines and Journals

1. Indian Journal of Chemistry
2. Indian Journal of Pharmaceutical Sciences

e. Websites

1. www.sciencedirect.com
2. www.elsevier.com
3. www.pubmed.com

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Course Specifications: Advanced Pharmacology – I

Course Title	Advanced Pharmacology – I
Course Code	PLC502
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The course helps students to strengthen their basic knowledge in pharmacology and understand the concepts of drug action and the mechanisms involved. The course also emphasizes on the recent advances in Pharmacology and Pharmacotherapy.

2. Course Size and Credits

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Explain the pharmacokinetics and mechanism of drug action at organ system/cellular/ molecular levels
- **CO-2** Discuss the pathophysiology and pharmacotherapy of certain diseases
- **CO-3** Summarize the pharmacology, adverse drug reactions and drug interactions of drugs acting on various systems
- **CO-4** Elaborate on the recent advances in Pharmacology and Pharmacotherapy

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4. Course Contents

Unit 1.

General Pharmacology **12 hours**

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

Pharmacodynamics: 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 2.

Neurotransmission **12 hours**

General aspects and steps involved in neurotransmission.

Neurohumoral transmission inautonomic nervous system (Detailed study about neurotransmitters- Adrenaline and Acetyl choline).

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

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

Unit 3.

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 **8 hours**

Parasympathomimetic and lytics, sympathomimetics and lytics; agents affecting neuromuscular junction

Central nervous system Pharmacology **12 hours**

General and local anesthetics; Sedatives and hypnotics, drugs used to treat anxiety; Depression, psychosis, mania, epilepsy, neurodegenerative diseases; Narcotic and non-narcotic analgesics

Cardiovascular Pharmacology **12 hour**

Diuretics, antihypertensives, anti-ischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia; Hematinics, coagulants, anticoagulants, fibrinolytics and antiplatelet drugs

Autocoid Pharmacology **12 hours**

The physiological and pathological role of Histamine, Serotonin, Kinins, Prostaglandins Opioid autocoids; Pharmacology of antihistamines, 5HT antagonists.

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – I PLL505")

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3									1	
CO-2									2				1
CO-3			3						2			1	1
CO-4											2		1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		50
Demonstrations		05
1. Demonstration using Videos	5	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		05
1. Case Study Presentation		
2. Guest Lecture	01	
3. Industry / Field Visit		
4. Brain Storming Sessions	01	
5. Group Discussions	02	
6. Discussing Possible Innovations	01	
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

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Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent	SC1	SC2	SC3	
Subcomponent Type	Attendance	Student – Teacher Interaction	Sessional Exam	Semester End Examination 75 Marks
Maximum Marks	8	2	15	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	**8**
90 – 94	**6**
85 – 89	**4**
80 – 84	**2**
Less than 80	**0**

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3-hour duration Semester End Examination will be conducted for maximum marks of 75. Both components will be evaluated by concerned course leader/s.

Re-assessment

1. A student who fails to secure a minimum 50% in component 1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

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The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class notes

b. Essential Reading

1. Brunton, L.L., Lazo, J.S. and Parker, K.L. (2006) Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th edn, New York: Pergamon Press.

2. Golan, D.E., Tashjian, A.H., Armstrong. A.W., and Ehrin, J.A. (2008) Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy, 3rd edn, Philadelphia: Lippincott Williams Wilkins.

3. Katzung, B.G. (2009) Basic and Clinical Pharmacology, 11th edn, New Delhi: Tata McGraw Hill.

4. Rang, M.P., Dale, M.M. and Riter, J.M. (1995) Pharmacology, 4th edn, China: Churchill Livingstone.

5. Gibaldi, M. and Prescott, L. (1988), Handbook of Clinical Pharmacokinetics Section III, Balgowlah, Australia: ADIS Health Science Press.

6. Eric Herfindal, T. (2000) Clinical Pharmacy and Therapeutics, 7th edn, Philadelphia: Lippincott Williams and Wilkins.

7. Shargel, L and Andrew, B.C. Yu. (2012) Applied Biopharmaceuticals & Pharmacokinetics, 6th edn, New York: McGraw-Hill publishers.

8. Younggil Kwon (2001) Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists, 1st edn, New York: Springer.

9. Dipiro, J., Talbert, R. L., Yee, G., Matzke, G., Wells, B. and Posey, M. (2011), Pharmacotherapy: A Pathophysiologic Approach, 8th edn, Connecticut: Appleton and Lange.

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c. Recommended Reading

1. Sharma, H.L. and Sharma, K. K. (2011) Principles of Pharmacology, 2nd edn, Hyderabad: Paras Medical Publisher.

2. Tripathi, K. D. (2008) Essentials of Medical Pharmacology, 6th edn, New Delhi: Jaypee Publishers.

3. Walker, R. (2009) Clinical Pharmacy and Therapeutics, 2nd edn, London: Churchill Livingstone.

4. Kumar, V., Abbas, A., Fausto, N., and Astor, J. C. (2011) Robbins and Cotran Pathologic Basis of Disease, 8th edn, Philadelphia: W. B. Saunders.

5. Longo, D. L., Kasper, D. L., Jameson, J. L., Fauci, A. S., Hauser, S. L. and Loscalzo, J. (2012) Harrisosn's Principles of Internal Medicine, 18th edn, New York: McGraw Hill.

d. Magazines and Journals

1. Indian Journal of Pharmacology
2. Journal of Pharmacology and Experimental Therapeutics
3. European journal of Pharmacology
4. British Journal of Pharmacology

e. Websites

1. www.aspet.org
2. www.virtualpharmacologylab.com

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Course Specifications: Pharmacological and Toxicological Screening Methods – I (Theory)

Course Title	Pharmacological and Toxicological Screening Methods – I
Course Code	PLC503
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This course imparts knowledge on preclinical evaluation of drugs and current advanced experimental techniques involved in drug discovery and development. The course content helps the student understand the maintenance of laboratory animals as per the guidelines and the various *in-vitro* and *in-vivo* preclinical evaluation processes.

2. Course Size and Credits:

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Explain the good laboratory practices in maintenance and handling of experimental animals
- **CO-2** Appraise the regulations and ethical requirements for the usage of experimental animals
- **CO-3** Relate preclinical data to humans and Identify alternatives to animal experiments
- **CO-4** Recommend appropriate preclinical models for evaluation of new drugs and justify

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4. Course Contents

Unit 1.
Laboratory Animals **12 hours**

a. Common laboratory animals: Description, handling and applications of different species and strains of animals
b. Transgenic animals: Production, maintenance and applications
c. Anaesthesia and euthanasia of experimental animals
d. Maintenance and breeding of laboratory animals
e. CPCSEA guidelines to conduct experiments on animals
f. Good laboratory practice
g. Bioassay-Principle, scope and limitations and methods

Unit 2: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. **12 hours**

a. General principles of preclinical screening
b. CNS Pharmacology: behavioral and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti-epileptics and nootropics
c. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimer's and multiple sclerosis. Drugs acting on the Autonomic Nervous System

Unit 3: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. **12 hours**

a. Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti allergics.
b. Reproductive Pharmacology: Aphrodisiac and antifertility agents
c. Analgesics, anti-inflammatory and antipyretic agents.
d. Gastrointestinal drugs: antiulcer, anti -emetic, antidiarrheal and laxatives.

Unit 4: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. **12hours**

a. Cardiovascular Pharmacology: antihypertensives, antiarrhythmics, antianginal, antiatherosclerotic agents and diuretics.
b. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents.
c. Anti-cancer agents.
d. Hepatoprotective screening methods.

Unit 5: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. **12 hours**

a. Immunomodulators, Immunosuppressants and immunostimulants
b. General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems.
c. Immunoassay methods evaluation; protocol outline, objectives and preparation.
d. Immunoassay for digoxin and insulin Limitations of animal experimentation and alternate animal experiments.
e. Extrapolation of in vitro data to preclinical and preclinical to humans

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – I PLL505")

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	2									2		1	1
CO-2							3						1
CO-3			2	2								2	
CO-4				2								1	
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		50
Demonstrations		05
1. Demonstration using Videos	5	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		05
1. Case Study Presentation		
2. Guest Lecture	01	
3. Industry / Field Visit		
4. Brain Storming Sessions	01	
5. Group Discussions	02	
6. Discussing Possible Innovations	01	
Written Examination		5
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table:

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Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent	SC1	SC2	SC3	
Subcomponent Type	Attendance	Student–Teacher Interaction	Sessional Exam	Semester End Examination 75 Marks
Maximum Marks	8	2	15	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3-hour duration Semester End Examination will be conducted for maximum marks of 75. Both components will be evaluated by concerned course leader/s.

Re-assessment

1. A student who fails to secure a minimum 50% in component 1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme. The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the

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above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class notes

b. Essential Reading

1. Burn, J. H., Finney, D.J., and Goodwin, I. G. Biological Standardisation, Blackwell Scientific Publications, Oxford.
2. Indian Pharmacopeia 7th Edn and other Pharmacopeias
3. Turner, R. A. (1965) Screening Methods in Pharmacology, New York: Academic Press Inc.
4. Laurence, D.R. and Bacharach, A.L. (1964) Evaluation of Drug Activities: Pharmacometrics. Vol. 1 and 2, London: Academic Press.
5. Schwartz, A. Methods in Pharmacology, New York: Plenum Publishing Corporation.
6. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company.
7. McLeod, L. J. (1970) Pharmacological experiments on intact preparations, New York: Churchill Livingstone
8. Vogel H.G. and Vogel, W.H. (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn, New York: Springer.
9. World Health Organisation, (2004) WHO guidelines on Safety Monitoring of Herbal Medicines in Pharmacovigilance Systems, World Health Organization.
10. OECD guidelines on toxicity studies

c. Recommended Reading

1. Goyal, R.K. (2000) Practicals in Pharmacology, 2nd edn, Ahmedabad: B S Shah Prakashan.
2. Gupta, S.K. (2009), Drug Screening Methods, 2nd edn, New Delhi: Jaypee Brothers Medical

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3. Kulkarni, S.K. (1999) Hand Book of Experimental Pharmacology, 3rd edn, New Delhi: Vallabh Prakashan.
4. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company.
5. Goyal, R.K. (2000) Practicals in Pharmacology, 2nd edn, Ahmedabad: BS Shah Prakashan.
6. Vrushabendra Swamy, B.M., Jayaveera, K.N. and Reddy, V.A. (2014) Experimental Pharmacology and Toxicology, New Delhi: Chand and Company Pvt. Ltd.
7. Parmer, N.S. and Prakash, S. (2006) Screening Methods in Pharmacology, New Delhi: Narosa Publishing House.
8. Himanshu Joshi. (2006) An Alternative Approach to Experimental Pharmacology, Naintal: Himadeep Publishers.
9. Brunton, L.L., Lazo, J.S. and Parker, K.L. (2006) Goodman and Gilman's The Pharmacological basis of Therapeutics, 11th Edn, New York: Pergamon Press

d. d. Magazines and Journals

1. Indian Journal of Pharmacology
2. Journal of Pharmacology and Experimental Therapeutics
3. European journal of Pharmacology
4. British Journal of Pharmacology

e. Websites

1. www.aspet.org
2. www.virtualpharmacologylab.com

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Course Specifications: Cellular and Molecular Pharmacology (Theory)

Course Title	Cellular and Molecular Pharmacology
Course Code	PLC504
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. **Course Summary**

This course imparts fundamental knowledge on the structure and functions of cellular components and helps students to understand the interaction of these components with drugs. This information will help students to gain better understanding of drug discovery process.

2. **Course Size and Credits:**

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Explain receptor signaling pathways and molecular mechanisms of drug action
- **CO-2** Discuss molecular biology and cell culture techniques for therapeutic innovation
- **CO-3** Analyze pharmacogenomics and genetic variations affecting drug response
- **CO-4** Identify the role of biomarkers and molecular concepts and tools in drug discovery

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4. Course Contents

Unit 1. Cell Biology **12 hours**

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 2. Cell Signaling **12 hours**

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 3. Principles and applications of genomic and proteomic tools **12 hours**

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 4. Pharmacogenomics **12 hours**

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, Immunotherapeutics

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

Unit 5. Cell culture techniques **12 hours**

Basic equipment's 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 Biosimilar

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – I PLL505P")

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			2									1	
CO-2			2									1	
CO-3			2									1	
CO-4				3	2							2	

3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution

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6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		45
Demonstrations		10
1. Demonstration using Videos	10	
2. Demonstration using Physical Models / Systems	00	
3. Demonstration on a Computer	00	
Tutorials		00
Practical Work		
Course Laboratory	00	
Computer Laboratory	00	
Engineering Workshop / Course/Workshop / Kitchen	00	
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		05
1. Case Study Presentation	00	
2. Guest Lecture	02	
3. Industry / Field Visit	00	
4. Brain Storming Sessions	03	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Written Examination		5
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document. The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Student – Teacher Interaction**	**Sessional Exam**	**Semester End Examination 75 Marks**
Maximum Marks	**8**	**2**	**15**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

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Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3-hour duration Semester End Examination will be conducted for maximum marks of 75. Both components will be evaluated by concerned course leader/s.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

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S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class notes

b. Essential Reading

1. Course notes
2. Cooper, G.M. (2000) the Cell, A Molecular Approach. 2nd edn. Boston University. Sunderland (MA): Sinauer Associates.
3. Licinio, J. and Wong, M. (2002) Pharmacogenomics: The Search for Individualized Therapies, Weinheim (Germany): Wiley-VCH.
4. Jingwu Zhang, (2007) Immune Regulation and Immunotherapy in Autoimmune Disease, US: Springer.
5. Ralph A. Bradshaw, (2009) Handbook of Cell Signaling: The second edition, San Francisco: Academic Press.
6. Dickenson, J., Freeman, F., Mills, C.Y., Thode, C. and Sivasubramaniam, S. (2032) Molecular Pharmacology: From DNA to Drug Discovery, 1st edn, New Jersey: Wiley-Blackwell.
7. Helgason, C.D. and Miller, C.L. (2004) Basic Cell Culture Protocols. 3rd edn, US: Springer.
8. Davis, J. M. (1996) Basic Cell Culture - A Practical Approach. UK: Oxford University Press.
9. John Masters. (2000) Animal Cell Culture, A Practical Approach, 3rd edn, UK: Oxford University Press.
10. Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman J.G., Smith, J.A. and Struhl, K. (eds.) (2003) Current Protocols in Molecular Biology, New York: John Wiley & Sons, Inc.

c. Recommended Reading

1. Alberts, B., Bray, 0., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (1994) Molecular Biology of the Cell, New York: Garland Publishing, Inc.
2. Watson, J.D., Gilman, M., Witkowski. J., and Zoller. M. (1992) Recombinant DNA A Scientific American Book, San Francisco: W.H. Freeman and Co.
3. Bruce, A., Dennis, B., Julian, L., Martin, R., Keith, R., James, D., Watson, N. O. and Kaye H.M. (1994) Molecular Biology of the Cell, 3rd Edn, New York: Garland Science Publishers.

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4. Lodish, H., Berk, A., Matsudaira, P., Chris A. K., Krieger, M., Scott, P. M., Zipursky, L. and Darnell, J. (2004) Molecular Cell Biology, 5th Edn, New York: WH Free man.
5. Turner, P., McLennan, A., Bates, A., White, M. and McLennan, A. (2005) Molecular Biology, 3rd Edn, New York: Taylor & Francis.
6. Lewin, B. (2004) Genes VIII, US: Benjamin Cummings.
7. Kornberg. A. and Baker. T. (1991) DNA Replication, San Francisco: W.H. Freeman and Co.

d. Magazines and Journals

1. Indian Journal of Pharmacology.
2. Journal of Pharmacology and Experimental Therapeutics.
3. European journal of Pharmacology.
4. British Journal of Pharmacology.

e. Websites

1. **www.aspet.org**
2. **www.virtualpharmacologylab.com**

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Course Specifications: Pharmacology Practical - I

Course Title	Pharmacology Practical - I
Course Code	PLL505A
Course Type	Core Practical
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of the course is to impart training in drug evaluation. The student acquires practical skills in instrumental methods of drug analysis, evaluation of drug action in animal models and the various analytical techniques in molecular biology.

2. Course Size and Credits

Number of credits	06
Credit Structure (Lecture: Tutorial: Practical)	0:0:6
Total Hours of Interaction	180
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	150 **Component 1: 50 Marks** 1A: Attendance: 10 Marks 1B: Practical Record & Viva-voce – 10 Marks 1C: Sessional Exam: 30 Marks **Component 2 (SEE):** Semester End Examination: 100 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Analyze drugs using various instrumental techniques
- **CO-2** Demonstrate molecular biology techniques as applicable for Pharmacology
- **CO-3** Evaluate drug action by in vitro and in vivo methods

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4. Course Contents

Suggested List of Experiments

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. Data Interpretation of IR Spectroscopy, TGA, DSC, NMR and Mass spectroscopy
8. Handling of laboratory animals
9. Various routes of drug administration.
10. Techniques of blood sampling, anesthesia and euthanasia of experimental animals
11. Functional observation battery tests (modified Irwin test)
12. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity
13. Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity
14. Evaluation of diuretic activity
15. Evaluation of antiulcer activity by pylorus ligation method
16. Oral glucose tolerance test
17. Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver)
18. Isolation of RNA from yeast
19. Estimation of proteins by Braford/Lowry's in biological samples.
20. Estimation of RNA/DNA by UV Spectroscopy
21. Gene amplification by PCR
22. Protein quantification Western Blotting
23. Enzyme based in-vitro assays (MPO, AChEs, α amylase, α glucosidase)
24. Cell viability assays (MTT/Trypan blue/SRB)
25. DNA fragmentation assay by agarose gel electrophoresis
26. DNA damage study by Comet assay
27. Apoptosis determination by fluorescent imaging studies
28. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using software
29. Enzyme inhibition and induction activity
30. Extraction of drug from various biological samples and estimation of drugs by various analytical techniques (UV)
31. Extraction of drug from various biological samples and estimation of drugs by various analytical techniques (HPLC)

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3								2	1	1
CO-2				3							2	1	1
CO-3							3						1
CO-4			3								2	1	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		10
Demonstrations		10
1. Demonstration using Videos	00	
2. Demonstration using Physical Models / Systems	00	
3. Demonstration on a Computer	10	
Tutorials		00
Practical Work		
Course Laboratory	160	
Computer Laboratory	00	
Engineering Workshop / Course/Workshop / Kitchen	00	
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		05
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	00	
4. Brain Storming Sessions	00	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Laboratory Examination		20
Total Duration in Hours		**200**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document. The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

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Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent	SC1	SC2	SC3	
Subcomponent Type	Attendance	Practical Records, Regular viva voce	Sessional Exam	Semester End Examination 100 Marks
Maximum Marks	10	10	30	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	10
Practical Records, Regular viva voce	10
Total	20

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Practical	Marks
95 – 100	**10**
90 – 94	**7.5**
85 – 89	**5**
80 – 84	**2.5**
Less than 80	**0**

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 6 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks will be the marks scored in the Sessional Examination

Component - 2: 100 marks

A 6 hour duration Semester End Examination will be conducted for maximum marks of 100 and evaluated by concerned course leader and External examiner.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme. The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.

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Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Laboratory interactions and self-study
2.	Understanding	Experiments conducted in laboratory
3.	Critical Skills	Experiments conducted in laboratory
4.	Analytical Skills	Inference of laboratory results
5.	Problem Solving Skills	Lab work and Examination
6.	Practical Skills	Face to face interactions and lab work
7.	Group Work	Laboratory Tasks
8.	Self-Learning	Practical Record writing and Examination
9.	Written Communication Skills	Viva voce and presentation of results
10.	Verbal Communication Skills	Presentation of results
11.	Presentation Skills	Laboratory Tasks
12.	Behavioral Skills	Practical Record writing and presentation of results
13.	Information Management	Group discussions and planning of Laboratory Tasks
14.	Leadership Skills	Presentation, Handling Questions during presentation, Interaction with peers

9. Course Resources

a. Essential Reading

1. Ghosh (2015) Fundamentals of experimental Pharmacology, Hilton and Company publishers, 6th edn. Kolkata - 700 012, India.
2. Kulkarni, S.K. (1999) Hand Book of Experimental Pharmacology, 3rd edn. New Delhi: Vallabh Prakashan.
3. Vogel H.G. and Vogel, W.H. Eds., (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn. New York: Springer.

b. Recommended Reading

1. Silverstein, R.M., Webster, F,X., Kiemle, D.J., Bryce, D.L. (2014) Spectrometric Identification of Organic Compounds, 8th edn. New York: John Wiley & Sons, Inc.
2. Skoog, D.A., Holler, J.F and Nieman, T.A. (1998) Principles of Instrumental Analysis, 5th edn. Singapore: Harcourt Asia PTE, LTD Publishers
3. Jeffery, G.H., Bassett J., Mendham J and Denney R.C. (1978) Vogel's text book of quantitative inorganic analysis. 4th edn. New York: John Wiley and Sons Inc.
4. Helgason, C.D. and Miller, C.L. (2004) Basic Cell Culture Protocols. 3rd edn. US: Springer.
5. John Davis. (2002) Basic Cell Culture, Second Edn. Practical Approach Series, UK: Oxford University Press.
6. John Masters. (2000) Animal Cell Culture, A Practical Approach, 3rd edn. UK: Oxford University Press.
7. Magazines and Journals
8. Indian Journal of Pharmacology. Mumbai: Wolters Kluwer - Medknow

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9. Publications
10. Journal of Pharmacology and Experimental Therapeutics. US: American Society
11. for Pharmacology and Experimental Therapeutics.
12. European journal of Pharmacology. Amsterdam: Elsevier.
13. British Journal of Pharmacology. UK: Wiley- Blackwell.
4. Lab manual
5. CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines.
6. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn. Kolkata: Hilton and Company.
7. M.N.

c. Websites

1. www. icp.org.nz
2. www.craigslist.org
3. www. druglib.com

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Course Specifications: Seminar/Assignment

Course Title	Seminar/Assignment
Course Code	PLS506
Type of Course	Seminar
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The course aims to instill critical thinking, analytical thinking and problem-solving skills amongst students. Students are trained to refer to literature and present their thought process, justification either in the form of an essay or debate as a concise report. Students are trained for collaborative learning while analyzing and solving problems. They are exposed to citation, referencing and paraphrasing. Students are also exposed in communicating the collected information/literature to present and defend their accomplishment.

2. Course Size and Credits

Number of Credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	105
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	100 **Component -1: Assignment = 60 Marks** Report evaluated individually for 15 marks for 4 theory Courses in the semester. **Component -2: Seminar = 40 Marks** Assignment presentation evaluated individually for 10 marks for 4 theory Courses in the semester
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Apply subject-specific concepts to solve assignment-based problems using logical reasoning and critical evaluation
- **CO-2** Critically review information from scientific literature and other credible sources to support assignment solutions and seminar topics
- **CO-3** Prepare and deliver scientifically well-structured seminar presentations and written assignments
- **CO-4** Demonstrate independent learning skills and incorporation of feedback received during assignments and seminar presentations

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4. Course Contents

Critical review of the literature on the given assignment
Writing and Communication skills
Citation and referencing styles-Harvard referencing style
Plagiarism review Analytical and problem-solving skills

Practical/Laboratory content: NA

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3								1	1	1
CO-2			3					1			2	1	2
CO-3			1					3			1	1	2
CO-4			1					2			3	1	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in Hours	Total Duration in Hours
Face to Face Lectures		10
Demonstrations		10
1. Demonstration using Videos	05	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer	05	
Tutorials		
Practical Work		15
Course Laboratory	05	
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen	10	
Clinical Laboratory		
Hospital		
Model Studio		
Others		50
1. Case Study Presentation	10	
2. Guest Lecture		
3. Industry / Field Visit		
4. Brain Storming Sessions	10	
5. Group Discussions		
6. Discussing Possible Innovations	30	
Written Examination/ Presentation		20
Total Duration in Hours		**105**

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7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document. The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

	Component 1: Assignment (60% Weightage)	Component 2: Seminar (40% Weightage)
Subcomponent	SC1	SC2
Subcomponent Type	Assignment	Seminar
Maximum Marks	60	40
CO-1	X	X
CO-2	X	
CO-3	X	
CO-4	X	X

Component - 1: Assignment = 60Marks [4 courses of 15 marks each]
One word processed assignment submitted for 4 theory courses in a semester will be evaluated by Course Leaders for a maximum of 15 marks each.

Component - 2: Seminar = 40Marks [4 courses of 10 marks each]
Presentation on submitted assignments will be evaluated by Course Leaders for a maximum of 10 marks each.

Marks awarded for four individual Courses (Assignment -15 marks & Seminar – 10 marks) will be summed and calculated for the total marks obtained for a maximum marks of 100.

The assessment questions are set to test the learning outcomes. In each component a certain learning outcomes are assessed. The following table illustrates the focus of learning outcome in each component assessed

Re-assessment
If a student fails in the course, it is considered fail and he or she has to earn the credits in the make up opportunity and re-registration to the Course is required.
The maximum number of such opportunities is limited as per the academic regulations governing this programme.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading and findings
2.	Understanding	Reading and findings
3.	Critical Skills	Literature Review
4.	Analytical Skills	Data collection
5.	Problem Solving Skills	Data analysis
6.	Practical Skills	Writing & Presentation

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7.	Group Work	Data analysis
8.	Self-Learning	Reading and findings
9.	Written Communication Skills	Assignment processing
10.	Verbal Communication Skills	Presentations
11.	Presentation Skills	Presentations
12.	Behavioral Skills	Interaction
13.	Information Management	Paper writing
14.	Leadership Skills	Effective management of learning, time management, achieving the learning

9. Course Resources

a. Essential Reading

Research articles

Relevant text books

Visits to websites relevant to assignment problem

b. Recommended Reading

NA

c. Magazines and Journals

Relevant magazines and journals pertaining to assignment

Websites

Specific web information pertaining to assignment

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SEMESTER – II

Course Specifications: Advanced Pharmacology – II

Course Title	Advanced Pharmacology – II
Course Code	PLC507
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The course helps students to strengthen their basic knowledge in pharmacology and understand the concepts of drug action and the mechanisms involved. The course also emphasizes the recent advances in Pharmacology and Pharmacotherapy.

2. Course Size and Credits

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Discuss the pharmacology of drugs acting on various systems and recent advances in Pharmacology
- **CO-2** Outline the pathophysiology and pharmacotherapy of certain diseases
- **CO-3** Analyze the role of free radicals in the pathogenesis of diseases and adverse drug reactions and drug interactions
- **CO-4** Compile the applications of chronotherapy in various diseases

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4. Course Contents

Unit 1.

Endocrine Pharmacology **12 hours**

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 2.

Chemotherapy **12 hours**

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 3.

Chemotherapy **12 hours**

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 4.

GIT Pharmacology **12 hours**

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 5.

Free radicals Pharmacology **12 hours**

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 antioxidants

Recent Advances in Treatment:

Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – I PLL511")

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	2			2							2	2	
CO-2	2											1	
CO-3			3									1	
CO-4	2								2			1	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

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6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		45
Demonstrations		05
1. Demonstration using Videos	05	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		10
1. Case Study Presentation	03	
2. Guest Lecture	02	
3. Seminar	05	
4. Brain Storming Sessions	01	
5. Group Discussions	02	
6. Discussing Possible Innovations	01	
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Student – Teacher Interaction**	**Sessional Exam**	**Semester End Examination 75 Marks**
Maximum Marks	**8**	**2**	**15**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

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Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3 hour duration Semester End Examination will be conducted for maximum marks of 75 and evaluated by concerned course leader.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving Cos

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments

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8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. **Class notes**

b. **Essential Reading**

Brunton, L.L., Lazo, J.S. and Parker, K.L. (2006) Goodman and Gilman's The Pharmacological Basis of Therapeutics, 11th edn, New York: Pergamon Press.

1. Golan, D.E., Tashjian, A.H., Armstrong. A.W., and Ehrin, J.A. (2008) Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy, 3rd edn, Philadelphia: Lippincott Williams Wilkins.
2. Katzung, B.G. (2009) Basic and Clinical Pharmacology, 11th edn, New Delhi: Tata McGraw Hill.
3. Rang, M.P., Dale, M.M. and Riter, J.M. (1995) Pharmacology, 4th edn, China: Churchill Livingstone.
4. Gibaldi, M. and Prescott, L. (1988), Handbook of Clinical Pharmacokinetics Section III, Balgowlah, Australia: ADIS Health Science Press.
5. Eric Herfindal, T. (2000) Clinical Pharmacy and Therapeutics, 7th edn, Philadelphia: Lippincott Williams and Wilkins.
6. Shargel, L and Andrew, B.C. Yu. (2012) Applied Biopharmaceuticals & Pharmacokinetics, 6th edn, New York: McGraw-Hill publishers.
7. Younggil Kwon (2001) Handbook of Essential Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists, 1st edn, New York: Springer.
8. Dipiro, J., Talbert, R. L., Yee, G., Matzke, G., Wells, B. and Posey, M. (2011), Pharmacotherapy: A Pathophysiologic Approach, 8th edn, Connecticut: Appleton and Lange.

c. **Recommended Reading**

1. Sharma, H.L. and Sharma, K. K. (2011) Principles of Pharmacology, 2nd edn, Hyderabad: Paras Medical Publisher.
2. Tripathi, K. D. (2008) Essentials of Medical Pharmacology, 6th edn, New Delhi: Jaypee Publishers.
3. Walker, R. (2009) Clinical Pharmacy and Therapeutics, 2nd edn, London: Churchill Livingstone.
4. Kumar, V., Abbas, A., Fausto, N., and Astor, J. C. (2011) Robbins and Cotran Pathologic Basis of Disease, 8th edn, Philadelphia: W. B. Saunders.
5. Longo, D. L., Kasper, D. L., Jameson, J. L., Fauci, A. S., Hauser, S. L. and Loscalzo, J. (2012) Harrisosn's Principles of Internal Medicine, 18th edn, New York: McGraw Hill.

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d. **Magazines and Journals**

1. Indian Journal of Pharmacology
2. Journal of Pharmacology and Experimental Therapeutics

e. Websites

www.aspet.org

www.virtualpharmacologylab.com

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Course Specifications: Pharmacological and Toxicological Screening Methods – II (Theory)

Course Title	Pharmacological and Toxicological Screening Methods – II (Theory)
Course Code	PLC508
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This 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.

2. Course Size and Credits

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 List the studies needed for IND submission and summarize the importance of ethical and regulatory requirements

CO-2 Illustrate various types of toxicity studies and the skills required to conduct the preclinical toxicity studies

CO-3 Recommend appropriate preclinical models for evaluation of new drugs

CO-4 Identify the alternatives to animal experiments

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4. Course Contents

Unit 1. **12 hours**

a. Basic definition and types of toxicology (general, mechanistic, regulatory and descriptive)
b. Regulatory guidelines for conducting toxicity studies OECD, ICH, EPA and Schedule Y
c. OECD principles of Good laboratory practice (GLP)

Unit 2. **12 hours**

a. History, concept and its importance in drug development
b. Acute, sub-acute and chronic- oral, dermal and inhalational studies as per OECD guidelines
c. Acute eye irritation, skin sensitization, dermal irritation & dermal toxicity studies
d. Test item characterization- importance and methods in regulatory toxicology studies

Unit 3. **12 hours**

a. Reproductive toxicology studies, Male reproductive toxicity studies, female reproductive studies (segment I and segment III), teratogenicity studies (segment II)
b. Genotoxicity studies (Ames Test, in vitro and in vivo Micronucleus and Chromosomal aberrations studies); In vivo carcinogenicity studies

Unit 4. **12 hours**

a. IND enabling studies (IND studies)- Definition of IND, importance of IND, industry perspective, list of studies needed for IND submission.
b. Safety pharmacology studies- origin, concepts and importance of safety pharmacology
c. Tier1- CVS, CNS and respiratory safety pharmacology, HERG assay. Tier2- GI, renal and other studies

Unit 5. **12 hours**

a. Toxicokinetics- Toxicokinetic evaluation in preclinical studies
b. Saturation kinetics Importance and applications of toxicokinetic studies
c. Alternative methods to animal toxicity testing

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – II PLL511")

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	2						3					1	1
CO-2			3									1	
CO-3				2								1	
CO-4	2									2		1	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

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6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		50
Demonstrations		05
1. Demonstration using Videos	05	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		05
1. Case Study Presentation		
2. Guest Lecture	01	
3. Industry / Field Visit		
4. Brain Storming Sessions	01	
5. Group Discussions	02	
6. Discussing Possible Innovations	01	
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Student – Teacher Interaction**	**Sessional Exam**	**Semester End Examination 75 Marks**
Maximum Marks	**8**	**2**	**15**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X

The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.

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Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	**8**
90 – 94	**6**
85 – 89	**4**
80 – 84	**2**
Less than 80	**0**

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3-hour duration Semester End Examination will be conducted for maximum marks of 75 and evaluated by concerned course leader and External examiner.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

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8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments

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4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class notes

b. Essential Reading

1. Burn, J. H., Finney, D.J., and Goodwin, I. G. Biological Standardisation, Blackwell Scientific Publications, Oxford
2. Indian Pharmacopeia 7th Edn and other Pharmacopeias
3. Turner, R. A. (1965) Screening Methods in Pharmacology, New York: Academic Press Inc
4. Laurence, D.R. and Bacharach, A.L. (1964) Evaluation of Drug Activities: Pharmacometrics. Vol. 1 and 2, London: Academic Press
5. Schwartz, A. Methods in Pharmacology, New York: Plenum Publishing Corporation
6. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company
7. McLeod, L. J. (1970) Pharmacological experiments on intact preparations, New York: Churchill Livingstone
8. Vogel H.G. and Vogel, W.H. (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn, New York: Springer
9. World Health Organisation, (2004) WHO guidelines on Safety Monitoring of Herbal Medicines in Pharmacovigilance Systems, World Health Organisation
10. OECD guidelines on toxicity studies

c. Recommended Reading

1. Goyal, R.K. (2000) Practicals in Pharmacology, 2nd edn, Ahmedabad: B S Shah Prakashan.
2. Gupta, S.K. (2009), Drug Screening Methods, 2nd edn, New Delhi: Jaypee Brothers Medical Publishers Pvt. LTD
3. Kulkarni, S.K. (1999) Hand Book of Experimental Pharmacology, 3rd edn, New Delhi: Vallabh Prakashan
4. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company
5. Goyal, R.K. (2000) Practicals in Pharmacology, 2nd edn, Ahmedabad: BS Shah Prakashan.
6. Vrushabendra Swamy, B.M., Jayaveera, K.N. and Reddy, V.A. (2014) Experimental Pharmacology and Toxicology, New Delhi: Chand and Company Pvt. Ltd
7. Parmer, N.S. and Prakash, S. (2006) Screening Methods in Pharmacology, New Delhi: Narosa Publishing House
8. Himanshu Joshi. (2006) An Alternative Approach to Experimental Pharmacology, Naintal: Himadeep Publishers
9. Brunton,L. L., Lazo, J.S.and Parker, K.L.(2006) Goodman and Gilman's The

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Pharmacological basis of Therapeutics, 11th Edn, New York: Pergamon Press

d.Magazines and Journals

Indian Journal of Pharmacology. Mumbai: Wolters Kluwer - Medknow Publications
Journal of Pharmacology and Experimental Therapeutics. US: American Society for Pharmacology and Experimental Therapeutics.
European journal of Pharmacology. Amsterdam: Elsevier
British Journal of Pharmacology. UK: Wiley- Blackwell

e.Websites

www.aspet.org
www.virtualpharmacologylab.com

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Course Specifications: Principles of Drug Discovery

Course Title	Principles of Drug Discovery
Course Code	PLC509
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This subject imparts knowledge on the preclinical safety and toxicological evaluation of drug and New Chemical Entity. This knowledge will make the student competent in regulatory toxicological evaluation.

2. Course Size and Credits

Number of Credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 Analyze the various stages of drug discovery and general sequence of rational for drug design

CO-2 Appraise the importance of genomics, proteomics and bioinformatics in drug development

CO-3 Discuss the various methods for identification, optimization of lead molecules

CO-4 Demonstrate QSAR, molecular modelling and role of virtual screening methods in drug discovery

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4. Course Contents

Unit 1 **12 hours**

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 2 **12 hours**

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 modelling methods Application of NMR and X-ray crystallography in protein structure prediction

Unit 3 **12 hours**

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 4 **12 hours**

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 5 **12 hours**

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.

(Practical/Laboratory content (please mention if Lab content doesn't exist for this course): Selected experiments pertaining to this course were dealt in the course Practical – PLL511")

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3									1	
CO-2	2										1	1	1
CO-3		3		3								2	
CO-4				2							2	1	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

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6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		50
Demonstrations		05
1. Demonstration using Videos	05	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		05
1. Case Study Presentation		
2. Guest Lecture	01	
3. Industry / Field Visit		
4. Brain Storming Sessions	01	
5. Group Discussions	02	
6. Discussing Possible Innovations	01	
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent	SC1	SC2	SC3	
Subcomponent Type	Attendance	Student – Teacher Interaction	Sessional Exam	Semester End Examination 75 Marks
Maximum Marks	8	2	15	
CO-1			x	
CO-2		x	x	x
CO-3		x	x	x
CO-4		x	x	x
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component : 1. 25 marks

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The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks
A 3-hour duration Semester End Examination will be conducted for maximum marks of 75 and evaluated by concerned course leader and External examiner.

Re-assessment
1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--

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7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a.Class Notes

b.Essential Reading

1. Mouldy, S. H. (2010) Target Discovery and Validation Reviews and Protocols, Volume 2: Emerging Molecular Targets and Treatment Options, New York: Humana Press Inc.
2. Leon, D. and Markelln, S. (2006) In Silico Technologies in Drug Target Identification and Validation, US: Taylor and Francis Group, LLC.
3. Distefano, J.K (2011) Disease gene identification: methods and protocols. New York: Springer.
4. Hugo Kubiny. (2008) QSAR: Hansch Analysis and Related Approaches. Methods and Principles in Medicinal Chemistry, New York: John Wiley & Sons, Inc.

c.Recommended Reading

1. Gubernator, K., Bohm, H.A., Mannhold, R., Kubinyi, H. and Timmerman, H. (2008) Structure-based Ligand Design, Wiley's Methods and Principles in Medicinal Chemistry Series, Vol. 6, New York: John Wiley & Sons, Inc.
2. Abby, L., Parrill, M. and Rami Reddy. (1999) Rational Drug Design. Novel Methodology and Practical Applications. ACS Symposium Series; Washington, DC: American Chemical Society.
3. Rick Turner, J. (2007) Illustrated edn: New drug development: design, methodology, and analysis, New York: John Wiley & Sons, Inc.

d.Magazines and Journals

1. Journal of Drug Discovery
2. Journal of theoretical and computational Chemistry
3. Journal of molecular modelling
4. Indian Journal of Pharmaceutical Sciences

e.Websites

1. www.drugdiscoverytoday.com
2. www.nature.com
3. www.pubchem.com
4. www.elsevier.com

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Course Specifications: Clinical Research and Pharmacovigilance (Theory)

Course Title	Clinical Research and Pharmacovigilance (Theory)
Course Code	PLC510
Course Type	Core Theory
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This course imparts knowledge on conceptualizing, designing, conducting, managing and reporting in clinical trials. This is a value-added course which focuses on the current requirement for students in clinical research and pharmacovigilance. It also focuses on the different methods of Pharmacovigilance that can be used to generate safety data. It will teach students in developing drug safety data in Pre-clinical and Clinical phases of Drug development and post market surveillance.

2. Course Size and Credits

Number of credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 Evaluate regulatory and ethical requirements in clinical trials
CO-2 Classify and design different types of clinical studies
CO-3 Analyze roles and responsibilities of clinical trial stakeholders
CO-4 Apply clinical research and pharmacovigilance principles in practice and Perform ADR reporting and safety evaluation

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4. Course Contents

Unit 1.

Regulatory Perspectives of Clinical Trials **12 hours**

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 2.

Clinical Trials: Types and Design **12 hours**

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 3.

Clinical Trial Documentation **12 hours**

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 4.

Basic aspects, terminologies and establishment of pharmacovigilance **12 hours**

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 5.

Methods, ADR reporting and tools used in Pharmacovigilance **12 hours**

International classification of diseases, International Nonproprietary 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, Vigi Flow, Statistical methods for evaluating medication safety data.

Pharmacoepidemiology, pharmacoeconomics, safety pharmacology

(Practical/Laboratory content: Selected experiments pertaining to this course were dealt in the course "Pharmacology-1 Practical – II PLL511")

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1							3						1
CO-2						2						1	
CO-3			3									1	
CO-4			3	2				2				2	1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		50
Demonstrations		08
1. Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer	08	
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		02
1. Case Study Presentation		
2. Guest Lecture	02	
3. Industry / Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document. The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

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Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			Component 2: SEE (75% Weightage)
Subcomponent	SC1	SC2	SC3	
Subcomponent Type	Attendance	Student – Teacher Interaction	Sessional Exam	Semester End Examination 75 Marks
Maximum Marks	8	2	15	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3-hour duration Semester End Examination will be conducted for maximum marks of 75 and evaluated by concerned course leader and External examiner.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

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8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Class notes

b. Essential Reading

1. Central Drugs Standard Control Organization (2001) Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. Ministry of Health, New Delhi.
2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. (1996) Guideline for Good Clinical Practice. E6. ICH Harmonized Tripartite Guideline.
3. Ethical Guidelines for Biomedical Research on Human Subjects (2000) Indian Council of Medical Research, New Delhi.

c. Recommended Reading

1. Machin, D., Day, S. and Green, S. Eds. (2005) Textbook of Clinical Trials, New York: John Wiley and Sons.
2. Rondels, R. K., Varley, S. A. and Webbs, C. F. (2000) Clinical Data Management, 2nd edn. New York: Wiley Publications.
3. Lloyd, J. and Raven, A. (1994) Handbook of clinical research, 2nd edn. Association for Clinical Research in the Pharmaceutical Industry, Churchill Livingstone publishers.
4. Ignazio, G.D., Di Giovanna and Haynes. (2007) Principles of Clinical Research, 2nd edn. US: Wiley.

d.Magazines and Journals

1. Indian Journal of Hospital Pharmacy
2. Indian Journal of Pharmacy Practice
3. Journal of Pharmacy Practice and Research
4. International Journal of Pharmacy Practice

e.Websites

1. www.scirus.com

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2. www.medscape.com
3. www.pubmed.com
4. www.ich.org

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Course Specifications: Pharmacology Practical – II

Course Title	Pharmacology Practical - II
Course Code	PLL511
Course Type	Core Practical
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of the course is to impart training in drug evaluation. The student acquires practical skills in instrumental methods of drug analysis, evaluation of drug action in animal models and the various analytical techniques in molecular biology.

2. Course Size and Credits

Number of credits	06
Credit Structure (Lecture: Tutorial: Practical)	0:0:6
Total Hours of Interaction	180
Number of Weeks in a Semester	15
Department Responsible	Department of Pharmacology
Total Course Marks	150 **Component 1: 50 Marks** 1A: Attendance: 10 Marks 1B: Practical Record & Viva-voce – 10 Marks 1C: Sessional Exam: 30 Marks **Component 2 (SEE):** Semester End Examination: 100 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 Apply knowledge in In-silico docking and conduct of toxicity studies following regulatory guidelines

CO-2 Evaluate drug action using various isolated tissue preparations and summarize vital parameters of small experimental animals

CO-3 Design protocols for clinical trials and ADR reporting

4. Course Contents

Suggested List of Experiments

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 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

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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 PA2 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, hematological, 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.)
19. In-silico pharmacophore-based screening
20. In-silico QSAR studies
21. ADR reporting

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			2	2			3					2	1
CO-2			2	2								2	
CO-3							3						1
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		10
Demonstrations		10
1. Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer	10	
Tutorials		
Practical Work		160
Course Laboratory	140	
Computer Laboratory	15	
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital	05	
Model Studio		
Others		

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1. Case Study Presentation		
2. Guest Lecture		
3. Industry / Field Visit		
4. Brain Storming Sessions		
5. Group Discussions		
6. Discussing Possible Innovations		
Laboratory Examination		20
Total Duration in Hours		**200**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document. The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Practical Records, Regular viva voce**	**Sessional Exam**	**Semester End Examination 100 Marks**
Maximum Marks	**10**	**10**	**30**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	10
Practical Records, Regular viva voce	10
Total	20

1A. Guidelines for the allotment of marks for attendance*

Percentage of Practical Attendance	Marks
95 – 100	10
90 – 94	7.5
85 – 89	5
80 – 84	2.5
Less than 80	0

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1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 6-hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks will be the marks scored in the Sessional Examination

Component - 2: 100 marks
A 6-hour duration Semester End Examination will be conducted for maximum marks of 100 and evaluated by concerned course leader and External examiner.

Re-assessment
1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.
The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Laboratory interactions and self-study
2.	Understanding	Experiments conducted in laboratory
3.	Critical Skills	Experiments conducted in laboratory
4.	Analytical Skills	Inference of laboratory results
5.	Problem Solving Skills	Lab work and Examination
6.	Practical Skills	Face to face interactions and lab work
7.	Group Work	Laboratory Tasks
8.	Self-Learning	Practical Record writing and Examination
9.	Written Communication Skills	Viva voce and presentation of results
10.	Verbal Communication Skills	Presentation of results
11.	Presentation Skills	Laboratory Tasks
12.	Behavioral Skills	Practical Record writing and presentation of results
13.	Information Management	Group discussions and planning of Laboratory Tasks
14.	Leadership Skills	Presentation, Handling Questions during presentation, Interaction with peers

9. Course Resources

a. Essential Reading

Lab manual
CPCSEA, OECD, ICH, USFDA, Schedule Y, EPA guidelines.
Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn. Kolkata: Hilton and Company.

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M.N. Ghosh (2015) Fundamentals of experimental Pharmacology, Hilton and Company publishers,

6th edn. Kolkata - 700 012, India.
Kulkarni, S.K. (1999) Hand Book of Experimental Pharmacology, 3rd edn. New Delhi: Vallabh Prakashan.
Vogel H.G. and Vogel, W.H. Eds., (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn. New York: Springer.

b.Recommended Reading

Silverstein, R.M., Webster, F,X., Kiemle, D.J., Bryce, D.L. (2014) Spectrometric Identification of Organic Compounds, 8th edn. New York: John Wiley & Sons, Inc.
Skoog, D.A., Holler, J.F and Nieman, T.A. (1998) Principles of Instrumental Analysis, 5th edn. Singapore: Harcourt Asia PTE, LTD Publishers
Jeffery, G.H., Bassett J., Mendham J and Denney R.C. (1978) Vogel's text book of quantitative inorganic analysis. 4th edn. New York: John Wiley and Sons Inc.
Helgason, C.D. and Miller, C.L. (2004) Basic Cell Culture Protocols. 3rd edn. US: Springer.
John Davis. (2002) Basic Cell Culture, Second Edn. Practical Approach Series, UK: Oxford University Press.
John Masters. (2000) Animal Cell Culture, A Practical Approach, 3rd edn. UK: Oxford University Press.

c.Magazines and Journals

Indian Journal of Pharmacology
Publications
Journal of Pharmacology and Experimental Therapeutics
for Pharmacology and Experimental Therapeutics.
European journal of Pharmacology
British Journal of Pharmacology

d.**Websites**

www. icp.org.nz
www.craigslist.org
www. druglib.com

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Course Specifications: Seminar/Assignment

Course Title	Seminar/Assignment
Course Code	PLS512
Type of Course	Seminar
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The course aims to instill critical thinking, analytical thinking and problem-solving skills amongst students. Students are trained to refer to literature and present their thought process, justification either in the form of an essay or debate as a concise report. Students are trained for collaborative learning while analyzing and also solving problems. They are exposed to citation, referencing and paraphrasing. Students are also exposed in communicating the collected information/literature to present and defend their accomplishment.

2. Course Size and Credits:

mber of credits	04
Total hours of Classroom and laboratory interaction during the course	105 hours in a semester
Total Course Marks	**100** **Component -1: Assignment = 60 Marks** Report evaluated individually for 15 marks for 4 theory Courses in the semester. **Component-2: Seminar = 40 Marks** Assignment presentation evaluated individually for 10 marks for 4 theory Courses in the semester.
Pass Criteria	As per the Academic Regulations
Attendance requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Apply subject-specific concepts to solve assignment-based problems using logical reasoning and critical evaluation
- **CO-2** Critically review information from scientific literature and other credible sources to support assignment solutions and seminar topics
- **CO-3** Prepare and deliver scientifically well-structured seminar presentations and written assignments
- **CO-4** Demonstrate independent learning skills and incorporation of feedback received during assignments and seminar presentations

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4. Course Contents

Critical review of the literature on the given assignment

Writing and Communication skills

Citation and referencing styles- Harvard referencing style

Plagiarism review

Analytical and problem-solving skills

Practical/Laboratory content: NA

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3								1	1	2
CO-2			3					1			2	1	2
CO-3			1					3			1	1	2
CO-4			1					2			3	1	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		10
Demonstrations		10
Demonstration using Videos		
Demonstration using Physical Models/Systems	5	
Demonstration on a Computer	5	
Numeracy		
Solving Numerical Problems		
Practical Work		15
1. Course Laboratory	05	
2. Computer Laboratory		
3. Engineering Workshop/Course Workshop/Kitchen	10	
4. Clinical Laboratory		
5. Hospital		
6. Model Studio		
Others		50
1. Case Study Presentation	10	
2. Guest Lecture		
3. Industry/Field Visit		
4. Brain Storming Sessions	10	
5. Group Discussions		
6. Discussing Possible Innovations	30	
Term Tests, Laboratory Examination/Written Examination, Presentations		20
Total Duration in Hours		105

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7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

	Component 1: Assignment (60% Weightage)	Component 2: Seminar (40% Weightage)
Subcomponent	**SC1**	**SC2**
Subcomponent Type	**Assignment**	**Seminar**
Maximum Marks	**60**	**40**
CO-1	X	X
CO-2	X	
CO-3	X	
CO-4	X	X

Component - 1: Assignment = 60Marks [4 courses of 15 marks each]
One word processed assignment submitted for 4 theory courses in a semester will be evaluated by Course Leaders for a maximum of 15 marks each.

Component - 2: Seminar = 40Marks [4 courses of 10 marks each]
Presentation on submitted assignments will be evaluated by Course Leaders for a maximum of 10 marks each.

Marks awarded for four individual Courses (Assignment -15 marks & Seminar – 10 marks) will be summed and calculated for the total marks obtained for a maximum mark of 100. The assessment questions are set to test the learning outcomes. In each component a certain learning outcome are assessed. The following table illustrates the focus of learning outcome in each componentassessed:

Reassessment

- If a student fails in the course, it is considered fail and he or she has to earn the credits inthe make-up opportunity and re-registration to the Course is required.
- The maximum number of such opportunities is limited as per the academic regulationsgoverning this programme.

8. Achieving COs

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading and findings
2.	Understanding	Reading and findings
3.	Critical Skills	Literature Review
4.	Analytical Skills	Data collection
5.	Problem Solving Skills	Data analysis
6.	Practical Skills	Writing & Presentation
7.	Group Work	Data analysis

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8.	Self-Learning	Reading and findings
9.	Written Communication Skills	Assignment processing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions
13.	Information Management	Paper writing
14.	Personal Management	Course work
14.	Leadership Skills	Effective management of learning, time management, achieving the learning

9. Course Resources

a. Essential Reading

1. Research articles
2. Relevant text books
3. Visits to websites relevant to assignment problem

b. Recommended Reading

NA

c. Magazines and Journals

Relevant Magazines and Journals pertaining to assignment

d. Websites

Specific web information pertaining to assignment

e. Other Electronic Resources

NA

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SEMESTER – III

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Course Specifications: Research Methodology and Biostatistics (Theory)

Course Title	Research Methodology and Biostatistics (Theory)
Course Code	PLF613
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This course deals with the basic principles of research methodology and medical research. The students are trained on statistical tools and methodologies to solve problem arising in medical research. The course will also impart students the guidelines for quality maintenance of laboratory animals for conducting biomedical research.

2. Course Size and Credits:

Number of Credits	04
Credit Structure (Lecture: Tutorial: Practical)	4:0:0
Total Hours of Interaction	60
Number of Weeks in a Semester	15
Department Responsible	Pharmacognosy & Pharmacy Practice
Total Course Marks	100 **Component 1: 25 Marks** 1A: Attendance: 8 Marks 1B: Student-Teacher interaction: 2 Marks 1C: Sessional Exam: 15 Marks **Component 2 (SEE):** Semester End Examination: 75 Marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Elaborate on the value, scope, objective and requirements of research
- **CO-2** Discuss the basic concept and importance of statistical analysis
- **CO-3** Explain principles of medical research and pharmaceutical ethics
- **CO-4** Summarize the guidelines for the maintenance of laboratory animals

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4. Course Contents

Unit 1 **12 Hours**

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

Unit 2 **12 Hours**

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

Unit 3 **12 Hours**

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

Unit 4 **12 Hours**

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

Unit 5 **12 Hours**

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

Practical/Laboratory content: NA

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1		3										2	
CO-2	3		2										2
CO-3							3		2		3		2
CO-4							3			1	3		2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		55
Demonstrations		
1. Demonstration using Videos		

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Bangalore - 54.

2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		
1. Case Study Presentation		
2. Guest Lecture	02	
3. Industry / Field Visit		05
4. Brain Storming Sessions		
5. Group Discussions	03	
6. Discussing Possible Innovations		
Written Examination		05
Total Duration in Hours		**65**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M.Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of COs on each Component or Subcomponent of Evaluation				
	Component 1: CE (25% Weightage)			**Component 2: SEE (75% Weightage)**
Subcomponent	**SC1**	**SC2**	**SC3**	
Subcomponent Type	**Attendance**	**Student – Teacher Interaction**	**Sessional Exam**	**Semester End Examination 75 Marks**
Maximum Marks	**8**	**2**	**15**	
CO-1		X	X	X
CO-2		X	X	X
CO-3		X	X	X
CO-4		X	X	X
The details of SC1, SC2, SC3 are presented in the Programme Specifications Document.				

Component - 1: 25 marks

The marks allocated for Continuous mode of internal assessment shall be awarded as per the scheme given below:

Criteria	Maximum Marks
Attendance*	8
Student-Teacher Interaction	2
Total	10

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1A. Guidelines for the allotment of marks for attendance*

Percentage of Attendance Theory	Marks
95 – 100	8
90 – 94	6
85 – 89	4
80 – 84	2
Less than 80	0

1B. Student-Teacher interaction

1C. Sessional exam: Two sessional exams (each for 30 marks) of 1 hour duration will be conducted, one at the end of 6th week and the other at the end of the 12th week. The average of the 2 sessional marks reduced to 15 will be the marks scored in the Sessional Examination

Component - 2: 75 marks

A 3 hour duration Semester End Examination will be conducted for maximum marks of 75 and evaluated by concerned course leader/s.

Re-assessment

1. A student who fails to secure a minimum 50% in component-1 and 2 put together will be asked to register for Supplementary examination.
2. A student who has not satisfied the attendance requirement (not eligible for SEE) shall have to appear for Supplementary examination.
3. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Classroom lectures, Assignments
2.	Understanding	Classroom lectures, Assignments
3.	Critical Skills	Classroom lectures, Student-Teacher interaction, Assignments
4.	Analytical Skills	Student-Teacher Interaction
5.	Problem Solving Skills	Classroom lectures, Examination and Assignments
6.	Practical Skills	--
7.	Group Work	Assignments
8.	Self-Learning	Assignment
9.	Written Communication Skills	Assignment, Examination, Student-Teacher Interaction
10.	Verbal Communication Skills	Presentations, Student-Teacher Interaction
11.	Presentation Skills	Classroom activity, Assignment, Examination
12.	Behavioral Skills	Course work
13.	Information Management	Group discussions and presentations, preparation for examination and

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		presentations
14.	Personal Management	Course work
15.	Leadership Skills	Handling questions during presentations, Classroom behavior with peers, Student-Teacher interaction

9. Course Resources

a. Essential Reading

1. Course notes
2. Booth W. C, Colomb and Williams, G.G (2005) The Craft of Research, Chicago University Press.
3. Willium M.K and Trochim. (2003) Research Methods, 2nd ed, Biztantra Publications
4. Jonathan Grix. (2004) The Foundation of Research, Palgrave Study Guides
5. Bolton S and Bon C (2009) Pharmaceutical Statistics - Practical & Clinical Applications. 5th ed.New York: Marcel Dekker.
6. Jagadeesh, G., Sreekant Murthy, Gupta Y.K., Amitabh Prakash (2010) Biomedical Research, Lippincott Williams and Wilkins, 1ST ed, New Delhi.
7. Gupta S.K. (2007) Basic principles of clinical Research and methodology, Institute of Clinical Research, India.
8. Ghosh M.N,(2008) Fundamentals of experimental Pharmacology, 4th ed, Hilton and company, Kolkata.

b. Recommended Reading

1. Muth, J.E.D.(2006) Basic Statistics and Pharmaceutical Statistical Applications, 2nd ed. New Delhi:CRC Press.
2. Jones, D.S. (2002) Pharmaceutical Statistics. UK: Pharmaceutical Press.
3. Himanshi Joshi, (2015) An alternative approach to experimental Pharmacology. India: Himdeep publication.

c. Magazines and Journals

1. Indian Journal of Medical Research
2. The International Journal of Biostatistics
3. Indian Journal of Pharmacology

d. Websites

1. www.sciencedirect.com
2. www.pubmed.com

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Course Specifications: Journal Club

Course Title	Journal Club
Course Code	PLF614
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of this course is to equip a student to critically appraise the research article published in reputed journals. Students are trained for inquiry based learning and critical thinking skills. Students will also be trained to access journals adopting search engines and made to choose a topic of interest, collect relevant data, analyze and assess the quality of scientific paper and comment on the internal and external validity of the findings. Student will be able to base their opinion on evidence-based literature

2. Course Size and Credits

Number of Credits	01
Credit Structure (Lecture: Tutorial: Practical)	1:0:0
Total Hours of Interaction	15
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	**Total Marks: 25** **Component 1: 15 Marks** Report Evaluation: 15 marks **Component 2: 10 Marks** Presentation: 10 marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Utilize scientific databases and digital research tools to identify relevant pharmaceutical and biomedical publications
- **CO-2** Validate the scientific literature for quality and relevance
- **CO-3** Create a presentation on the critically appraised article
- **CO-4** Demonstrate effective communication skills by presenting findings in appropriate forum

4. Course Contents

- Select scientific articles from reputed journals
- Use search engines to select scientific articles
- Critically appraise scientific articles and assess the quality
- Develop a report on the critically appraised article
- Present the critically appraised article in appropriate forum

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1			3							1	2	1
CO-2				2								2	
CO-3		1		2				3			1	2	2
CO-4		1						3			1	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		
Demonstrations		
1. Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
Practical Work		
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		
1. Case Study Presentation	05	
2. Guest Lecture		
3. Industry / Field Visit		15
4. Brain Storming Sessions	10	
5. Group Discussions		
6. Discussing Possible Innovations		
Report preparation/ Report Evaluation & Presentation		05
Total Duration in Hours		**20**

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7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment is presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

Focus of COs on each Component or Subcomponent of Evaluation		
	Component 1: Report evaluation (15% Weightage)	Component 2: Presentation (10% Weightage)
Subcomponent Type	Report Evaluation	Presentation
Maximum Marks	15	10
CO-1	X	
CO-2	X	
CO-3	X	
CO-4	X	X

Component - 1: 15 marks
Report submitted will be evaluated by a committee of examiners consisting not less than 2 members with in the Department appointed by the Head of the Department in consultation with the Academic Registrar of the Faculty

Component - 2: 10 marks
Evaluation of presentation by a committee of examiners consisting not less than 2 members within the Department appointed by the Head of the Department in consultation with the Academic Registrar of the Faculty.

Re-assessment
1. If a student fails in the course, it is considered fail and he /she has to re-register in the next opportunity. The marks awarded will be recapped to 50%.
2. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester.
Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading
2.	Understanding	Reading
3.	Critical Skills	Review on Seminar topic
4.	Analytical Skills	Comments on the reviewed topic
5.	Problem Solving Skills	---
6.	Practical Skills	---
7.	Group Work	---
8.	Self-Learning	Reading and Research

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9.	Written Communication Skills	Paper writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions
13.	Information Management	Paper writing
14.	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

9. Course Resources

a. Essential Reading

Jennifer Raff, 2013, How to read and understand a scientific paper: A guide for non- scientists.

b. Recommended Reading

Relevant articles pertaining to the programme domain

c. Magazines and Journals

Relevant magazines and journals pertaining to the programme domain

d. Websites

1. www.sciencedirect.com
2. www.elsevier.com

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Course Specifications: Group Project

Course Title	Group Project
Course Code	PLF615
Department	Pharmacology
Course Type	Faculty Common
Faculty	Pharmacy

1. Course Summary

This course will focus on the applications of appropriate methods and techniques involved in pharmaceutical Sciences using relevant University resources for definition and execution of the project. The group project will enable the students to apply the theoretical and practical aspects of pharmaceutical sciences as well as project management techniques taught during the programme. This course will enable the students to gain practical experience of working in a project mode, requiring interactions with the domain specialist to meet the technical challenges

2. Course Size and Credits:

Number of Credits	04
Total Hours of Interaction	NA
Number of Weeks in a Semester (Lecture: Tutorial: Practical)	NA
Department Responsible	Department of Pharmacognosy, Pharmaceutical Chemistry, Pharmacology, Pharmaceutics, Pharmacy Practice
Total Course Marks	NA
Pass Criterion	Report Submission, Presentation & Exhibition of the project
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 Develop the ability to work in a team to execute research projects

CO-2 Apply appropriate research methodologies in project planning and execution

CO-3 Compile, document the findings and defend the project with a structured presentation

4. Course Contents

Unit 1

Need for undertaking a project, Project design, protocol / specifications design, methodology, analysis, product/design/model evaluation and presentation

Unit 2

Project Management, Time Management, Resource Management

Unit 3

Project Material indent, Project Development, Testing, Project Evaluation

Unit 4

Project Exhibition, Presentation

Unit 5

Team building, Team work, Leadership skills

Unit 6

Practical/Laboratory content: Interdepartmental laboratory work

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1					2			2				2	1
CO-2	1	2	3	2	3	1						2	1
CO-3					2	1		3			1	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		00
Demonstrations		00
1. Demonstration using Videos	00	
2. Demonstration using Physical Models / Systems	00	
3. Demonstration on a Computer		
Tutorials		00
Practical Work		
Course Laboratory	00	
Computer Laboratory	00	
Engineering Workshop / Course/Workshop / Kitchen	00	
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		00
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	00	
4. Brain Storming Sessions	00	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Written Examination		00
Total Duration in Hours		**NA**

7. Course Assessment and Reassessment

There are two components for assessment in this course

No.	Intended Learning Outcome	Type of Assessment: Component-I (Project Report and Viva-Voce)	Component-II (Exhibition and Presentation)
1	CO-1	X	
2	CO-2	X	
3	CO-3	X	X

Component-1: 50% weight

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Project Report and Viva-Voce

Component - 2: 50% weight
Exhibition and Presentation
Both components will be evaluated by concerned course leader and the credits will be awarded after satisfying completion of the project work.

Reassessment
If a student fails in any one of the components, it is considered fail and the student should resubmit the project report or re-register to the course as applicable.
The maximum number of such opportunities is limited as per the academic regulations governing this course.

8. Meeting Programme Objectives through Course Objectives

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Group Project Work
2.	Understanding	Group Project Work
3.	Critical Skills	Group Project Work
4.	Analytical Skills	Group Project Work
5.	Problem Solving Skills	Group Project Work
6.	Practical Skills	Group Project Work
7.	Group Work	Group Project Work
8.	Self-Learning	Group Project Work
9.	Written Communication Skills	Report writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Group Project Work
13.	Information Management	Group Project Work
14.	Personal Management	Group Project Work
15.	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

9. **Course Resources**

a. Essential Reading
Assigned reading relevant to the group project.

b. Recommended Reading
Assigned reading relevant to the group project.

c. Magazines and Journals
Specific Journals relevant to group project work

d. Websites
Specific Websites relevant to group project work

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Course Specifications: Discussion / Synopsis Presentation (Theory)

Course Title	Discussion / Synopsis Presentation (Theory)
Course Code	PLF616
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

This course is designed to impart knowledge on the area of advances in targeted drug delivery systems. The coursed also focuses on molecular mechanistic approaches to the development of bio-available drugs and delivery systems.

2. Course Size and Credits:

Number of Credits	02
Credit Structure (Lecture: Tutorial: Practical)	2:0:0
Total Hours of Interaction	02
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	50
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Analyze relevant scientific literature for the selection of research problem
- **CO-2** Compile the findings obtained from scientific articles to identify a research problem
- **CO-3** Design a research protocol based on the identified research problem with structured objectives
- **CO-4** Defend the research problem and proposed plan of work in appropriate forum

4. Course Contents

Unit 1

Collect and appraise the relevant data from the scientific article for the chosen research problem.

Record the findings/data for solving research problem.

Develop a report on the critical observations and discuss with mentor /peer.

Presentation of the reports/findings in appropriate forum.

Practical/Laboratory content: NA.

5. Course Map (CO-PO-PSO Map)

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	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	2			2								2	
CO-2			1	1							1	2	2
CO-3		2	2	1				2				2	1
CO-4								3			2	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		20
Demonstrations		10
1. Demonstration using Videos	5	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer	5	
Tutorials		00
Practical Work		00
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		00
1. Case Study Presentation		
2. Guest Lecture		
3. Industry / Field Visit		
4. Brain Storming Sessions	05	
5. Group Discussions		
6. Discussing Possible Innovations	20	
Synopsis preparation/ Presentation/ Discussion		05
Total Duration in Hours		**35**

7. Course Assessment and Reassessment

Synopsis to be evaluated along with the supporting documents by the Head of the Department/ Nominated Examiner by the HoD/Academic Registrar/Dean. Panel to evaluate and endorse. Dean of the Faculty to approve and submit to the University.

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Re-assessment

The remarks/queries/suggestions made by the examiner during scrutiny of the synopsis should be attended by the candidate in consultation with the Research Supervisor and must be re-submitted for evaluation process

Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading
2.	Understanding	Reading
3.	Critical Skills	Review on research topic
4.	Analytical Skills	Comments on reviewed topic
5.	Problem Solving Skills	Research work, discussion
6.	Practical Skills	Research work, interactions
7.	Group Work	Discussion
8.	Self-Learning	Reading and Research
9.	Written Communication Skills	Report writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions
13.	Information Management	Document writing and Presentation
14.	Personal Management	Presentation
15.	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

9. Course Resources

a. Essential Reading

1. Jennifer Raff, 2013, *How to read and understand a scientific paper: A guide for non-scientists.*

b. Magazines and Journals

1. International Journal of Pharmaceutics, Elsevier, ScienceDirect, Amsterdam
2. European Journal of Pharmaceutical Sciences, Elsevier, ScienceDirect, Amsterdam
3. Advanced Drug Delivery Reviews, Elsevier, ScienceDirect, Amsterdam
4. Journal of Controlled Release, Elsevier, ScienceDirect, Amsterdam
5. Drug Development and Industrial Pharmacy, Informa UK
6. Asian Journal of Pharmaceutical Sciences, Elsevier, ScienceDirect, Amsterdam
7. Indian Journal of Pharmaceutical Sciences, Indian Pharmaceutical Association, Mumbai

c. Websites

1. www.sciencedirect.com
2. www.elsevier.com

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SEMESTER – IV

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Course Specifications: Research Work

Course Title	Research Work
Course Code	PLF617
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of this course is to encourage students to develop skills in identification of a research problem in the chosen domain. This course also emphasizes the application of principles of research methodology, preparation of research project proposal, research project management, execution of research project with effective technical documentation and presentation.

2. Course Size and Credits:

Number of Credits	14
Credit Structure (Lecture: Tutorial: Practical)	0:0:14
Total Hours of Interaction	28
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	**Total Marks : 350** **Component -1: 250 Marks** Evaluation of Interim-Dissertation work Progress **Component -2: 100 Marks** Evaluation of Interim-Dissertation Presentation
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Apply appropriate research methodologies to conduct research and achieve the stated objectives
- **CO-2** Develop innovative ideas and methodologies to improve the identified research problem
- **CO-3** Compile and present research findings effectively in an appropriate forum

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4. Course Contents

- Information search, retrieval and review
- Research problem identification
- Project definition and project planning with objectives
- Use of conceptual models/methodologies and frameworks
- Problem solving and evaluation
- Interpretations and drawing conclusions
- Proposing ideas or methods for further work
- Dissertation writing
- Oral presentation

Practical/Laboratory content: Yes

5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1	3	3	2			2		1	1	1	2	2
CO-2	1	2	2	1			1			1	1	2	2
CO-3				2		2		3				2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		00
Demonstrations		
1.Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		00
Practical Work		
Course Laboratory	25	
Computer Laboratory	03	
Engineering Workshop / Course/Workshop / Kitchen	00	28
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	00	00
4. Brain Storming Sessions	00	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Presentation Evaluation		02
Total Duration in Hours		30

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7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M.Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table.

Focus of Cos on each Component or Subcomponent of Evaluation		
	Component 1: CE (250 Marks)	**Component 2: SEE (100 Marks)**
CO-1	X	X
CO-2	X	X
CO-3	X	X

Component - 1: Evaluation of Dissertation Book

Objectives	25 Marks
Review of literature	25 Marks
Methodology – Preliminary and on-going, evaluation parameters	100 Marks
Results and Discussion	100 Marks
Total	**250 Marks**

Component - 2: Evaluation of Dissertation Presentation

Presentation of work	50 Marks
Communication skills	25 Marks
Question and answer skills	25 Marks
Total	**100 Marks**

The components will be evaluated by two examiners, one would be the Guide/ Supervisor (Internal Examiner) and the other External examiner would be the senior faculty member (within Department/Faculty for Component-1 & outside external to the University for Component-2.

However the process of Dissertation evaluation in the IV semester should be carried out only afterthe student passes all the courses till III semester.

Re-assessment

1. If a student fails in the course, it is considered fail and re-registration to the course is required
2. The maximum number of such opportunities is limited as per the academic regulations governing this programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

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8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Dissertation
2.	Understanding	Dissertation
3.	Critical Skills	Dissertation
4.	Analytical Skills	Dissertation
5.	Problem Solving Skills	Dissertation
6.	Practical Skills	Dissertation
7.	Group Work	Dissertation
8.	Self-Learning	Dissertation
9.	Written Communication Skills	Report writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Presentation
13.	Information Management	Report writing and Presentation
14.	Personal Management	Report writing and Presentation
15.	Leadership Skills	Effective management of learning, time management, achieving the learning outcome

9. Course Resources

a. Essential Reading

1. Barry White, 2011, Mapping Your Thesis: The Comprehensive Manual of Theory andTechniques for Masters and Doctoral Research, ACER press, Australia.
2. Maximiano M. Rivera, Jr. and Roela Victoria Rivera, 2007, *Practical Guide to Thesis andDissertation Writing*, KATHA Publishing, Philippines.
3. Lecture sessions on Dissertation, Thesis preparation delivered by the concerned Head of theDept.

b. Recommended Reading

Relevant books pertaining to research problem

c. Magazines and Journals

Relevant magazines and journals pertaining to research problem

d. Websites

Relevant websites pertaining to research problem

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Course Specifications: Journal Club

Course Title	Journal Club
Course Code	PLF618
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of this course is to equip a student to critically appraise the research article published in reputed journals. Students are trained for inquiry based learning and critical thinking skills. Students will also be trained to access journals adopting search engines and made to choose a topic of interest, collect relevant data, analyze and assess the quality of scientific paper and comment on the internal and external validity of the findings. Student will be able to base their opinion on evidence-based literature

2. Course Size and Credits:

Number of Credits	01
Credit Structure (Lecture: Tutorial: Practical)	1:0:0
Total Hours of Interaction	15
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	**Total Marks: 25** **Component 1: 15 Marks** Report Evaluation: 15 marks **Component 2: 10 Marks** Presentation: 10 marks
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Utilize scientific databases and digital research tools to identify relevant pharmaceutical and biomedical publications
- **CO-2** Validate the scientific literature for quality and relevance
- **CO-3** Create a presentation on the critically appraised article
- **CO-4** Demonstrate effective communication skills by presenting findings in appropriate forum

4. Course Contents

- Select scientific articles from reputed journals
- Use search engines to select scientific articles
- Critically appraise scientific articles and assess the quality
- Develop a report on the critically appraised article
- Present the critically appraised article in appropriate forum

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1			3							1	2	1
CO-2				2								2	
CO-3		1		2				3			1	2	2
CO-4		1						3			1	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		00
Demonstrations		00
1. Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		00
Practical Work		00
Course Laboratory		
Computer Laboratory		
Engineering Workshop / Course/Workshop / Kitchen		
Clinical Laboratory		
Hospital		
Model Studio		
Others		10
1. Case Study Presentation		
2. Guest Lecture		
3. Industry / Field Visit		
4. Brain Storming Sessions	10	
5. Group Discussions		
6. Discussing Possible Innovations		
Report preparation/ Report Evaluation & Presentations		05
Total Duration in Hours		**15**

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M. Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

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Focus of COs on each Component or Subcomponent of Evaluation		
	Component 1: Report evaluation (15% Weightage)	Component 2: Presentation (10% Weightage)
Subcomponent Type	Report Evaluation	Presentation
Maximum Marks	15	10
CO-1	X	
CO-2	X	
CO-3	X	
CO-4	X	X

Component - 1: 15 marks
Report submitted will be evaluated by a committee of examiners consisting not less than 2 members with in the Department appointed by the Head of the Department in consultation with the Academic Registrar of the Faculty

Component - 2: 10 marks
Evaluation of presentation by a committee of examiners consisting not less than 2 members within the Department appointed by the Head of the Department in consultation with the Academic Registrar of the Faculty.

Re-assessment
1. If a student fails in the course, it is considered fail and he /she has to re-register in the next opportunity. The marks awarded will be recapped to 50%.
2. The maximum number of such opportunities are limited and as per the academic regulations governing this Programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading
2.	Understanding	Reading
3.	Critical Skills	Review on Seminar topic
4.	Analytical Skills	Comments on the reviewed topic
5.	Problem Solving Skills	---
6.	Practical Skills	---
7.	Group Work	---
8.	Self-Learning	Reading and Research
9.	Written Communication Skills	Paper writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions
13.	Information Management	Paper writing
14.	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

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9.Course Resources

a. Essential Reading

1. Jennifer Raff, 2013, How to read and understand a scientific paper: A guide for non- scientists.

b. Recommended Reading

Relevant articles pertaining to the programme domain

c. Magazines and Journals

Relevant magazines and journals pertaining to the programme domain

d. Websites

1. www.sciencedirect.com
2. www.elsevier.com

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Course Specifications: Discussion / Presentation (Theory)

Course Title	Discussion / Presentation (Theory)
Course Code	PLF619
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. **Course Summary**

The aim of this course is to enrich a student to critically solve the research problem/project proposal. Students will be trained to plan and execute the solution for the research problem through discussion and presentation with their mentor and peers using acquired knowledge, skills, evidence-based literature and experience

2. **Course Size and Credits:**

Number of Credits	03
Credit Structure (Lecture: Tutorial: Practical)	3:0:0
Total Hours of Classroom and laboratory Interaction during the course	45
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Course Marks	75
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. **Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

CO-1 Apply appropriate research methodologies to conduct research and achieve the stated objectives

CO-2 Develop innovative ideas and methodologies to improve the identified research problem

CO-3 Compile and present research findings effectively in an appropriate forum

4. **Course Contents**

Unit 1

Conduct of research work /Group Project in the laboratories and collection of data/findings

Unit 2

Record the findings/data for solving research problem with scientific based results

Unit 3

Develop a report on the critical observations and discuss with mentor/peer.

Unit 4

Investigation of medicinal Presentation of the reports/findings in appropriate forum).

Unit 5

Practical/Laboratory content: Research work in the Post Graduate Laboratories

5. **Course Map (CO-PO-PSO Map)**

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	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1	3	3	2			2		1	1	1	2	2
CO-2	1	2	2	1			1			1	1	2	2
CO-3				2		2		3				2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		00
Demonstrations		05
1. Demonstration using Videos	05	
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		
1. Solving Numerical Problems	05	05
Practical Work		25
Course Laboratory	00	
Computer Laboratory	20	
Engineering Workshop / Course/Workshop / Kitchen	05	
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		10
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	00	
4. Brain Storming Sessions	10	
5. Group Discussions	00	
6. Discussing Possible Innovations	05	
Written Examination / Presentation		05
Total Duration in Hours		**50**

7. Course Assessment and Reassessment

Process:

Log book of the research work/Group Project / Colloquium presentation to be evaluated along with the supporting documents by the Head of the Department/ Nominated Examiner by the HoD/Academic Registrar/Dean along with the Supervisor. Panel to evaluate and endorse. Dean of the Faculty to approve and submit to the University

Reassessment

The remarks/queries/suggestions made by the examiner during discussion / colloquium should be attended by the candidate in consultation with the Research Supervisor and must

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be re-submitted for evaluation process.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading
2.	Understanding	Reading
3.	Critical Skills	Review on Seminar topic
4.	Analytical Skills	Comments on the reviewed topic
5.	Problem Solving Skills	Research work, discussion
6.	Practical Skills	Research work, Interactions
7.	Group Work	Discussion
8.	Self-Learning	Reading and Research
9.	Written Communication Skills	Report writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions
13.	Information Management	Document writing and Presentation
14.	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

9. Course Resources

Essential Reading

a. Research Papers
b. Visits to websites relevant to research

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Course Specifications: Research Work

Course Title	Research Work
Course Code	PLF620
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of this course is to encourage students to develop skills in identification of a research problem in the chosen domain. This course also emphasizes the application of principles of research methodology, preparation of research project proposal, research project management, execution of research project with effective technical documentation and presentation.

2. Course Size and Credits:

Number of Credits	16
Credit Structure (Lecture: Tutorial: Practical)	0:0:31
Total Hours of Interaction	31
Number of Weeks in a Semester	15
Department Responsible	Pharmacology
Total Course Marks	**Total Marks : 400** **Component -1: 250 Marks** Evaluation of Final Dissertation Book **Component -2: 150 Marks** Evaluation of Final Dissertation Presentation
Pass Criterion	As per the Academic Regulations
Attendance Requirement	As per the Academic Regulations

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

CO-1 Apply appropriate research methodologies to conduct research and achieve the stated objectives

CO-2 Develop innovative ideas and methodologies to improve the identified research problem

CO-3 Compile and present research findings effectively in an appropriate forum

4. Course Contents

- Information search, retrieval and review
- Research problem identification
- Project definition and project planning with objectives
- Use of conceptual models/methodologies and frameworks
- Problem solving and evaluation
- Interpretations and drawing conclusions
- Proposing ideas or methods for further work
- Dissertation writing
- Oral presentation

Practical/Laboratory content: Yes

5. Course Map (CO-PO-PSO Map)

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	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1	3	3	2			2		1	1	1	2	2
CO-2	1	2	2	1			1			1	1	2	2
CO-3				2		2		3				2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Teaching and Learning Methods	Duration in hours	Total Duration in Hours
Face to Face Lectures		00
Demonstrations		
1.Demonstration using Videos		
2. Demonstration using Physical Models / Systems		
3. Demonstration on a Computer		
Tutorials		00
Practical Work		
Course Laboratory	28	
Computer Laboratory	00	
Engineering Workshop / Course/Workshop / Kitchen	00	430
Clinical Laboratory	00	
Hospital	00	
Model Studio	00	
Others		
1. Case Study Presentation	00	
2. Guest Lecture	00	
3. Industry / Field Visit	03	30
4. Brain Storming Sessions	00	
5. Group Discussions	00	
6. Discussing Possible Innovations	00	
Research Presentation		05
Total Duration in Hours		465

7. Course Assessment and Reassessment

The details of the components and subcomponents of course assessment are presented in the Programme Specifications document pertaining to the M.Pharm Programme. The procedure to determine the final course marks is also presented in the Programme Specifications document.

The evaluation questions are set to measure the attainment of the COs. In either component (CE or SEE) or subcomponent of CE (SC1, SC2 or SC3), COs are assessed as illustrated in the following Table:

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Focus of Cos on each Component or Subcomponent of Evaluation		
	Component 1: CE (500 Marks)	Component 2: SEE (250 Marks)
CO-1	X	X
CO-2	X	X
CO-3	X	X

Component - 1: Evaluation of Dissertation Book

Methodology: Experimental work &Evaluation studies	50 Marks
Results & Discussion	150 Marks
Conclusion & final outcomes	50 Marks
Total	**250 Marks**

Component - 2: Evaluation of Dissertation Presentation

Presentation of work	50 Marks
Communication skills	50 Marks
Question and Answer skills	50 Marks
Total	**150 Marks**

The components will be evaluated by two examiners, one would be the Guide/ Supervisor (Internal Examiner) and the other External examiner would be the senior faculty member (within Department/Faculty for Component-1 & outside external to the University for Component-2.

However the process of Dissertation evaluation in the IV semester should be carried out only afterthe student passes all the courses till III semester.

Re-assessment

1. If a student fails in the course, it is considered fail and re-registration to the course is required
2. The maximum number of such opportunities is limited as per the academic regulations governing this programme.

The Course Leader assigned to the course, in consultation with the Head of the Department, shall provide the focus of COs in each component of assessment in the above template at the beginning of the semester. Course reassessment policies are presented in the Academic Regulations document.

8. Achieving COs

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Dissertation
2.	Understanding	Dissertation
3.	Critical Skills	Dissertation
4.	Analytical Skills	Dissertation
5.	Problem Solving Skills	Dissertation
6.	Practical Skills	Dissertation

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7.	Group Work	Dissertation
8.	Self-Learning	Dissertation
9.	Written Communication Skills	Report writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Presentation
13.	Information Management	Report writing and Presentation
14.	Personal Management	Report writing and Presentation
15.	Leadership Skills	Effective management of learning, time management, achieving the learning outcome

9. Course Resources

a. Essential Reading

1. Barry White, 2011, Mapping Your Thesis: The Comprehensive Manual of Theory and Techniques for Masters and Doctoral Research, ACER press, Australia.
2. Maximiano M. Rivera, Jr. and Roela Victoria Rivera, 2007, *Practical Guide to Thesis and Dissertation Writing*, KATHA Publishing, Philippines.
3. Lecture sessions on Dissertation, Thesis preparation delivered by the concerned Head of the Dept.

b. Recommended Reading

Relevant books pertaining to research problem

c. Magazines and Journals

Relevant magazines and journals pertaining to research problem

d. Websites

Relevant websites pertaining to research problem

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Course Specifications: Participation/ Presentation in Research Forum

Course Title	Participation/ Presentation in Research Forum
Course Code	PLF621
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. **Course Summary**

The aim of this course is to make a student participate / present a research paper in a conference /seminar/workshop/symposium based on his/her research work specialization during his/her programme. The student is required to carry out original research, author a conference paper and present it. The student is also required to submit the paper to a conference approved by the department

2. **Course Size and Credits:**

Number of Credits	03 National level participation: 01 International level participation: 02
Credit Structure (Lecture: Tutorial: Practical)	NA
Total Hours of Interaction	NA
Number of Weeks in a Semester	NA
Department Responsible	Pharmacology
Total Course Marks	NA
Pass Criterion	As per the Academic Regulations
Attendance Requirement	NA

3. **Course Outcomes (COs)**

After the successful completion of this course, the student will be able to:

CO-1 Analyze scientific research findings and prepare structured conference presentations

CO-2 Demonstrate professional and communication skills by presenting research work in scientific forums

CO-3 Build professional development skills and stay updated with emerging advancements

4. **Course Contents**

Unit 1 : Identification of suitable conference of research domain

Unit 2 : Participation in a conference/symposium/workshop

Unit 3: Presentation of research work in a conference

Practical/Laboratory content: NA

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5. Course Map (CO-PO-PSO Map)

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3			1		3				2	2
CO-2			1		3	3		3				2	2
CO-3					1	2					3	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Self-Learning

Description	Number of credits
Participation in National Level Seminar/Conference / Workshop / Symposium / Training Programs (related to the specialization of the student)	01
Participation in outside India International Level Seminar /Conference / Workshop / Symposium / Training Programs (related to the specialization of the student)	02

7. Course Assessment and Reassessment

NA

Process: To be nominated by the Head of the department/Course Supervisor with the supporting documents. Panel to evaluate and endorse. Dean of the Faculty to approve the credit awarded and submit to the University.

Re-assessment

NA

Course reassessment policies are presented in the Academic Regulations document.

8. Achieving Cos

The following skills are directly or indirectly imparted to the students in the following teaching and learning methods:

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading and Research
2.	Understanding	Reading and Research
3.	Critical Skills	Literature Review
4.	Analytical Skills	Research
5.	Problem Solving Skills	Research
6.	Practical Skills	Research
7.	Group Work	Data analysis
8.	Self-Learning	Reading and Research
9.	Written Communication Skills	Paper writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12	Behavioral Skills	Interactions
13	Information Management	Paper writing
14	Leadership Skills	Effective management of learning, time management, achieving the learning outcomes

9. Course Resources

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a. **Class Notes**
b. **Essential Reading**
Research Papers

Visits to websites relevant to research

a. **Websites**
1. www.sciencedirect.com

2. www.elsevier.com

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New BEL Road, M.S.R. Nagar,
Bengaluru-560054

Dean
Faculty of Pharmacy
M.S. Ramaiah University of Applied Sciences
Bangalore - 54.

Course Specifications: Publication: National/International Journals

Course Title	Publication: National/ International
Course Code	PLF622
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. Course Summary

The aim of this course is to make a student submit a research paper to a journal based on his/her research work during the programme. The student is required to carry out original research or explicit review of an article, author a journal paper for publication. The student is required to submit the research paper to a journal approved by the department.

2. Course Size and Credits

Number of Credits	Scopus indexed National Journal : 01 Scopus indexed International Journal : 02
Credit Structure (Lecture: Tutorial: Practical)	NA
Total Hours of Interaction	NA
Number of Weeks in a Semester	NA
Department Responsible	Pharmacology
Total Course Marks	NA
Pass Criterion	Acceptance of research work manuscript in a Scopus indexed journal
Attendance Requirement	NA

3. Course Outcomes (COs)

After the successful completion of this course, the student will be able to:

- **CO-1** Analyze and interpret scientific research data to prepare well-structured manuscripts
- **CO-2** Identify suitable journal and apply modern tools in the preparation and submission of manuscripts
- **CO-3** Develop communication skills by responding to peer-review feedback, revising manuscripts and engaging in continuous learning

4. Course Contents

Identify a suitable journal for research publication

Collection, presentation and analysis of relevant research data

Preparation of manuscript according to the Journal instructions

Submission of manuscript for publication and further review

Practical/Laboratory content: NA

5. Map (CO-PO-PSO Map)

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Academic Affairs
University of Applied Sciences
Bangalore

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1			3			1		3				2	2
CO-2			1	3			3	1				2	2
CO-3				1		3		2			3	2	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution													

6. Course Teaching and Learning Methods

Self-Directed

Description	Number of credits
Research /Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research /Review Publication in International Journals (Indexed in Scopus / Web ofScience)	02

7. Course Assessment and reassessment : NA

Process: To be nominated by the Head of the department/Course Supervisor with the supporting documents. Panel to evaluate and endorse. Dean of the Faculty to approve the credit awarded and submit to the University.

Reassessment

NA

8. Achieving COs

S. No	Curriculum and Capabilities Skills	How imparted during the course
1.	Knowledge	Reading and Research
2.	Understanding	Reading and Research
3.	Critical Skills	Literature Review
4.	Analytical Skills	Research
5.	Problem Solving Skills	Research
6.	Practical Skills	Research
7.	Group Work	Data analysis
8.	Self-Learning	Reading and Research
9.	Written Communication Skills	Paper writing
10.	Verbal Communication Skills	Presentation
11.	Presentation Skills	Presentation
12.	Behavioral Skills	Interactions

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13.	Information Management	Paper writing
14.	Personal Management	Course work
14.	Leadership Skills	Effective management of learning ,timemanagement, achieving the learning outcomes

9. Course Resources

a. Essential Reading

1. Research Papers/Publications from reputed journals
2. Visits to websites relevant to research

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Course Specifications: Academic/Research Award/MOOC

Course Title	Academic/Research Award/MOOC
Course Code	PLF623
Course Type	Faculty Common
Department	Pharmacology
Faculty	Pharmacy

1. **Course Summary**

The students with extraordinary academic achievement/ research accomplishment are provided an opportunity to utilize in a State/National / International awarding agencies or platforms as a means to further encourage sound scholarship. The students are trained to develop required documents like statement of purpose and resume and also developing concept note / abstract of their accomplishment.

2. **Course Size and Credits:**

Number of Credits	State/National agency awarded : 01 International agency awarded : 02
Credit Structure (Lecture: Tutorial: Practical)	NA
Total Hours of Interaction	NA
Number of Weeks in a Semester	NA
Department Responsible	Pharmacology
Total Course Marks	NA
Pass Criterion	Certificate of Excellence Award from the appropriate agency
Attendance Requirement	NA

3. **Course Outcomes (COs)**

- **CO-1** Identify areas for professional development and independent learning
- **CO-2** Improve communication and presentation skills
- **CO-3** Develop professional advancement and lifelong learning practices

4. **Course Contents**

Skill of developing report on the content of their domain for academic achievement/ research accomplishment.

Technical communication skills for submission of the documents /records for the award.

Practical/Laboratory content: NA

5. **Course Map (CO-PO-PSO Map)**

	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)	
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO-1	PSO-2
CO-1	1										3	1	2
CO-2						2		2			2	1	2
CO-3					2	2		3			2	1	2

3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution

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6. **Course Teaching and Learning Methods**

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Self-directed

Description	Number of credits
Academic /Research award from State/National level agencies	01
Academic/Research award from International level agencies	02
Completion of MOOC courses	01

7. Course Assessment and Reassessment

Process: To be nominated by Head of the department/ Course Supervisor with supporting documents. Constitution panel will evaluate and endorse the application. Dean of faculty to approve nomination and submit to the University.

8. Achieving Cos

NA

9. Course Resources

a. Essential Reading

1. Richard J Stelzer, 2002, How to write winning personal statement of purpose for graduate and professional school, 3rd edition, United States of America.
2. Parker and Beth Brown, 2012, The Damn Good
3. Leah M. Akins and Jefferson H. Akins, 2009, Technical Report Writing Guidelines, Dutchess Community College, Poughkeepsie, New York

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