RAMAIAH UNIVERSITY OF APPLIED SCIENCES | Faculty of Pharmacy

nirf Faculty of Pharmacy RUAS AIR # 65 Ranked By NIRF India Ranking 2023

Celebrating 32 Years of Excellence in Pharmacy Education (1992–2024)

STUDENT HANDBOOK

M.Pharm - Pharmacology

A Quick Guide to Academic Policies

|| ज्ञानं विज्ञानं च भक्तिसहितं ||

RAMAIAH

|| ಜ್ಞಾನಂ ವಿಜ್ಞಾನಂ ಚ ಭಕ್ತಿ ಸಹಿತಂ ||
ಜ್ಞಾನ ವಿಜ್ಞಾನ ವಿದ್ಯಾ ವಿನಯ ಭೂಷಣ
ಈ ರಾಮಯ್ಯ ಸಮೂಹ ಸಂಸ್ಥಾನ |

ತಾರೆ ನೀಹಾರಿಕೆಯಾಗಲಿ ಈ ಮಾಲಿಕೆ
ಜಯವೆನ್ನುವ ಜಯವೆನ್ನುವ ಈ ಸಂಸ್ಥಾನಕೆ ||

ದ್ರಷ್ಟಾರರು ಕಟ್ಟಿದ ಕನಸಿನ ಸಾಮ್ರಾಜ್ಯವಿದು
ದೀಪದೋಳು ಪ್ರದೀಪಗಳ ಬೆಳಗುವ ಶ್ರದ್ಧಾ ಸ್ಥಾನವಿದು |
ಅರಿವಿನ ದಿಗಂತದಾಚೆಗೆ ಜಿಗಿಯುವ ಸಂಪನ್ಮೂಲವಿದು
ಗ್ರಹ ಗ್ರಹದಲಿ ಗೃಹ ನಿರ್ಮಾಣಕೆ ತಂತ್ರಜ್ಞಾನದ ಸೋಪಾನವಿದು ||

ಮಿತಿ ಇಲ್ಲದ ಅಮಿತ ಜ್ಞಾನಕೆ ಸಾಧನ ಕ್ಷೇತ್ರವಿದು
ಪ್ರತಿ ಪ್ರತಿ ಪ್ರತಿಭೆಯು ಸಾಧನೆ ಮಾಡಲು ಸ್ಫೂರ್ತಿಯ ಕೇಂದ್ರವಿದು |
ಅಜ್ಞಾನದ ಕತ್ತಲೆ ನೀಗುವ ಸುಜ್ಞಾನದ ಸೂರ್ಯನ ರಶ್ಮಿಯಿದು
ಜಗದೋದ್ಧಾರನ ಹೊಂಗನಸನು ಹೊತ್ತಿಹ ಅರಿವಿನ ತಾಣವಿದು |
ಅರಿವಿನ ಹಣತೆಯು ಬೆಳಕನು ಚೆಲ್ಲಿದೆ
ಅಸಂಖ್ಯಾತ ಕಿರಣಗಳು ಎಲ್ಲೆಡೆ ಹೊರ ಹೊಮ್ಮಿವೆ ||

Applied Brilliance
Makes All the Difference

RAMAIAH UNIVERSITY OF APPLIED SCIENCES | Faculty of Pharmacy

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

- ***To impart quality education to develop pharmacy professionals to lead the progress in global healthcare***
- ***To evolve into center of excellence in pharmaceutical research***
- ***To create entrepreneurs and problem solvers in multi-disciplinary arena***
- ***To inculcate professional ethics and passion for lifelong learning***

PHARMACIST'S OATH

- *I swear by the code of ethics of Pharmacy Council of India, in relation to the community and shall act as an integral part of health care team*
- *I shall uphold the laws and standards governing my profession*
- *I shall strive to perfect and enlarge my knowledge to contribute to the advancement of pharmacy and public health*
- *I shall follow the system which I consider best for Pharmaceutical care and counseling of patients*
- *I shall endeavor to discover and manufacture drugs of quality to alleviate sufferings of humanity*
- *I shall hold in confidence the knowledge gained about the patients in connection with my professional practice and never divulge unless compelled to do so by the law*
- *I shall associate with organizations having their objectives for betterment of the profession of Pharmacy and make contribution to carry out the work of those organizations*
- *While I continue to keep this oath unviolated, may it be granted to me to enjoy life and the practice of pharmacy respected by all, at all times*
- *Should I trespass and violate this oath, may the reverse be my lot !*

Leadership Team

Dr. M. R. Jayaram

Hon'ble Chancellor

Prof. K. K. Raina

Hon'ble Vice-Chancellor

Prof. O. P. Kharbanda

Pro Vice-Chancellor, Health Sciences

Dr. G. S. Venkatesh

Registrar

Dr. Medha Y Rao

Dean - Academics

Dr. S. Bharath

Dean

Head of the Departments

Dr. B. V. Basavaraj

Pharmaceutics

Dr. Harish Kumar. D. R

Pharmaceutical Chemistry

Dr. J. Anbu

Pharmacology

Dr. Ashoka Babu. V. L

Pharmacognosy

Dr. G. R. Saraswathy

Pharmacy Practice

COMMITTEES FOR FACULTY EXCELLENCE

Sl. No.	NAME OF THE COMMITTEE	ROLES AND RESPONSIBILITIES	MEMBERS
1	Academic Affairs and Examination Committee	• To frame academic calendar of events for all programmes • To co-ordinate smooth conduct of academic activities • To frame timetable for conduct of sessional and SEE/YEE examinations • To co-ordinate for timely announcement of results	Dr. Judy Jays Dr. K. Sundara Saravanan HOD'S Dr. R. Deveswaran
2	Time Table Committee	• To prepare, check and review academic time table for B.Pharm, M.Pharm, Pharm.D and MBA (Pharma Business Management) programmes for each semester/year	Dr. R.Gowri Dr. Sharon C Furtado Dr. Yuvapriya. M. K Mrs. Ashwini Somayaji Mrs. Jeesa George
3	ICT Committee	• To monitor the availability of required IT facilities within the faculty for conduct of regular classes, exams, seminars and conferences, presentations, campus placements and other events in the faculty	Dr. P. Parasuraman Dr. A. R. Mahesh Dr. Mohammad Shabi Dr. Aswathi R Hegde Mr. K. L. Krishnakanth
4	Proctoring and Student Counseling Committee	• To have a complete record of allotted students data • To monitor the academic performance of the students • To conduct proctor meetings with students and record the meeting proceedings	Dr. Judy Jays All Class teachers All Proctors
5	Scholarship Committee	• To provide information regarding Government and private scholarships to students • To co-ordinate for PG students GPAT scholarships with respective agencies for approval	Dr. A. R. Mahesh Dr. Aswathi R Hegde Mr. Ramesh B Mr. Shivaraj Kumar. M. B
6	Library Committee	• To co-ordinate for procurement of new books, renewal of online and print journals & magazines • To ensure students usage of offline and online library facilities • To organize book week, books display's on special occasions • To co-ordinate for digital library databases, National and International online journals	Dr. E. Maheswari Dr. Sindhu Abraham Dr. Vijaybhanu. P HOD's Dr. Mallikarjun S Manta
7	Career Guidance, Placement & Higher Studies, Entrepreneurship Committee	• To guide, motivate students for taking up jobs, guidance for interview, motivation for higher studies (PG and Ph.D) • To co-ordinate for campus placements • To motive students to initiate startups and business portfolios after graduation • To enhance perception of FPH among the companies involved in campus placements	Dr. A. R. Mahesh Dr. R. Deveswaran Dr. G. R. Saraswathy Dr. Sandhya. K. V

Sl. No.	NAME OF THE COMMITTEE	ROLES AND RESPONSIBILITIES	MEMBERS
8	Anti-Ragging Committee (As per RUAS) & Overall Disciplinary Committee	• To monitor the students not to indulge in any sort of ragging within the campus • To monitor the students discipline and conduct in the faculty premises	Dr. B. V. Basavaraj Dr. Judy Jays Dr. B. V. Suma Dr. Ashoka Babu. V. L
9	Sports Committee	• To co-ordinate for sports activities for faculty and students • To encourage students to participate in inter/intra University, state and national level competitions	Dr. K. Sundara Saravanan Dr. Prizvan L D Souza Mrs. S. Vijayalakshmi
10	Cultural Committee	• To co-ordinate for cultural activities for faculty and students • To encourage students to participate in inter/intra University, state and national level competitions	Dr. Tanmoy Ghosh Mrs. Gouri Nair Dr. Yuvapriya. M. K Dr. Ritesh Giri
11	Literary & Celebrations Committee	• To co-ordinate Bi-annual Faculty Development Programmes • To display newspaper/magazine/journal cuttings on notice board • To make necessary arrangements for conduct of special events in the faculty	Mrs. Shwetha. K Mrs. Jeesa George Mrs. Knolin K Thachil Dr. Ksheeraja S Satish Mr. Damodar Nayak. A
12	Academia-Industry Collaboration Committee	• To interact with pharmaceutical companies across India for collaboration in terms of internship, projects and consultancy works • To co-ordinate with foreign Universities for multi-disciplinary collaborations in terms of research proposals, faculty and student exchange programmes	Dr. R. Deveswaran Dr. J. Anbu Dr. Sandhya. K. V Dr. P. Parasuraman Dr. A. R. Mahesh HOD's
13	Research Review Committee	• To review and approve manuscripts/ abstracts prior to submission to Journals and Conferences. • To review and approve the research proposals submitted by faculty for funding agencies in terms of its quality, merit, collaborations etc.	Dr. B. V. Basavaraj Dr. R. Deveswaran Dr. G. R. Saraswathy Dr. J. Anbu Dr. Sharon C Furtado Dr. Parasuraman P
14	Faculty Visibility Committee	• To co-ordinate for various Faculty/ University ranking process across the country & globally like QS, NIRF, AICTE, Educational Magazine awards etc..	Dr. Lakshmi M Sundar Dr. J. Anbu J Dr. B. V. Basavaraj Dr. Sharon C Furtado
15	Alumni Association Committee	• To co-ordinate with students' alumni for updating database • To initiate alumni activities in the faculty • To update students' alumni about the proceedings of FPH through mails and social media • To increase the perception of FPH among the alumni, their parents, peers, public	Dr. Tanmoy Ghosh Dr. Prizvan L D Souza Dr. Ksheeraja S Satish Ms. S. Nikitha Mrs. S. Vijayalakshmi
16	IAEC Committee	• To monitor the animal experiments, to conduct annual meetings, approval of research proposals etc.	Dr. J. Anbu Dr. K. Sundara Saravanan Dr. Kesha M Desai External CPCSEA members

Student Support Team

***Anti-Ragging*: Dr. B. V. Basavaraj**

***Internal Complaints Committee/Women's cell*: Dr Judy Jays**

***Scholarships*: Dr. A. R. Mahesh**

***Student Grievances*: Dr. Vijayabhanu. P**

***Admin Executive*: Mr. Ramesh. B**

***Store In Charge*: Mr. Samsiva Rao. P**

***Examination & Assessment*: Mrs. Asha Shyam, Mr. S. Ventakesh**

***Librarian*: Dr. Mallikarjun S Manta**

***Accounts*: Mr. Shivaraj Kumar. M. B**

***HR & Student Insurance*: Mrs. Nethra. V**

***Custodian Teaching Aids*: Mr. K. L. Krishnakanth**

Laboratory Technicians

Mr. Shivaprakash. S
Dept. of Pharmacognosy & Dept. of Pharmaceutical Chemistry

Mrs. Vijayalakshmi. C
Dept. of Pharmaceutics

Ms. Ashwini. C. V
Dept. of Pharmacology

TABLE OF CONTENTS

Faculty	**Pharmacy**
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 2022**
7. **Date of Programme Approval by the Academic Council of MSRUAS: April 2017**
8. **Next Review Date: June 2024**
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.

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. Pharmacy Knowledge: Ability to acquire knowledge and comprehend 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.

GA-2. Planning Abilities: Ability to demonstrate effective planning including time management, resource management, delegation skills and organizational skills. Also to develop and implement plans and organize work to meet deadlines.

GA-3. Problem analysis: Ability to 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.

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

GA-5. Leadership skills: Ability to 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. Also to assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well- being.

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

GA-7. Pharmaceutical Ethics: Ability to 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.

GA-8. Communication: Ability to 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, give and receive clear instructions.

GA-9. The Pharmacist and society: Ability to 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.

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

GA-11. Life-long learning: Ability to 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.

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.

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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 the experimental procedures in animals and the environment

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 knowledge of recent advances in Pharmacology and Pharmacotherapy along with principles of molecular pharmacology in drug discovery process

PSO-2. Justify the rationale for the usage of animal models with appropriate pharmacological techniques and validate various methods for identification and optimization of lead molecules by considering regulatory requirements

PSO-3. Develop novel pharmacological screening methods by employing molecular modelling and virtual screening methods as alternatives for animal models with the capability to develop interpreted technical reports on drug responses

PSO-4. Understand the significance of Life-long Learning philosophy with leadership qualities for the betterment of environment and society.

21. Programme Structure

Table 1. Programme Structure

SEMESTER – I			
Course Code	**Courses**	**Credits**	**Hours/ Week**
DEPARTMENT COMMON COURSE			
PLF510	1. Modern Pharmaceutical Analytical Techniques	4	4
PROGRAMME SPECIALIZATION COURSES			
PLC502	1. Advanced Pharmacology-I	4	4
PLC503	2. Pharmacological and Toxicological Screening Methods-I	4	4
PLC504	3. Cellular and Molecular Pharmacology	4	4
PLL505	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	2. 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
PLF614	2. Journal Club	1	1
PLF615	3. Group project	4	-
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	1- 3	**-**
PLF622	2. Publication: National / International Journals		**-**
PLF623	3. Academic/Research award: State/National/International Agencies		**-**

Mentor: Dr. J. Anbu, Professor & HoD, Department of Pharmacology

SEMESTER I

SEMESTER	**I**
DEPARTMENT	**Pharmaceutical chemistry**
COURSE TITLE	**Modern Pharmaceutical Analytical Techniques**
COURSE CODE	**PLF501**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
The aim of this course is to impart knowledge and to familiarize the students with the principles, instrumentation and applications of UV-visible, IR, NMR, and Mass spectroscopy, as well as thermo-analytical techniques and X-ray crystallography in the analysis of various drugs and pharmaceuticals. The course also emphasizes the chromatographic and electrophoretic separation techniques.	**CO-1.** Summarize the fundamental principles, theory, and applications of UV-visible and IR spectroscopy, flourimetric analysis, flame emission and atomic absorption spectroscopy **CO-2.** Theory, instrumentation and applications of NMR and Mass spectroscopy, **CO-3.** Explain the principles and applications of chromatographic, and electrophoretic separation techniques **CO-4.** Elaborate the principle and applications of potentiometric methods, X-ray crystallographic methods and thermo-analytical methods **CO-5.** Discuss the instrumentation of the various modern analytical techniques

Course Content and Assessment Plan

SL. No.	Course Content	Syllabus (Chapters / Units)	Distribution of marks of assessment			
			CE component (25% of Marks of Assessment)		Semester End Examination (75% of marks of Assessment)	Marks for Assessment
			Sessional 1	Sessional 2		
1	**UV-Visible spectroscopy:** Introduction, Theory, Laws, and Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. **IR spectroscopy:** Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation **Spectroflourimetry:** Theory of Fluorescence,	Unit 1	25		15	40

	Factors affecting fluorescence (Characteristics of drugs that can be analyzed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. **Flame emission spectroscopy and Atomic absorption spectroscopy:** Principle, Instrumentation, Interferences and Applications.					
2	**NMR spectroscopy:** Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ^{13}C NMR. Applications of NMR spectroscopy	Unit 2		15	15	30
3	**Mass Spectroscopy**: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	Unit 3		5	15	20
4	**Chromatography:** Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution,	Unit 4	10	15	20	45

	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 h) Paper Chromatography					
5	**Electrophoresis**: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing. **X ray Crystallography:** Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	Unit 5	10		10	20
6	**Potentiometry:** Principle, working, Ion selective Electrodes and Application of potentiometry. **Thermal Techniques:** Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental	Unit 6		10	15	25

	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.					
Total marks for assessment including choice			**45**		**90**	180

REFERENCES BOOKS: (Theory)

1. Silverstein, RM. Webster, FX (2004) Spectrometric identification of organic compounds, 6th Edition, NewYork: John Wiley and Sons.
2. Willard, HH. Merritt, LL. Dean, JA. Settle, FA. Instrumental methods of analysis.7th Edition, New Delhi: CBSPublishers and Distributors.
3. Beckett, AH. Stenlake, JB. (2004) Practical Pharmaceutical Chemistry. Vol. I & II. London: The Athlon Press ofthe University of London.

SEMESTER	**I**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**ADVANCED PHARMACOLOGY – I**
COURSE CODE	**PLC502**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** Outline the steps involved in neuro-humoural transmission **CO-2.** Explain the pharmacokinetics and mechanism of drug action at organ system/cellular/ molecular levels **CO-3.** Summarize the pharmacology of drugs acting on various systems **CO-4.** Appraise the pathophysiology and pharmacotherapy of certain diseases **CO-5.** Predict adverse drug reactions and drug interactions **CO-6.** Discuss on the recent advances in Pharmacology and Pharmacotherapy

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**Unit 1. General Pharmacology 12 hours** a. Pharmacokinetics: The dynamics of drug absorption, distribution, biotransformation and elimination; Concepts of linear and non-linear compartment models; Significance of Protein binding. b. 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 1	20		20	40
2	**Unit 2. Neurotransmission 12 hours** **a.** General aspects and steps involved in neurotransmission. **b.** Neurohumoral transmission in autonomic nervous system	Unit 2	15		20	35

	(Detailed study about neurotransmitters- Adrenaline and Acetyl choline). **c.** Neurohumoral transmission in central nervous system (Detailed study about neurotransmitters- histamine, serotonin, dopamine, GABA, glutamate and glycine]. **d.** Non adrenergic non cholinergic transmission (NANC). Co-transmission					
3	**Unit 3. Systemic Pharmacology 12 hours** A detailed study on pathophysiology of diseases, mechanism of action, pharmacology and toxicology of existing as well as novel drugs used in the following systems **a. Autonomic Pharmacology** Parasympathomimetics and lytics, sympathomimetics and lytics; agents affecting neuromuscular junction	Unit 3		25	15	40
4	**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	Unit 4		10	15	25
5	**Cardiovascular Pharmacology 12 hours** Diuretics, antihypertensives, antiischemics, anti- arrhythmics, drugs for heart failure and hyperlipidemia; Hematinics, coagulants, anticoagulants, fibrinolytics and antiplatelet drugs	Unit 5	10		10	20
6	**Autocoid Pharmacology 12 hours** The physiological and pathological role of Histamine, Serotonin, Kinins, Prostaglandins Opioid autocoids; Pharmacology of antihistamines, 5HT			10	10	20

	antagonists.					
Total marks for assessment including choice			**45**		**90**	180

REFERENCES BOOKS: (Theory)

1. Katzung, B.G. (2009) *Basic and Clinical Pharmacology*, 11rd edn, New Delhi: Tata McGraw Hill.
2. Rang, M.P., Dale, M.M. and Riter, J.M. (1995) *Pharmacology*, 4th edn, China: Churchill Livingstone.
3. 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.

SEMESTER	**I**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS – I**
COURSE CODE	**PLC503**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** Summarise 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.** Identify alternatives to animal eperiments **CO-4.** Justify the screening methods used in drug development **CO-5.** Relate preclinical data to humans **CO-6.** Recommend appropriate preclinical models for evaluation of new drugs

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**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 1	10		15	25
2	**Unit 2. Preclinical screening of new substances for the**	Unit 2	25		20	45

	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, Alzheimers and multiple sclerosis. Drugs acting on the Autonomic Nervous System					
3	**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, antiinflammatory and antipyretic agents. d. Gastrointestinal drugs: antiulcer, anti -emetic, antidiarrheal and laxatives.	Unit 3	10	15	20	45
4	Unit 4. **Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. 12 hours** **a .** Cardiovascular Pharmacology: antihypertensives, antiarrythmics, antianginal, antiatherosclerotic agents and diuretics.	Unit 4		15	20	35

	b. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents. c. Anti-cancer agents. d. Hepatoprotective screening methods.					
5	**Unit 5. Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative model 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	Unit 5		15	15	30
Total marks for assessment including choice			**45**		**90**	**180**

REFERENCES BOOKS: (Theory)

1.Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company.

2.McLeod, L. J. (1970) Pharmacological experiments on intact preparations, New York: Churchill Livingstone

3.Vogel H.G. and Vogel, W.H. (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn, New York: Springer.

SEMESTER	**I**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**CELLULAR AND MOLECULAR PHARMACOLOGY**
COURSE CODE	**PLC504**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** Outline the receptor signal transduction processes and molecular pathways affected by drugs **CO-2.** Demonstrate various molecular biology techniques **CO-3.** Appraise the principles of pharmacogenomics and their applications **CO-4.** Relate the applicability of molecular pharmacology and biomarkers in drug discovery process **CO-5.** Discuss the mechanism of gene expression and gene therapy **CO-6.** Apply the concepts of molecular biology to discover new therapeutic options

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**Cell Biology** Structure and functions of cell and its organelles Genome organization Gene expression and its regulation, importance of siRNA and micro RNA, gene mapping and gene sequencing Cell cycles and its regulation Cell death– events, regulators, intrinsic and extrinsic pathways of apoptosis Necrosis and autophagy	Unit 1	15		20	35
2	**Cell Signaling** Intercellular and intracellular signaling pathways Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors Secondary messengers: cyclic AMP, cyclic GMP, calcium ion, inositol	Unit 2	15		20	35

	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					
3	Principles and applications of genomic and proteomic tools DNA electrophoresis, PCR (reverse transcription and real time), Gene sequencing, micro array technique, SDS page, ELISA and western blotting Recombinant DNA technology and gene therapy Basic principles of recombinant DNA technology-Restriction enzymes, various types of vectors; Applications of recombinant DNA technology Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy	Unit 3		25	20	45
4	**Pharmacogenomics** Gene mapping and cloning of disease gene Genetic variation and its role in health/ pharmacology Polymorphisms affecting drug metabolism Genetic variation in drug transporters Genetic variation in G protein coupled receptors Applications of proteomics science: Genomics, proteomics, metabolomics, functionomics, nutrigenomics Immunotherapeutics Types of immunotherapeutics,	Unit 4	15		10	25

	humanisation antibody therapy, Immunotherapeutics in clinical practice					
5	Cell culture techniques 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	Unit 5		20	20	40
Total marks for assessment including choice			**45**		**90**	180

REFERENCES BOOKS: (theory)

1. Cooper, G.M. (2000) the Cell, A Molecular Approach. 2nd edn. Boston University. Sunderland (MA): Sinauer Associates.
2. Licinio, J. and Wong, M. (2002) Pharmacogenomics: The Search for Individualized Therapies, Weinheim (Germany): Wiley-VCH.
3. Jingwu Zhang, (2007) Immune Regulation and Immunotherapy in Autoimmune Disease, US: Springer.

COURSE TITLE	PHARMACOLOGY PRACTICAL I
COURSE CODE	PLL505

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 Outcomes (COs)

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

CO-1. Demonstrate various routes of drug administration

CO-2. Analyze drugs using various instrumental techniques

CO-3. Evaluate drug action by in vitro and in vivo methods

CO-4. Estimate DNA and RNA from different sources

CO-5. Perform molecular biology techniques as applicable for Pharmacology

3. Course Contents:

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) Handling of laboratory animals
8) Various routes of drug administration.
9) Techniques of blood sampling, anesthesia and euthanasia of experimental animals
10) Functional observation battery tests (modified Irwin test)
11) Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity
12) Evaluation of analgesic, anti-inflammatory, local anesthetic, mydriatic and miotic activity
13) Evaluation of diuretic activity
14) Evaluation of antiulcer activity by pylorus ligation method
15) Oral glucose tolerance test
16) Isolation and identification of DNA from various sources (Bacteria, Cauliflower, onion, Goat liver)
17) Isolation of RNA from yeast
18) Estimation of proteins by Braford/Lowry's in biological samples.
19) Estimation of RNA/DNA by UV Spectroscopy
20) Gene amplification by PCR
21) Protein quantification Western Blotting
22) Enzyme based in-vitro assays (MPO, AChEs, α amylase, α glucosidase)
23) Cell viability assays (MTT/Trypan blue/SRB)
24) DNA fragmentation assay by agarose gel electrophoresis

25) DNA damage study by Comet assay
26) Apoptosis determination by fluorescent imaging studies
27) Pharmacokinetic studies and data analysis of drugs given by different routes of administration using software
28) Enzyme inhibition and induction activity
29) Extraction of drug from various biological samples and estimation of drugs by various analytical techniques (UV)
30) Extraction of drug from various biological samples and estimation of drugs by various analytical techniques (HPLC)

Scheme of Evaluation:

Component 1(CE): 50 Marks

1A: Attendance: 10 Marks

1B: Student Teacher-interaction: 10 Marks

1C: Sessional Exam: 30 Marks

Component 2(SEE): Semester End Examination: 100 Marks

Component 1(CE): 50 Marks

1A: Attendance: 10 Marks

1B: Student Teacher-interaction: 10 Marks

1C: Sessional Exam: 30 Marks

Component 2(SEE): Semester End Examination: 100 Marks

Synopsis – 20 Marks

Major Experiment – 35 Marks

Minor Experiment – 25 Marks

Viva Voce – 20 Marks

REFERENCE BOOKS: (Practical)

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

COURSE TITLE	Seminar/Assignment
COURSE CODE	PLS506

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 Outcomes (COs)

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

CO-1. Develop critical thinking, analytical thinking and problem-solving skills

CO-2. Demonstrate the ability to synthesize the report

CO-3. Develop academic report with appropriate citation and referencing style

CO-4. Communicate the contents of the report to the panel

CO-5. Defend the contents of the report in the panel

3. 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

4. Course Assessment

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)

REFERENCE BOOKS: (Seminar/Assignment)

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

SEMESTER II

SEMESTER	**II**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**ADVANCED PHARMACOLOGY – II**
COURSE CODE	**PLC507**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** Describe the pharmacology of drugs acting on various systems **CO-2.** Outline the pathophysiology and pharmacotherapy of certain diseases **CO-3.** Predict adverse drug reactions and drug interactions **CO-4.** Appraise the applications of chronotherapy in various diseases **CO-5.** Signify the role of free radicals in the pathogenesis of several diseases **CO-6.** Discuss on the recent advances in Pharmacology and Pharmacotherapy

Course Content and Assessment Plan

SL. No.	Course Content	Syllabus (Chapters / Units)	Distribution of marks of assessment			
			CE component (25% of Marks of Assessment)		Semester End Examination (75% of marks of Assessment)	Marks for Assessment
			Sessional 1	Sessional 2		
1	**Endocrine Pharmacology:** 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 1	20		20	40
2	**Chemotherapy:** 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 2	15		20	35
3	**Chemotherapy** Drugs used in Protozoal Infections Drugs used in the treatment o Helminthiasis Chemotherapy o cancer **Immunopharmacology** Cellular and biochemical mediators of inflammation	Unit 3		25	20	45

	and immune response Allergic or hypersensitivity reactions Pharmacotherapy of asthm and COPD Immunosuppressar and Immunostimulants					
4	**GIT Pharmacology** Antiulcer drugs, Prokinetics, antiemetics, anti-diarrheals and drugs for constipation and irritable bowel syndrome **Chronopharmacology** Biological and circadian rhythms, applications of chronotherapy in various diseases like cardiovascular disease, diabetes, asthma and peptic ulcer	Unit 4		20	20	40
5	**Free radicals Pharmacology** Generation of free radicals, role of free radicals in etiopathology of various diseases such as diabetes, neurodegenerative diseases and cancer Protective activity of certain important antioxidants **Recent Advances in Treatment:** Alzheimer's disease, Parkinson's disease, Cancer, Diabetes mellitus	Unit 5	10		10	20
Total marks for assessment including choice		**45**			**90**	**180**

REFERENCES BOOKS: (Theory)

1) Katzung, B.G. (2009) Basic and Clinical Pharmacology, 11th edn, New Delhi: Tata McGraw Hill.
2) Rang, M.P., Dale, M.M. and Riter, J.M. (1995) Pharmacology, 4th edn, China: Churchill Livingstone.
3) 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.

SEMESTER	**II**
DEPARTMENT	**Pharmacology**
COURSE TITLE	**Pharmacological and Toxicological Screening Methods – II**
COURSE CODE	**PLC508**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** List the studies needed for IND submission **CO-2.** Illustrate various types of toxicity studies **CO-3.** Demonstrate the practical skills required to conduct the preclinical toxicity studies **CO-4.** Point out the importance of ethical and regulatory requirements for toxicity studies **CO-5.** Identify alternatives to animal experiments **CO-6.** Recommend appropriate preclinical models for evaluation of new drugs

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**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 1	15		20	35
2	**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 2	25		15	40
3	**Unit 3. 12 hours** a. Reproductive toxicology	Unit 3	5	20	20	45

	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					
4	**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 4		15	20	35
5	**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	Unit 5		10	15	25
Total marks for assessment including choice			**45**		**90**	180

REFERENCES (Theory)

1. Ghosh, M.N. (2008) Elements of Experimental Pharmacology, 4th edn, Kolkata: Hilton and Company
2. McLeod, L. J. (1970) Pharmacological experiments on intact preparations, New York: Churchill Livingstone
3. Vogel H.G. and Vogel, W.H. (2002) Drug Discovery and Evaluation: Pharmacological Assays, 2nd edn, New York: Springer

SEMESTER	**II**
DEPARTMENT	**Pharmaceutical Chemistry**
COURSE TITLE	**Principles of Drug Discovery**
COURSE CODE	**PLC509**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	CO-1. Outline the various stages of drug discovery CO-2. Summarize the importance of genomics, proteomics and bioinformatics in drug discovery CO-3. Discuss the general sequence of rational drug design CO-4. Demonstrate QSAR, molecular modelling and virtual screening methods CO-5. Evaluate the various methods for identification and optimization of lead molecules CO-6. Demonstrate the role of computer aided drug design in drug discovery

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**Unit 1** 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 1	20		20	40
2	**Unit 2** Lead Identification-combinatorial chemistry & high throughput screening, in silico lead discovery techniques, Assay development for hit	Unit 2	20		20	40

	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					
3	**Unit 3** 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 3	05	15	20	40
4	**Unit 4** 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 4		25	15	40

5	**Unit 5** 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.	Unit 5		5	15	20
Total marks for assessment including choice				**45**	**90**	**180**

REFERENCES BOOKS: (Theory)

1) Mouldy, S. H. (2010) *Target Discovery and Validation Reviews and Protocols,* Volume 2 Emerging Molecular Targets and Teratment Options, New York, Humana Press Inc.
2) León, D. and MarkelIn, S. (2006) *In Silico Technologies in Drug Target Identification andValidation,* US: Taylor and Francis Group, LLC.
3) Distefano, J.K (2011) *Disease gene identification*: *methods and protocols*. New York: Springer.

SEM	**II**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**CLINICAL RESEARCH AND PHARMACOVIGILANCE**
COURSE CODE	**PLC 510**

AIM / COURSE SUMMARY	**OBJECTIVES / COs**
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.	**CO-1.** Appraise the regulatory requirements for conducting clinical trial **CO-2.** Outline the types of clinical trial designs **CO-3.** Point out the responsibilities of key players involved in clinical trials **CO-4.** Summarize the significance of safety monitoring and establishment of pharmacovigilance **CO-5.** Conduct safety monitoring, reporting and close-out activities **CO-6.** Apply the concepts of clinical research

Course Content and Assessment Plan

SL. No.	**Course Content**	**Syllabus (Chapters / Units)**	**Distribution of marks of assessment**			
			CE component (25% of Marks of Assessment)		**Semester End Examination (75% of marks of Assessment)**	**Marks for Assessment**
			Sessional 1	**Sessional 2**		
1	**Regulatory Perspectives of Clinical Trials:** 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 1	10		20	30
2	**Clinical Trials: Types and Design** Experimental Study- RCT and Non RCT,	Unit 2	15		10	25

	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					
3	**Clinical Trial Documentation** Guidelines to the preparation of documents, Preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report Clinical Trial Monitoring-Safety Monitoring in CT **Adverse Drug Reactions:** Definition and types. Detection and reporting methods Severity and seriousness assessment Predictability and preventability assessment Management of adverse drug reactions; Terminologies of ADR	Unit 3	20		30	50
4	**Basic aspects, terminologies and establishment of pharmacovigilance** History and progress of pharmacovigilance, Significance of safety monitoring, Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, Establishing pharmacovigilance centres in Hospitals, Industry and National programmes related to pharmacovigilance	Unit 4		25	20	45

	Roles and responsibilities in Pharmacovigilance					
5	**Methods, ADR reporting and tools used in Pharmacovigilance** 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	Unit 5		20	10	30
Total marks for assessment including choice			**45**		**90**	

REFERENCES BOOKS: (Theory)

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

SEM	**II**
DEPARTMENT	**PHARMACOLOGY**
Course Title	**Pharmacology Practical - II**
Course Code	**PLL511**

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 Outcomes (COs)

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

CO-1. Acquire knowledge in *In-silico* docking and QSAR studies
CO-2. Record vital parameters of small experimental animals
CO-3. Evaluate drug action using various isolated tissue preparations
CO-4. Conduct toxicity studies following regulatory guidelines
CO-5. Design protocols for clinical trials and ADR reporting

3. Course Contents:

To record the DRC of agonist using suitable isolated tissues preparation, To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation, To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation, To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation, To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation, To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation, Estimation of PA2 values of various antagonists using suitable isolated tissue preparations, To study the effects of various drugs on isolated heart preparations, Recording of rat BP, heart rate and ECG, Recording of rat ECG, Drug absorption studies by averted rat ileum preparation, Acute oral toxicity studies as per OECD guidelines, Acute dermal toxicity studies as per OECD guidelines, Repeated dose toxicity studies- Serum biochemical, hematological, urine analysis, functional observation tests and histological studies, Drug mutagenicity study using mice bone-marrow chromosomal aberration test, Protocol design for clinical trial (3 Nos.), Design of ADR monitoring protocol, In-silica docking studies (2 Nos.), In-silica pharmacophore-based screening, In-silica QSAR studies, ADR reporting

Scheme of Evaluation:

Component 1(CE): 50 Marks

1A: Attendance: 10 Marks

1B: Student Teacher-interaction: 10 Marks

1C: Sessional Exam: 30 Marks

Component 2(SEE): Semester End Examination: 100 Marks

Synopsis – 20 Marks, Major Experiment – 35 Marks, Minor Experiment – 25 Marks, Viva Voce – 20 Marks, **Total: 100 Marks**

REFERENCE BOOKS (Practical):

1) M.N. 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.

SEM	**II**
DEPARTMENT	**PHARMACOLOGY**
COURSE TITLE	**Seminar/Assignment**
COURSE CODE	**PLS512**

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 Outcomes (COs)

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

CO-1. Develop critical thinking, analytical thinking and problem-solving skills
CO-2. Demonstrate the ability to synthesize the report
CO-3. Develop academic report with appropriate citation and referencing style
CO-4. Communicate the contents of the report to the panel
CO-5. Defend the contents of the report in the panel

3. 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

REFERENCE BOOKS: Seminar/Assignment

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

SEMESTER III

COURSE TITLE	Research Methodology and Biostatistics
COURSE CODE	PLF613

AIM / COURSE SUMMARY	OBJECTIVES / COs
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.	**CO-1.** Recognize the value, scope, objective and requirements of research **CO-2.** Discuss the basic concept and importance of statistical analysis **CO-3.** Outline the basic principles of medical research **CO-4.** Summarize the guidelines for the maintenance of laboratory animals **CO-5.** Perform the profession of Pharmacy with code of conduct and ethics **CO-6.** Apply the principles of medical research for the development of knowledge in the field of medicine

Course Content and Assessment Plan

SL. No.	Course Content	Syllabus (Chapters / Units)	Distribution of marks of assessment			
			CE component (25% of Marks of Assessment)		Semester End Examination (75% of marks of Assessment)	Marks for Assessment
			Sessional 1	Sessional 2		
1	**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 1	5	20	25	50
2	**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 2	20	10	20	50
3	**Medical Research:** History, values in medical ethics, autonomy, beneficence, non-	Unit 3	--------	15	15	30

	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.					
4	**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 4	10	--------	15	25
5	**Declaration of Helsinki:** History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	Unit 5	10	--------	15	25
Total marks for assessment including choice			**45**		**90**	180

REFERENCE BOOKS: (Theory)

1. Booth W. C, Colomb and Williams, G.G (2005) The Craft of Research, Chicago University Press.
2. Himanshi Joshi, (2015) An alternative approach to experimental Pharmacology. India: Himdeep publication.
3. Jonathan Grix. (2004) The Foundation of Research, Palgrave Study Guides

COURSE TITLE	Journal club
COURSE CODE	PLF614

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 Outcomes (COs)

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

CO-1. Select scientific articles from reputed journals
CO-2. Use search engines to select scientific articles
CO-3. Critically appraise scientific articles and assess the quality
CO-4. Develop a report on the critically appraised article
CO-5. Present the critically appraised article in appropriate forum

3. 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

4. Course Assessment

Total Marks: 25
Component 1: Report Evaluation: 15 marks
Component 2: Presentation: 10 marks

REFERENCE BOOKS:

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

COURSE TITLE	Group Project
COURSE CODE	PLF615

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 Outcomes (COs)

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

CO-1. Work in a team and undertake a project in the area of Pharmaceutical Sciences
CO-2. Apply concepts of pharmaceutical sciences for executing the project
CO-3. Apply appropriate research methodology while formulating a project
CO-4. Generate specifications, synthesize, analyse, develop and evaluate a project
CO-5. Defend the project, exhibit, make a presentation and document the work

3. Course Contents

Need for undertaking a project, Project design, protocol / specifications design, methodology, analysis, product/design/model evaluation and presentation Project Management, Time Management, Resource Management Project Material indent, Project Development, Testing, Project Evaluation Project Exhibition, Presentation Team building, Team work, Leadership skills Practical/Laboratory content: Interdepartmental laboratory work

4. Course Assessment

Component - 1: 50% weight Project Report and Viva-Voce

Component - 2: 50% weight Exhibition and Presentation

COURSE TITLE	Discussion / Synopsis Presentation
COURSE CODE	PLF616

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 bioavailable drugs and delivery systems

2. Course Outcomes (COs)

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

CO-1. Identify Research problem
CO-2. Discuss research problem with team and peers for solution
CO-3. Develop a protocol report on the critically appraised research problem
CO-4. Present the critically appraised research problem in appropriate forum

3. Course Contents

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.

4. Course Assessment

Total Marks: 50 Marks

COURSE TITLE	Research Work
COURSE CODE	PLF617

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 Outcomes (COs)

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

CO-1. Review scholarly literature collected from various sources critically for the project and formulate a research problem
CO-2. Prepare and present a research proposal
CO-3. Conduct research to achieve research objectives
CO-4. Propose new ideas/methodologies or procedures for further improvement of the research problem
CO-5. Create research document of the findings
CO-6. Defend the research findings in front of scholarly audience

3. 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 and Oral presentation

Practical/Laboratory content: Yes.

4.Course Assessment : **Total Marks: 350**

Component -1: 250 Marks : Evaluation of Interim-Dissertation Presentation

Component-2:100 Marks: Evaluation of Interim Dissertation work Progress

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**

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

SEMESTER IV

COURSE TITLE	Journal club
COURSE CODE	PLF618

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 Outcomes (COs)

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

CO-1. Select scientific articles from reputed journals

CO-2. Use search engines to select scientific articles

CO-3. Critically appraise scientific articles and assess the quality

CO-4. Develop a report on the critically appraised article

CO-5. Present the critically appraised article in appropriate forum

3. Course Contents

Select scientific articles from reputed journal, 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

4. Course Assessment

Total Marks: 25

Component 1: Report Evaluation: 15 marks

Component 2: Presentation: 10 marks

COURSE TITLE	Discussion / Presentation
COURSE CODE	PLF619

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 Outcomes (COs)

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

CO-1. Identify Research problem
CO-2. Discuss research problem with team and peers for solution
CO-3. Develop a protocol report on the critically appraised research problem
CO-4. Present the critically appraised research problem in appropriate forum

3. Course Contents

Conduct of research work /Group Project in the laboratories and collection of data/findings, Record the findings/data for solving research problem with scientific based results, develop a report on the critical observations and discuss with mentor /peer, Investigation of medicinal Presentation of the reports/findings in appropriate forum)

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

4. Course Assessment

Total Marks: 75 Marks

COURSE TITLE	Research Work
COURSE CODE	PLF620

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 Outcomes (COs)

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

CO-1. Review scholarly literature collected from various sources critically for the project and formulate a research problem
CO-2. Prepare and present a research proposal
CO-3. Conduct research to achieve research objectives
CO-4. Propose new ideas/methodologies or procedures for further improvement of the research problem
CO-5. Create research document of the findings
CO-6. Defend the research findings in front of scholarly audience

3. 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.

4. Course Assessment : **Total Marks: 400**

Component -1: 250 Marks: Evaluation of Final Dissertation Book

Component-2:150 Marks: Evaluation of Final Dissertation Presentation

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

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

COURSE TITLE	Participation/ Presentation in Research Forum
COURSE CODE	PLF621

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 Outcomes (COs)

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

CO-1. Identify a suitable conference /research forum/workshop/symposium for participation/presentation
CO-2. Participation in a conference/research forum/workshop/symposium of the chosen research domain
CO-3. Present a research work in the conference/research forum of the chosen research domain

3. Course Contents

Identification of suitable conference of research domain, Participation in a conference/symposium/workshop, Presentation of research work in a conference

Practical/Laboratory content: NA

4. Course Assessment: Total Marks: NA, Self-directed

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

COURSE TITLE	Publication: National/ International
COURSE CODE	PLF622

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 Outcomes (COs)

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

CO-1. Write a research paper based on research and journal requirements
CO-2. Publish the research work manuscript in a reputed journal

3. 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

4. Course Assessment: Total Marks: NA, 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 of Science)	02

COURSE TITLE	Academic/Research Award
COURSE CODE	PLF623

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 Outcomes (COs)

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

CO-1. Synthesize the academic accomplishments /research findings in the form of report
CO-2. Identify an appropriate award granting agency to submit the report
CO-3. Develop required documents applicable to submit the academic accomplishment / research report

3. 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

4. Course Assessment: Total Marks: NA, Self-directed

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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The Ramaiah Group, through our Trusts, Gokula Education Foundation (set up in 1963) and Gokula Education Foundation – Medical (set up in 1979), focus on

Healthcare & Education

we seek to move our society towards greater harmony and inclusiveness