Raghavendra Institute of Pharmaceutical Education and Research (RIPER)-Autonomous

Accorded under Sections 2 (f) and 12 (B) of UGC act 1956 and accredited by NBA (UG) & NAAC-A Grade, Approved by PCI & AICTE, New Delhi

Academic regulations, Program structure & syllabus

Effective from AY 2023

Doctor of Pharmacy

Applicable for the batch admitted from 2023-2024

Awarding University

Jawaharlal Nehru Technological University Anantapur (JNTUA)

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Doctor of Pharmacy (Pharm D)

Pharm. D is the doctoral programme with specialization of pharmacy practice introduced by Pharmacy Council of India (PCI) approved by Government of India (GOI) Ministry of Health and Family Welfare, Regulations framed under section 10 of the Pharmacy Act, 1948 (8 of 1948), Published in the Gazette of India, No.19, PART III, SECTION 4 dated 10th May 2008. The Pre-PhD, post-graduate professional doctoral program (Pharm. D) was introduced to improve clinical pharmacy services in India and it is the only pharmacy service which is in direct contact with patient health care system.

Raghavendra Institute of Pharmaceutical Education and Research (RIPER), is one of the premier and renowned pharmacy institute in India, running the Doctor of Pharmacy program approved by the Pharmacy Council of India (PCI), New Delhi., India and affiliated to the Jawaharlal Nehru Technological University Anantapur (JNTUA), Anantapuramu, Andhra Pradesh, India. RIPER offers both Pharm. D (06 years) & Post Baccalaureate Pharm. D (03 years) from 2008 successfully and gained its reputation as the best private pharmacy institute of Andhra Pradesh.

Program Outcome (PO's)

PO 01: Graduates will demonstrate knowledge of Pharmaceutical sciences

PO 02: Graduates will demonstrate an ability to identify, formulate and resolve difficulties in pharmaceutical industry, community and hospital Pharmacy.

PO 03: Graduates will conduct analyze and interpret data of experiments in production, analytical and clinical aspects.

PO 04: Graduates will enter into the practice of pharmacy to serve society as ethical and caring professionals.

PO 05: Graduates will apply knowledge of drugs and drug therapy to resolve medication related problems and make decisions on behalf of their patients for better patient care.

PO 06: Graduates will educate, communicate, and collaborate with patients and health care professionals.

PO 07: Graduates willassume a leadership role in the future direction of the profession and practicing with international standards.

PO 08: Graduates will demonstrate knowledge of professional and ethical responsibilities liable to the profession and society.

PO 09: Graduate will understand and implement the professional knowledge in research team and or alone in multidisciplinary tasks.

PO 10: Graduates will develop professional practice as a lifelong learning experience.

Introduction

The guidelines published in this document are official guidelines by the Board of Studies (BoS) and Academic council of Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous sponsored by Raghavendra Educational and Rural Development Society (RERDS) – Ananthapuramu, Andhra Pradesh. The document is a fusion product based on

a. Recommendations and guidelines stipulated for syllabus structure by UGC, AICTE, PCI, New Delhi.

b. Academic regulations stipulated by Jawaharlal Nehru Technological University Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.

c. Experts opinion from the Board of Studies (BoS) and Academic Council consisting of approved Advisory board members includes both academicians and researchers from reputed organizations at national and international levels.

d. Suggestions and inputs from members of Board of Studies (BoS) and Academic Council

e. Recommendations based on feedback from alumni, employers, faculty, students, parents and other experts from allied areas.

This ***academic regulations and course structure document*** has been prepared to ensure quality system in teaching and learning process, examination, assessment, and functioning of other academic related matters to the satisfaction of stakeholders, such as students, parents, alumni, employers, faculty, etc. This document provides core principles of academic regulations duly approved by Board of Studies (BoS) and Academic Council of this institution. The

Implementation of these academic regulations shall lead to be considered in the institute and thereby enrich the quality of education and research in the field of pharmaceutical sciences. The guidelines shall aid the transparency and accountability in the administration set up. The list of objectives for implementing academic regulations and course structure through these guidelines are listed below,

- To improve the academic regulations and course structure.
- To strengthen the Industry-Institute interaction.
- To comply with rules and regulations of regulatory bodies like UGC, JNTUA, PCI, AICTE etc.,
- To meet the requirements of accreditation councils.
- To enhance the quality of teaching-learning process and assessments.

- To provide career support programs, training for enhancing quality in placements and higher education.
- To provide Add on courses according to the need of placement needs of industry and hospital sectors.
- To place improved systems for feedback, self-appraisal of faculty and staff.
- To create bench marking with other institutes of repute.

Preamble

Title, application, and the authorities to interpret, clarify, modify and to amend

a) The regulations stated herein below shall be called as a document of "**Academic regulations and course structure for Pharm D/Pharm D Post Baccalaureate (PB)"** for Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous.

b) These regulations shall be in force from the batch admitted from 2023-2024 by the date of ratification by the Board of Studies (BoS) and Academic Council of the college.

c) In the event of any doubt about the interpretation of these regulations, the matter shall be referred to Board of Studies (BoS) and Academic Council and their decision shall be final.

d) The Board of Studies (BoS) and Academic Council shall have the authority to modify, amend and repeal any of the provisions of these regulations from time to time.

Definitions

In this document, unless there is anything repugnant to the subject or context

i. "***College***" means "Raghavendra Institute of Pharmaceutical Education & Research (RIPER)–Autonomous", Anantapur, Andhra Pradesh".

ii. "***Student***" means a candidate who has taken admission into Pharm. D / Pharm D (PB) program of this college as per the guidelines stipulated from time to time by the regulations of State Government of Andhra Pradesh and the Government of India for admissions into various courses of study and the affiliating university, i.e., Jawaharlal Nehru Technological University, Anantapur (JNTUA), Ananthapuramu, Andhra Pradesh.

iii. "***Academic Council***" means the Academic council constituted as per the guidelines of UGC.

iv. "***Board of Studies***" means Board of Studies constituted as per the guidelines of UGC.

v. ***"Principal"*** means the Head of the institution

vi. ***"Head of the Department"*** means the Head of an Academic Department of the College.

vii. ***"Faculty member"*** means the teacher (Assistant/Associate/Professor) working on regular or adhoc basis in any of the Academic Departments of the College.

viii. *"**Program"*** means a candidate who has chosen to avail degree of Pharm. D/Pharm D (PB)of this college as per the marks/ rank awarded by the National/ University/ State common entrance tests, India.

ix. *"**Course**" individual subjects described with content for instructions to the students.*

xi. *"**Assessment"*** means evaluation process for the outcome and grading in term of the marks.

xii. ***"Credit"*** means a weight to the time requirements of the academic course in the institute.

Academic Regulations – 2023

Raghavendra Institute of Pharmaceutical Education and Research (RIPER) – Autonomous, under JNT University Anantapur (JNTUA)

Program	Doctor of Pharmacy (Pharm. D) & Post Baccalaureate (Pharm. D-PB)
Approved by	Academic council
Effective from	Students admitted from AY 2023-2024

As per the Academic council of Raghavendra Institute of Pharmaceutical Education and Research - Autonomous and as directed by the University grant commission (UGC), the Jawaharlal Nehru technological University Anantapur (JNTUA), shall confer the post graduate degree in Doctor of Pharmacy (Pharm. D) and post baccalaureate (Pharm. D-PB) with the fulfilment of all the requirements for the award of degree.

1. Short title and commencement

These regulations shall be called as "The Regulations for the Pharm. D and Pharm. D. (Post Baccalaureate) Degree courses of the Raghavendra Institute of Pharmaceutical Education and Research (RIPER) - Autonomous, Anantapur". They shall come into force from the Academic Year 2023-2024. The regulations and syllabi framed are subject to modifications from time to time by the Academic Council.

2. Minimum Qualification for admission

2.1 Pharm. D

A pass in any of the following examinations –

1. 10+2 examination with Physics and Chemistry as compulsory subjects along with one of the two subjects: Mathematics or Biology.
2. A pass in D. Pharm course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.
3. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.
4. Provided that a student should complete the age of 17 years on or before 31st December of the year of admission to the course.
5. Provided that there shall be reservation of seats for the students belonging to the Scheduled Castes, Scheduled Tribes and other Backward Classes in accordance with the instructions issued by the Central Government/State Government/Union Territory Administration as the case may be from time to time.

2.2 Pharm. D. (Post Baccalaureate)

1 A pass in B. Pharm from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act:

2 Provided that there shall be reservation of seats for the students belonging to the Scheduled Castes, Scheduled Tribes, and other Backward Classes in accordance with the instructions issued by the Central Government/State Government/Union Territory Administration as the case may be from time to time.

3. Duration of the course

3.1. **Pharm. D**: The duration of the course shall be six academic years (five years of study and one year of internship or residency). The period of six years duration is divided into two phases.

Phase I –consisting of First, Second, Third, Fourth and Fifth academic year.

Phase II –consisting of internship or residency training during sixth year involving posting in specialty units. It is a phase of training wherein a student is exposed to actual pharmacy practice or clinical pharmacy services and acquires skill under supervision of a preceptor so that he or she may become capable of functioning independently.

3.2. Pharm. D. (Post Baccalaureate): The duration of the course shall be for three academic years (two years of study and one-year internship or residency). The period of three years duration is divided into two phases.

Phase I – consisting of First and Second academic year.

Phase II – consisting of Internship or residency training during third year involving posting in specialty units. It is a phase of training wherein a student is exposed to actual pharmacy practice or clinical pharmacy services, and acquires skill under supervision of a preceptor so that he or she may become capable of functioning independently.

4. Medium of Instruction and Examinations

Medium of Instruction and Examination shall be English.

5. Working days in the academic year

Each academic year shall consist of not less than 200 working days.

6. Attendance and Progress

- A student shall be eligible to appear for the year-end examinations if the student acquires a minimum of 80% of attendance in aggregate of all the subjects and not less than 50% of attendance in any of the subject.
- Shortage of attendance in aggregate up to 10% (70% and above, and below 80%) in

each year may be condoned by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

- A stipulated fee shall be payable for condoning of shortage of attendance. Shortage of attendance below 70% in aggregate shall in no case be condoned.
- Students whose shortage of attendance is not condoned in any year are not eligible to take their end examinations of that year.

7. Program or Course Credit Structure

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

7.1 Credit assignment

7.1.1 Theory and Practical courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and/or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course are dependent on the number of hours of instruction per week in that course and are obtained by using a multiplier of two (2) for lecture and tutorial hours, and a multiplier of one (1) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the year carries a credit of 8. Similarly, a practical having three laboratory hours per week throughout the year carries a credit of 3.

7.2 Minimum Credit Requirement

The minimum credit points required for award of a Pharm D degree is **335** and Pharm D PB is **171.** These credits are divided into Theory, Practical, Clerkship, Project, extra/co-curricular activities over the duration of the first five years. The credits are distributed year wise as shown in **Table 7**. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the year-wise schedule of courses given in the syllabus.

7.3 Audit Courses

Audit Courses: All the students of I, III & IV year Pharm D shall choose anyone out of three audit courses. A candidate is required to submit the report at the end of the year to the examining authority of the RIPER-Autonomous.

7.4 Elective Courses

All the students of II and V year Pharm D shall choose any one out of three elective courses. The credit allocation and evaluation pattern will be similar to that of compulsory courses.

8. Academic work

A regular record of attendance both in Theory and Practical shall be maintained by the teaching staff of respective courses.

9. Course Structure

The course of study for Pharm. D shall include the subjects as given in Tables 1 to 7. The number of hours in a week, devoted to each subject for its teaching in theory, practical and tutorial shall not be less than that noted against it in columns below.

Doctor of Pharmacy (Pharm D)

Table 1 First year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Marks
1.1	23PMD101	Human Anatomy and Physiology (CC)	3	1	8	100
1.2	23PMD102	Pharmaceutics (CC)	2	1	6	100
1.3	23PMD103	Medicinal Biochemistry (CC)	3	1	8	100
1.4	23PMD104	Pharmaceutical Organic Chemistry (CC)	3	1	8	100
1.5	23PMD105	Pharmaceutical Inorganic Chemistry (CC)	2	1	6	100
1.6	23PMD106	Remedial Mathematics(AECC)	2	1	6	100
		Remedial Biology (AECC)	2	-	4	100
1.7	23PMD107	Human Anatomy and Physiology (CC)	3	-	3	100
1.8	23PMD108	Pharmaceutics (CC)	3	-	3	100
1.9	23PMD109	Medicinal Biochemistry (CC)	3	-	3	100
1.10	23PMD110	Pharmaceutical Organic Chemistry (CC)	3	-	3	100
1.11	23PMD111	Pharmaceutical Inorganic Chemistry (CC)	3	-	3	100
1.12	23PMD112	Biology# (AECC)	2	-	2	100
1.13	23PMD113A1	Yoga and stress management	-	-	-	-
	23PMD113A2	Disaster management				
	23PMD113A3	Green Initiatives				
Total			30/32	6/5	57	1100$/1200#
Total number of contact hours per week			36$/37#			

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at Intermediate/HSC and appearing for Remedial Mathematics (RM) course**.**

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at Intermediate/HSC and appearing for Remedial Biology (RB) course**.**

CC-Core Course

AECC- Ability Enhancement Compulsory Course

Table 2 Second year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Marks
2.1	23PMD201	Pathophysiology (CC)	3	1	8	100
2.2	23PMD202	Pharmaceutical Microbiology (CC)	3	1	8	100
2.3	23PMD203	Pharmacognosy &Phytopharmaceuticals (CC)	3	1	8	100
2.4	23PMD204	Pharmacology-I (CC)	3	1	8	100
2.5	23PMD205	Community Pharmacy (CC)	2	1	6	100
2.6	23PMD206	Pharmacotherapeutics – I (CC)	3	1	8	100
Practical						
2.7	23PMD207	Pharmaceutical Microbiology (CC)	3	-	3	100
2.8	23PMD208	Pharmacognosy &Phytopharmaceuticals (CC)	3	-	3	100
2.9	23PMD209	Pharmacotherapeutics – I (CC)	3	-	3	100
Elective Courses (Choose any one)						
2.10	23PMD210E1	Dietary supplements and Nutraceuticals (DSE)	2	1	6	100
	23PMD210E2	Social and preventive pharmacy (DSE)				
	23PMD210E3	Environmental Sciences (GE)				
Total			28	7	61	1000
Total number of contact hours per week			35 hours			

CC- Core Course

DSE- Discipline Specific Elective

GE-General Elective

Table 3 Third year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Marks
3.1	23PMD301	Pharmacology-II (CC)	3	1	8	100
3.2	23PMD302	Pharmaceutical Analysis (CC)	3	1	8	100
3.3	23PMD303	Pharmacotherapeutics-II (CC)	3	1	8	100
3.4	23PMD304	Pharmaceutical Jurisprudence (AECC)	2	-	4	100
3.5	23PMD305	Medicinal Chemistry (CC)	3	1	8	100
3.6	23PMD306	Pharmaceutical Formulations (CC)	2	1	6	100
Practical						
3.7	23PMD307	Pharmacology-II (CC)	3	-	3	100
3.8	23PMD308	Pharmaceutical Analysis (CC)	3	-	3	100

3.9	23PMD309	Pharmacotherapeutics-II (CC)	3	-	3	100
3.10	23PMD310	Medicinal Chemistry (CC)	3	-	3	100
3.11	23PMD311	Pharmaceutical Formulations (CC)	3	-	3	100
Audit Courses (Choose any one)						
3.12	23PMD312A1	Water conservation	-	-	-	-
	23PMD312A2	Waste management				
	23PMD312A3	Pollution control				
Total			31	5	57	1100
Total number of contact hours per week			36 hours			

CC- Core Course

AECC- Ability Enhancement Compulsory Course

Table 4 Fourth year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Marks
4.1	23PMD401	Pharmacotherapeutics-III (CC)	3	1	8	100
4.2	23PMD402	Hospital Pharmacy (CC)	2	1	6	100
4.3	23PMD403	Clinical Pharmacy (CC)	3	1	8	100
4.4	23PMD404	Biostatistics and research methodology (CC)	2	1	6	100
4.5	23PMD405	Biopharmaceutics and pharmacokinetics (CC)	3	1	8	100
4.6	23PMD406	Clinical toxicology (CC)	2	1	6	100
4.7	23PMD411	Pharmacotherapeutics I &II*	3	1	8	100
Practical						
4.8	23PMD407	Pharmacotherapeutics-III (CC)	3	-	3	100
4.9	23PMD408	Hospital Pharmacy (CC)	3	-	3	100
4.10	23PMD409	Clinical Pharmacy (CC)	3	-	3	100
4.11	23PMD410	Biopharmaceutics and pharmacokinetics (CC)	3	-	3	100
4.12	23PMD412	Pharmacotherapeutics I &II*	3	-	3	100
Audit Courses (Choose any one)						
4.13	23PMD413A1	Human rights and responsibilities	-	-	-	-
	23PMD413A2	Constitution of India				
	23PMD413A3	Bhagavat Gita for personality development				
Total			27/33*	6/7*	54/65*	1000/ 1200*
Total number of contact hours per week			33/40* hours			

*Additional subject for Pharm. D (Post Baccalaureate) students

CC- Core Course

Table 5 Fifth year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Marks
5.1	23PMD501	Clinical Research (CC)	3	1	8	100
5.2	23PMD502	Pharmacoepidemiology and Pharmacoeconomics (CC)	3	1	8	100
5.3	23PMD503	Clinical Pharmacokinetics & Pharmacotherapeutics Drug Monitoring (CC)	3	1	8	100
5.4	23PMD504	Clerkship*	9		9	100
5.5	23PMD505	Project work (Six Months)	9		9	100
Elective Courses (Choose any one)						
5.6	23PMD506E1	Entrepreneurship Development (GE)	3	1	8	100
	23PMD506E2	Pharmacological Screening Methods (DSE)				
	23PMD506E3	Scientific writing (DSE)				
Total			30	4	50	600
Total number of contact hours per week			34 hours			

***** Attending ward rounds on daily basis

CC- Core Course

DSE-Ability Enhancement

GE-General Elective

Table 6 Sixth Year

S. No.	Code	Name of subject	No. of hours	Tutorial hours	Credits	Grades
6	23PMD601	Internship*	36	-	50	

*Internship or residency training including postings in speciality units. Student should provide the clinical pharmacy services to the allotted wards, under the supervision of a preceptor.

(i) Six months in General Medicine department, and

(ii) Two months each in three other specialty departments

Table 6: Extracurricular & Co-curricular activities - 6 Credits

S. No.	Name of the Category
1.	Add-on Courses-compulsory credit- 1
2.	NSS, NCC and other social service activities- Compulsory credit- 1
3.	Achievements- Compulsory credits- 3
4.	**6th Credit can be any one of the above**

Table 7: Year wise credit distribution

Year	Pharm D	Pharm D PB
I	57	-
II	61	-
III	57	-
IV	54	65
V	50	50
VI	50	50
Extra-curricular & Co-curricular activities	6	6
Total credits for the program	335	171

Extra-curricular & Co-curricular activities 6 Credits

Rules and Regulations

Categories

1. Add on courses **(1 credit)**
2. NSS, NCC and other social service activities **(1 credit)**
3. Achievements **(3 credits)**
4. **6th credit can be any one of the above.**

Award of Credits

1. **Add on courses(1 credit Compulsory) (In campus/Off campus) (Offline/online)**

   One credit -Each short-term course certificate as per UGC norms for add on courses. (30hrs Duration/8 weeks)

   Two credits- Diploma course certificate as per UGC norms for add on courses (60hrs Duration/23 weeks)

   Others discretion of Director of Academics/CE/Principal

2. **NSS, NCC and other social service activities(1 credit Compulsory)**

(30 hours for One credit. 60 hours for Two credits)

Calculation of Hours

A. Three Commemoration Day celebrations/Any other day celebration participation=1 hr (i.e.-Independence Day, Republic Day, Gandhi Jayanti, etc)
B. One Participation in Rally = 2 hrs
C. For one day camp participation= 3 hrs
D. One day Yoga/training involving learn and practice participation =2 hrs
E. One session of Plantation Day- 2 hrs
F. Donating blood donation at Blood donation camp at college or hospital- 5 hrs (Maximum one per year allowed. Certificate is required in case in outside of the college)
G. One day participation in Clean India like activities at outside -5 hrs
H. Three Awareness program participation-1 hr
I. One Street play performance/flash mob performance -3 hrs
J. Four audience participation in programs (Discretion of NSS Officer/CE/Principal)- 1 hr
K. Any performance in any of the events which are not listed here (Discretion of NSS officer/CE/Principal)-2 hrs One Social service merit certificate (Lion's

club/Rotary club/Traffic police/Police volunteers/Other Govt. Organizations)-1 credit

L. Others discretion of NSS officer/CE/Principal

3. Achievements (3 credit Compulsory)

NOTE: Two credits are compulsory from listed research Scholar Initiative activities. Only one credit can be obtained from own institute for any of the clause in "Achievement" Category

Research Scholar Initiatives

A. One Indexed Publications (Scopus/WOS)-1 Credit
B. One Indexed publications (SCI, SCIE) -2 credit
C. One IPC Participation-1 credit
D. One IPC presentation Oral/Poster)-2 Credits
E. Local chapters like IPA/ISPOR/RSC publications or presentations-1 credit
F. One Presentations at seminars/conferences at india-1 credit
G. One Presentations at seminars/conferences at outside India-2 credits
H. Six Conferences/seminars/workshops Participation national level -1 credits
I. Four International level Conferences/seminars/workshops Participation at India - 1 credit
J. One International Conferences/seminars/workshops Participation at outside India -2 credits
K. Others discretion of R&D Director/CE/Principal

Certificates for Achievements (Sports/cultural/others)

A. One National/State/District/University level certificate-2 credits (winner/runner)
B. One National/State/District/University level certificate-1 credit (only when Participation certificate received)
C. One Non-government/affiliated institution Merits/own institute level certificate-1 credit (winner/runner)
D. Other's discretion of NSS officer/CE/Principal

Evaluation of Extracurricular/Co-curricular activities

A detailed report has to be prepared by the student, consisting of Extracurricular/Co-curricular activities (Certificates of Add-on courses, Research scholar initiatives, Participation in social service activities like NSS & NCC). All these certificates shall be duly signed by the project guide & NSS officer respectively. This report has to be submitted by the student to the Project guide, which shall be forwarded to the external evaluator at the time of Project Viva Voce in Pharm D V Year.

10. Program Committee

1. The Pharm D and Pharm (D PB) program shall have a Program Committee constituted by the Head of the institution in consultation with all the Heads of thedepartments.
2. The composition of the Program Committee shall be asfollows: A senior teacher/Principal shall be the Chairperson; One Teacher from each department handling Pharm D courses/HODs of the departments; senior faculty.
3. Duties of the ProgramCommittee:

i. Periodically reviewing the progress of theclasses.
ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective year.
iv. Communicating its recommendation to the Head of the institution on academic matters.
v. The Program Committee shall meet at least thrice in a year preferably at the end of each Midterm examination.

11. Examination/Assessments

Distribution and Weightage of Marks:

i. The performance of a student in each year shall be evaluated course-wise with a maximum of 100 marks for theory and 100 marks for practical subject.
ii. For theory subjects, the distribution shall be 30 marks for Internal assessment (Midterm exam=20, Student-teacher interaction (Seminar=3M & Group Discussion=2M), and Assignment=5) and 70 marks for the End assessment (End-Examination).

Internal Assessment (30 Marks)

iii. For the theory subject, the midterm examination shall be conducted after the 12th week of instruction. There will be three midterm theory examinations that should be conducted for 30 marks. It has to be converted to 20 by multiplying with a factor of 0.667, 80% weightage from the best midterm exam and 20% weightage from the average of remaining two midterm exams is considered for internal assessment..

Mid – Examination Rubrics

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA)

Subject Name: Subject Code:

Date of Examination: Total Marks: 30 M

Section-A

I. Short answer questions (All Compulsory) 5× 2 = 10 M

Section-B

II. Answer any TWO out of THREE questions 2× 10 = 20 M

iv. For theory subject, there will be one or two assignments in relevance to course outcome, need to be evaluated for 10marksas per standard rubrics and documented under continuous mode. The assignment marks will be converted to 5 marks and considered for internal assessment. Rubrics for assignment evaluation were given in Table.

Rubrics for Assignment Evaluation

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA)

Parameter	Very good (2)	Good (1)	Satisfactory (0.5)	Not satisfactory (0)
Relevance of content to Topic (2)				
Reliable resources used (2)				
Presentation of content (2)				
Similarity Index (2)				
Total				
Total (8)				
Submission Date	Before Due date (2)		After due date (1)	

Scheme for awarding internal assessment (Theory)

Internal assessment	Marks
Midterm examination (Conducted for 30 marks and converted to 20)	20
Assignment (Given for 10 marks and converted to 5)	5
Student-teacher interaction (Seminar=3M & Group Discussion=2M)	5
Total	30

v. The midterm practical examinations should be conducted for 20 marks.80% weightage from the best midterm exam and 20% weightage from the average of remaining two midterm exams is considered for internal assessment.

Annexure-III:Mid – Examination Rubrics (Practical)

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA)

Practical question paper pattern

Course Name: Course Code:

Date of Examination: Total Marks: 30 M

I. Synopsis	5 M
II. Experiment	20 M
III. Viva voce	5 M

vi. For practical subjects, there shall be a continuous day-to-day evaluation based on lab work and record (5 marks), regular viva-voce (5 marks) and there will be a midterm practical examination along with midterm theory examinations.

Scheme for awarding internal assessment (Practical)

Internal assessment	Marks
Midterm examination (Conducted for 30 marks and converted to 20)	20
Lab work and record	5
Regular viva voce	5
Total	30

vii. Laboratory marks and the sessional marks awarded by the instructors are not final. They are subject to scrutiny and scaling by the chief controller of examinations, wherever felt desirable. In such conditions, the sessional and laboratory marks awarded by the College will be referred to a committee. The Committee will arrive at a scaling factor and the marks will be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University/regulatory bodies as and when they ask for.

End Assessment (End Examination)

viii. End theory examination will be conducted for 70 Marks. The rubrics for the end theory examination was given below.

End Examinations (Theory question paper rubrics)

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA)

Subject Name:	Subject Code:
Date of Examination:	Total Marks: 70 M

Section-A

I. Short answer questions (All Compulsory)	10× 2 = 20 M

Section-B

II. Answer any FIVE out of EIGHT questions	5 × 10 = 50 M

ix. End theory examination will be conducted for 70 Marks. The rubrics for end practical examination was given below.

Annexure-V: End examinations - Practical question paper rubrics

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA)

Subject Name:	Subject Code:
Date of Examination:	Total Marks: 70 M

I. Synopsis	10 M
II. Major Experiment	25 M
III. Minor Experiment	20 M
IV. Viva voce	15 M

x. In case, the student does not secure the minimum academic requirement in any course (i.e. 40 % in end examination and 50 % aggregate of the overall subject in the year), he/she has to reappear for the End examination, either in advance supplementary or regular in that particular course, or repeat the course when next offered. However, the internal assessment marks remain the same.

NOTE: In case any candidates continue assessment is low only if due to absenteeism to attend mid -term examinations, he/she shall submit the application with appropriate reason to Principal. Then trueness of the application may be evaluated by the examination committee including the controller of examination. In such cases, if the committee feels to allow, a prescribed fee is paid to the examination section, to undertake a midterm examination, scheduled by the Controller of examinations.

Clerkship (V Pharm. D) examination –

i. Oral examination shall be conducted after the completion of clerkship of students. An external and an internal examiner will evaluate the student.

Students have to present the allotted medical cases followed by a discussion in

Three presentations. Thirty marks each and the average of best two shall be forwarded to the university with marks of other subjects.

ii. Students' capabilities in delivering clinical pharmacy services, pharmaceutical care planning, and knowledge of therapeutics shall be assessed.

30 marks – Internal Assessment, 70 marks – End Practical Examination

Internship (23PMD601)

Internship or residency training including postings in specialty units.Students should provide clinical pharmacy services to the allotted wards, under the supervision of a preceptor.

(i) Six months in the General Medicine department, and

(ii) Two months each in three other specialty departments

1) **Specific objectives:**

i) To provide patient care in cooperation with patients, prescribers, and other members of an interprofessional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social-cultural, economic, and professional issues, emerging technologies, and evolving biomedical, pharmaceutical, social or behavioral or administrative, and clinical sciences that may impact therapeutic outcomes.

ii) To manage and use resources of the health care system, in cooperation with patients,

prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.

iii) To promote health improvement, wellness, and disease prevention in co-operation with patients, communities, at-risk population, and other members of an interprofessional team of health care providers.

iv) To demonstrate skills in the monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community.

v) To develop leadership qualities to function effectively as a member of the health care team organized to deliver the health and family welfare services in existing socio-economic, political, and cultural environments.

vi) To communicate effectively with patients and the community.

2) **Other details:**

i) All parts of the internship shall be done, as far as possible, in institutions in India. In case of any difficulties, the matter may be referred to the Pharmacy Council of India to be considered on merits.

ii) Where an intern is posted to district hospital for training, there shall be a committee consisting of representatives of the college or university, and the district hospital administration, who shall regulate the training of such trainee. For such trainee, a certificate of satisfactory completion of training shall be obtained from the relevant administrative authorities which shall be countersigned by the Principal or Dean of College.

iii) Every candidate shall be required, after passing the final Pharm. D. or Pharm. D. (Post Baccalaureate) examination as the case may be to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of twelve months so as to be eligible for the award of the degree of Pharm. D. or Pharm. D. (Post Baccalaureate) as the case may be.

3. Assessment of internship:

i) The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practitioner) under whom he works. Apart from the scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills, and attitude during and at the end of the training. Based on the record of work and date of evaluation, the

Dean or Principal shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him eligible for it.

ii) Satisfactory completion of internship shall be determined on the basis of the following:

(1) Proficiency of knowledge required for each case management SCORE 0-5

(2) The competency in skills expected for providing Clinical Pharmacy Services SCORE 0-5

(3) Responsibility, punctuality, work up of case, involvement in patient care SCORE 0-5

(4) Ability to work in a team (Behaviour with other healthcare professionals including medical doctors, nursing staff and colleagues). SCORE 0-5

(5) Initiative, participation in discussions, research aptitude. SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	5

A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

12. Criteria for pass

a) Candidates who have secured a minimum of 50% marks in the Theory (40 % in end examination) and Practical (40 % in end examination) separately in any subject or subjects shall be declared to have passed in that subject/s.

b) Theory and Practical of a particular subject are considered as individual subjects for the purpose of pass criteria. Those candidates who fail in one or more subjects shall have to appear only in the subject so failed, in the subsequent examinations.

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

13. Improvement of Internal Assessment

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

14. Conditions under which candidates are permitted to proceed to next higher class:

a) **Pharm. D**

1. Candidates of I Pharm. D are permitted to carry not more than any two subjects (Two Theory/ Two Practicals/ One theory & one practical of same or different subjects) to II Pharm. D and appear for II Pharm. D examination concurrently along with failed subjects of I Pharm. D. However, these candidates have to pass all the failed subjects of I Pharm. D to become eligible to III Pharm. D.
2. Similarly, candidates of II Pharm. D who have completely passed all the subjects of I Pharm. D but have failed in II Pharm. D are permitted to carry not more than any two subjects (Two Theory/ Two Practicals/ One theory & one practical of same or different subjects) of II Pharm. D to III Pharm. D and appear for III Pharm. D concurrently along with failed subjects of II Pharm. D. However, these candidates have to pass all the failed subjects of II Pharm. D to become eligible to proceed to IV Pharm. D.
3. Candidates of III Pharm. D who have completely passed all the subjects of II Pharm. D but have failed in III Pharm. D are permitted to carry not more than any two subjects (Two Theory/ Two Practicals/ One theory & one practical of same or different subjects) of III Pharm. D to IV Pharm. D and appear for IV Pharm. D examination concurrently along with failed subjects of III Pharm. D. However, these candidates have to pass all the failed subjects of III Pharm. D to become eligible to proceed to V Pharm. D.
4. Candidates of IV Pharm. D who have completely passed all the subjects of III Pharm. D but have failed in IV Pharm. D are permitted to carry not more than any two subjects (Two Theory/ Two Practicals/ One theory & one practical of same or different subjects) of IV Pharm. D to V Pharm. D and appear for V Pharm. D examination concurrently along with failed subjects of IV Pharm. D. However, these candidates have to pass all the failed subjects of IV and V Pharm. D to become eligible to proceed to VI Pharm. D., to undergo internship.

b**) Pharm. D. (Post Baccalaureate)**

Candidates of Pharm. D. (Post Baccalaureate) admitted directly to IV Year course are permitted to carry not more than any two subjects (Two Theory/ Two Practicals/ One theory & one practical of same or different subjects) to V Pharm. D. and appear for V Pharm. D. examination concurrently along with failed subjects of IV Pharm. D. However, these candidates have to pass all the subjects of IV & V Pharm. D to become eligible to proceed to VI Pharm. D., to undergo internship.

15. Declaration of class

a) **Pharm. D**

The result of the successful candidate shall be classified at the end of the final year examination on the basis of the aggregate of all subjects, theory and practical's, secured by the candidate in the I to V year examinations and completes the course in 5 years, as indicated below.

I Class : 60% and above

II Class : 50%-59%

Candidate securing aggregate of 75% or above marks and have passed in all the subjects in a year in first attempt shall be declared to have obtained Distinction.

b) **Pharm. D. (Post Baccalaureate)**

The result of the successful candidate shall be classified at the end of the final year examination on the basis of the aggregate of all subjects, theory and practical's, secured by the candidate in the IV & V year examinations and completes the course in 2 years, as indicated below.

I Class : 60% and above

II Class: 50%-59%

Candidate securing aggregate of 75% or above marks and have passed in all the subjects in a year in first attempt shall be declared to have obtained Distinction.

23. Internship

Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy and healthcare and acquires skills under the supervision so that he or she may become capable of functioning independently. Every student has to undergo one-year internship as per Pharmacy Council of India regulations.

17. Practical training

1. **Hospital posting**: Every student shall be posted in constituent hospital for a period of not less than fifty hours to be covered in not less than 200 working days in each of second, third & fourth year course of Pharm. D and in first and second year of Pharm. D. (Post Baccalaureate). Each student shall submit report duly certified by the preceptor and duly attested by the Head of the Department or Institution as prescribed. In the fifth year, every student shall spend half a day in the morning hours attending ward rounds on daily basis as a part of clerkship. Theory teaching may be scheduled in the afternoon.

2. **Project work**:

(i) To allow the student to develop data collection and reporting skills in the area of community, hospital and clinical pharmacy, a project work shall be carried out under the supervision of a teacher. The project topic must be approved by the Head of the Department or Head of the Institution. The same shall be announced to students within one month of commencement of the fifth-year classes of Pharm. D and second year of Pharm. D. (Post Baccalaureate). Project work shall be presented in a written report and as a seminar at the end of the year. External and the internal examiners shall do the assessment of the project work.

(ii) Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

3. **Objectives of project work**: The main objectives of the project work are to:

(i) show the evidence of having made accurate description of published work of others and of having recorded the findings in an impartial manner; and

(ii) develop the students in data collection, analysis and reporting and interpretation skills.

4. **Methodology**: To complete the project work following methodology shall be adopted, namely:

(i) Students shall work in groups of not less than *two* and not more than *four* under an authorised teacher;

(ii) Project topic shall be approved by the Head of the Department or Head of the Institution;

(iii) Project work chosen shall be related to the pharmacy practice in community, hospital and clinical setup. It shall be patient and treatment (Medicine) oriented, like drug utilisation reviews, pharmacoepidemiology, Pharmacovigilance or Pharmacoeconomics.

(iv) Project work shall be approved by the institutional ethics committee;

(v) student shall present at least three seminars, one in the beginning, one at middle and one at the end of the project work; and

(vi) Two-page write-up of the project indicating title, objectives, methodology anticipated benefits and references shall be submitted to the Head of the Department or Head of the Institution.

5. Reporting:

(i) Student working on the project shall submit jointly to the Head of the Department or Head of the Institution a project report of about 40-50 pages. Project report should include a certificate issued by the authorized teacher, Head of the Department as well as by the Head of the Institution

(ii) Project report shall be computer typed in double space using Times Roman font on A4 paper. The title shall be in bold with font size 18, sub-tiles in bold with font size 14 and the text with font size 12. The cover page of the project report shall contain details about the name of the student and the name of the authorized teacher with font size 14.

(iii)Plagiarism: The project must have less than 30% of similarity index.

(iii)Submission of the project report shall be done at least one month prior to the commencement of annual or supplementary examination.

6. Evaluation: The following methodology shall be adopted for evaluating the project work

(i) Project work shall be evaluated by internal and external examiners.

(ii) Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of four students).

(iii)**Three seminars** presented by students shall be evaluated for thirty marks each and the average of best two shall be forwarded to the university with marks of other subjects.

(iv) Evaluation shall be done on the following items:	**Marks**
a) Write up of the seminar	(7.5)
b) Presentation of work	(7.5)
c) Communication skills	(7.5)
d) Question and answer skills	(7.5)
Total	(30 marks)

(v) Final evaluation of project work shall be done on the following items: **Marks**

a) Write up of the seminar	(17.5)
b) Presentation of work	(17.5)
c) Communication skills	(17.5)
d) Question and answer skills	(17.5)
Total	(70 marks)

Explanation: For the purposes of differentiation in the evaluation in case of topic being the same for the group of students, the same shall be done based on item numbers b, c and d mentioned above.

18. Award of Ranks

Ranks and Medals shall be awarded on the basis of aggregate of all the five and two university examinations of Pharm. D. and &Pharm. D. (Post Baccalaureate), respectively. However, candidates who fail in one or more subjects during the Pharm. D/ Pharm. D. (Post Baccalaureate) courses shall not be eligible for award of ranks.

Moreover, the candidates should have completed the Pharm. D course in minimum prescribed number of years, (five years for Pharm. D and two years for Pharm. D. (Post Baccalaureate)) for the award of Ranks.

19. Award of degree

Candidates who fulfil the requirements of credits and satisfactory completion of Internship during sixth year will be eligible for award of degree during the ensuing convocation.

20. Duration for completion of the course of study

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

21. Withholding of results:

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher class. The issue of awarding a degree is liable to be withheld in such cases.

Program	Pharm D
Year	First year
Name of the course	Human Anatomy and Physiology
Course Code	23PMD101
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The Human anatomy and physiology course that provides an integrated presentation of human anatomy and physiology. Information about each system is presented to explain the processes involved in homeostasis so that students will develop an understanding of the working of the entire human body. Wherever appropriate, information about mechanisms of action of selected drugs is presented. This course also provides the laboratory skills related to various systems, even though no dissection is involved, students must wear proper attire in the gross anatomy laboratory (requirements will be outlined in the introductory lecture). During lab periods students will work alone or in small groups and follow the instructions for each lab that are provided in the Lab Notes and Guide.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Recognize the anatomical structures and explain the physiological functions of body systems.

CO 2: Use anatomical knowledge to predict physiological consequences, and use knowledge of function to predict the features of anatomical structures

CO 3: Synthesize ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

CO 4: Demonstrate laboratory procedures used to examine anatomical structures and evaluate physiological functions of each organ system.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Scope of anatomy and physiology, basic terminologies used in this subject Description of the body as such planes and terminologies. Structure of cell – its components and their functions.
II (12 Hours)	Elementary tissues of the human body: Epithelial tissue, Connective tissue. Muscular and Nervous tissue & their sub-types and characteristics
III (12 Hours)	Osseous system - structure, composition and functions of the Skeleton. (done in practical classes - 6hrs). Classification of joints, Types of movements of joints and disorders of joints.
IV (12 Hours)	Haemopoietic System, Composition and functions of blood Haemopoiesis and disorders of blood components (definition of disorder), Blood groups, Clotting factors and mechanism
V (12 Hours)	Lymph and lymphatic system, composition, formation and circulation. Spleen: structure and functions, Disorders of lymphatic system. Cardiovascular system 1: Anatomy and functions of heart, Blood vessels and circulation (Pulmonary, coronary and systemic circulation)
VI (12 Hours)	Cardiovascular system 2: Electrocardiogram (ECG)Cardiac cycle and heart sounds, Blood pressure – its maintenance and regulation Definition of the following disorders, Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias
VII (12 Hours)	Respiratory system, Anatomy of respiratory organs and functions, Mechanism / physiology of respiration and regulation of respiration, Transport of respiratory gases, Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation. Sense organs: Eye, Ear, Nose, Skin and tongue
VIII (12 Hours)	Digestive system: Anatomy and physiology of GIT, Anatomy and functions of accessory glands of GIT, Digestion and absorption, Disorders of GIT (definitions only),
IX (12 Hours)	Nervous system 1: Definition and classification of nervous system Anatomy, physiology and functional areas of cerebrum, cerebellum, mid brain, Thalamus, hypothalamus and Basal Ganglia, Spinal card: Structure & reflexes – mono-poly-planter Cranial nerves – names and functions,
X (12 Hours)	Nervous system 2: ANS – Anatomy & functions of sympathetic & parasympathetic N.S. Urinary system, Anatomy and physiology of urinary system, Formation of urine. Renin Angiotensin system – Juxta glomerular apparatus - acid base Balance.

XI (12 Hours)	Endocrine system: Pituitary gland, Adrenal gland, Thyroid and Parathyroid glands Pancreas and gonads. Skeletal muscle: Histology and Physiology of Muscle contraction, Physiological properties of skeletal muscle and their disorders (definitions)
XII (12 Hours)	Reproductive system: Male and female reproductive system Their hormones – Physiology of menstruation Spermatogenesis & Oogenesis, Sex determination (genetic basis) Pregnancy, maintenance and parturition, Contraceptive devices. Sports physiology: Muscles in exercise, Effect of athletic training on muscles and muscle Performance Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Recommended Text books (Latest Editions)**:**

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA

4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.

5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.

8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference books (Latest Editions)**:**

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.

3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata

Program	**Pharm D**
Year	**First year**
Name of the course	**Human Anatomy and Physiology (Lab)**
Course Code	**23PMD107**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

Focus on the correlation between the structure and function of the various body systems, and examine topics such as the nervous, endocrine, cardiovascular and reproductive systems. Become familiar with dissection and basic microscopic examination of tissues. Biology majors, premedical and pre-health students, and those looking for a career change or to refresh their biological knowledge can benefit greatly from this course.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Learn procedures that are standard practice in an anatomy laboratory.

CO2: Communicate clearly and in a way, that reflects knowledge and understanding of the human body and demonstrates the ability to adapt information to different audiences and applications.

CO 3: Approach and examine issues related to anatomy and physiology from an evidence-based perspective

CO 4: Learn how to study, interpret and care for anatomical specimens.

Practical Course: Contents

Week	Topics
1	Study of microscope
2	Study of Muscular tissue.
3	Study of Connective tissue.
4	Study of Nervous tissue.
5	Study of Epithelial tissue.
6	Study of appliances used in haematological experiments
7	Determination of W.B.C. count of blood.
8	Determination of R.B.C. count of blood.
9	Determination of Erythrocyte Sedimentation Rate.
10	Determination of Haemoglobin content of Blood.
11	Determination of Bleeding time
12	Determination of clotting time
13	Determination of Blood Pressure.
14	Determination of Blood group.
15	Study of various systems with the help of charts, models & specimens Skeleton system part I-axial skeleton.
16	Skeleton system part II- appendicular skeleton.
17	Study of Cardiovascular system.
18	Study of Respiratory system.
19	Study of Digestive system.
20	Study of Urinary system.
21	Study of Nervous system.

22	Study of Special senses: Ear
23	Study of Sense organ: Eye
24	Study of sense organ: Nose and Tongue
25	Study of sense organ: Skin
26	Study of Male Reproductive system.
27	Study of Female Reproductive system.
28	Study of different family planning appliances.
29	To perform pregnancy diagnosis test.
30	Study of appliances used in experimental physiology.
31	To record simple muscle curve using gastrocnemius sciatic nerve preparation.
32	To record simple summation curve using gastrocnemius sciatic nerve preparation.
33	To record simple effect of temperature using gastrocnemius sciatic nerve preparation.
34	To record simple effect of load & after load using gastrocnemius sciatic nerve preparation.
35	To record simple fatigue curve using gastrocnemius sciatic nerve preparation.
36	REVISION/Assessment

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Recommended Text books (Latest Editions)**:**

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA

4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.

5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.

8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference books (Latest Editions)**:**

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.

3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

Program	**Pharm. D**
Year	**First year**
Name of the course	**Pharmaceutics**
Course Code	**23PMD102**
Paper	**Theory**
Hours /week	**2+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The Pharmaceutics course includes an introduction to the history and development of pharmacy, Prescription terminology, systems of measurement and Pharmaceutical calculations which are essential in preparation of various dosage forms. This course will emphasize on advantages, disadvantages, formulations and evaluations of different types of dosage forms.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: List the salient features of different Pharmacopoeias.

CO 2: Explain various procedures involved in formulation and evaluation of different types of dosage forms

CO 3: Calculate different Pharmaceutical calculations involved in formulation.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Introduction to dosage forms, Prescription: definition, parts and handling. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.

II (12 Hours)	Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.
III (12 Hours)	Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.
IV (12 Hours)	Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.
V (12 Hours)	Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.
VI (12 Hours)	Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.
VII (12 Hours)	Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.
VIII (12 Hours)	Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.
IX (12 Hours)	Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.

X (12 Hours)	Surgical aids: Surgical dressings, absorbable gelatine sponge, sutures, ligatures and medicated bandages.
XI (12 Hours)	Incompatibilities: Introduction, classification of incompatibilities
XII (12 Hours)	Methods to overcome the incompatibilities.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Carter S.J. Cooper & Gunns Dispensing for Pharmaceutical students. 12th ed. New Delhi: CBS Publication; 2008.
2. Mehtha R.M. Dispensing Pharmacy. New Delhi: Vallabh Publication; 2006.
3. Rawlins EA. Text Book of Pharmaceutics. 8th ed. New Delhi: ELBS Publications; 2004.
4. Gaud R.S. Modern dispensing Pharmacy. 3rd ed. Maharastra: career publication; 2009
5. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
6. Indian pharmacopoeia.
7. British pharmacopoeia

8. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
9. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.
10. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.

Program	**Pharm. D**
Year	**First year**
Name of the course	**Pharmaceutics (Lab)**
Course Code	**23PMD108**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The Pharmaceutics laboratory course is aimed to train the students on formulation of different types of dosage forms. This course also deals with Pharmaceutical calculations which are essential in compounding, dispensing and utilisation of dosage forms. This course also provides the skills to identify various incompatibilities in handling of Prescriptions.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Identify various incompatibilities in handling of Prescriptions

CO2: Calculate different Pharmaceutical calculations involved in formulation.

CO 3: Formulate different types of dosage forms.

Practical Course: Contents

Week	Topics
1	Preparation of Simple syrup IP
2	Preparation of Orange Syrup BP.
3	Preparation of Syrup of Ephedrine Hcl NF
4	Preparation of Syrup Vasaka IP

5	Preparation of Syrup of Ferrous phosphate IP
6	Preparation of Aqueous Iodine solution IP
7	Preparation of Strong solution of Iodine IP
8	Preparation of Strong Ammonium acetate solution IP
9	Preparation of Solution of cresol with soap
10	Preparation of Strong solution of ferric chloride BPC
11	Preparation of Linctus – Simple linctus BPC
12	Preparation of Paediatric simple linctus BPC
13	Preparation of Turpentine Liniment IP
14	Preparation of Liniment of camphor IP
15	Preparation of Eutectic powder
23	Preparation of Explosive powder
17	Preparation of Dusting powder
18	Preparation of Piperazine citrate elixir IP
19	Preparation of Paracetamol elixir BPC
20	Preparation of Cascara elixir BPC
21	Preparation of Magnesium hydroxide mixture BP
22	Preparation of Calamine Lotion.
23	Preparation of Emulsions – Cod liver oil emulsion
24	Preparation of Liquid Paraffin & castor oil emulsion
25	Preparation of Boric Acid Suppositories
26	Preparation of Chloral Suppositories
27	Mixture with physical incompatibilities
28	Mixture with Chemical incompatibilities

29	Mixture with therapeutic incompatibilities
30	Problem based exercise
31	Problem based exercise
32	**Revision**

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Subrahmanyam C.V.S. Laboratory manual of Pharmaceutics. Delhi: vallabh publications; 2006.
2. Carter S.J. Cooper & Gunns Dispensing for Pharmaceutical students. 12th ed. New Delhi: CBS Publication; 2008.
3. Metha R.M. Dispensing Pharmacy. New Delhi: Vallabh Publication; 2006

Program	Pharm. D
Year	First year
Name of the course	Medicinal Biochemistry
Course Code	23PMD103
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The Medicinal Biochemistry gives information about transport mechanisms across membrane. It deals with catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases. It also provides the knowledge about the metabolic process of bio molecules in health and illness (metabolic disorders), genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism. This course also provides the biochemical principles of organ function tests of kidney, liver and endocrine gland. This course also deals with the qualitative analysis and determination of bio molecules in the urine and serum.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Understand the transport mechanisms across the membrane, catalytic activity of enzymes diagnostic importance.

CO 2: Explain the metabolism of bio molecules and their metabolic disorders. Demonstrate the possible mechanism and the intermediate product involved in a chemical reaction.

CO 3: Estimate the constituents present in urine and serum

CO 4: Describe the diagnosis for kidney and liver diseases.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Introduction to biochemistry: Cell and its biochemical organization, transport process across the cell membranes.
	Energy rich compounds; ATP, Cyclic AMP and their biological significance.
II (12 Hours)	Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity;
	Enzyme action; enzyme inhibition.
	Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases
III (12 Hours)	Carbohydrate metabolism: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt.
	Glycogenolysis, gluconeogenesis, glycogenesis.
	Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism
IV (12 Hours)	Lipid metabolism: Oxidation of fatty acids (β-oxidation); Ketogenesis.
	Ketolysis and biosynthesis of fatty acids.
	Metabolism of cholesterol and Hormonal regulation of lipid metabolism.
	Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia).
V (12 Hours)	Biological oxidation: Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition);

	Uncouplers of ETC; Oxidative phosphorylation
VI (12 Hours)	Protein and amino acid metabolism: protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation).
	Urea cycle and its metabolic disorders, production of bile pigments, hyperbilirubinemia, porphyria, jaundice.
	Metabolic disorder of Amino acids
VII (12 Hours)	Nucleic acid metabolism: Metabolism of purine and pyrimidine nucleotides;
	Protein synthesis; Genetic code.
	Inhibition of protein synthesis, mutations.
	DNA replication (semiconservative /onion peel models) and DNA repair mechanism
VIII (12 Hours)	Introduction to clinical chemistry: Cell; composition; malfunction; Roll of the clinical chemistry laboratory.
IX (12 Hours)	The kidney function tests: Role of kidney; Laboratory tests for normal function includes- a) Urine analysis (macroscopic and physical examination).
	Quantitative and semi quantitative tests.
	b) Test for NPN constituents. (Creatinine /urea clearance).
	Determination of blood and urine creatinine, urea and uric acid.
	c) Urine concentration test d) Urinary tract calculi (stones).
X (12 Hours)	The liver function tests. Laboratory tests for SGPT, SGOT, Bilirubin.
	Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids,
	Determination of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.

XI (12 Hours)	Immunochemical techniques for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases.
XII (12 Hours)	Electrolytes: Body water, compartments, water balance, and electrolyte distribution.
	Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Satyanarayana U. Textbook of Biochemistry, 4th ed. New Delhi: ELSEVIER a Division of Reed Elsevier India Pvt Ltd; 2013.
2. Lehninger. Principles of Biochemistry, 5th ed. New York: M/s worth Publishers; 1978.
3. Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell. Harper's Biochemistry, 5th ed. Mc Graw Hill Medical; 2013.
4. Jain J. L., Sunjay Jain, Nitin Jain. Fundamentals of Biochemistry, 6th ed.: Chand Company & Company Ltd.
5. Powar C. B. & Chatwal G. R. Biochemistry, 5th ed.: Himalaya Publishing House; 1989.
6. Stryer L. Textbook of Biochemistry, 6th ed.: W.H.Freemann & Co Ltd; 2012.
7. Conn E. E. & Stump P. K. *Outline of Biochemistry*, 5th ed.: John Wiley and sons, New York; 2010.
8. Harper, Biochemistry Mc Graw Hill Medical, 28th Edition.
9. Textbook of Biochemistry by Deb.

Program	**Pharm. D**
Year	**First year**
Name of the course	**Medicinal Biochemistry (Lab)**
Course Code	**23PMD109**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The Medicinal Biochemistry laboratory course is aimed to train the students on experimental techniques for the identification of normal and abnormal constituents in urine. This course also deals with estimation of amount of constituents present in urine and serum. This course also provides information about normal values and significance of estimation of constituents of urine and serum.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Identify the normal and abnormal constituents of urine.

CO 2: Explain about the normal values of components present in urine and serum and significance of their estimation

CO 3: Demonstrate the skills in determining the amount of components present in urine and serum.

Practical Course: Contents

Week	Topics
1	Qualitative analysis of normal constituents of urine
2	Qualitative analysis of abnormal constituents of urine. *
3	Quantitative estimation of urine sugar by Benedict's reagent method. **
4	Quantitative estimation of urine chlorides by Volhard's method
5	Quantitative estimation of urine creatinine by Jaffe's method. **
6	Quantitative estimation of urine calcium by precipitation method. **
7	Kidney function tests
8	Preparation of Folin Wu filtrate from blood. *
9	Identification tests for carbohydrates and proteins
10	Quantitative estimation of blood sugar Folin-Wu tube method
11	Estimation of SGOT in serum. **
12	Estimation of SGPT in serum. **
13	Estimation of Urea in Serum. **
14	Estimation of Proteins in Serum. **
15	Determination of serum bilirubin**
23	Determination of Glucose by means of Glucose oxidase. **
17	Enzymatic hydrolysis of Glycogen/Starch by Amylases. ** (pH & Temp.) **
18	Study of factors affecting Enzyme activity.
19	Determination of sodium in serum. **
20	Determination of potassium in serum
21	Determination of Ammonia in urine
22	Lipid profile tests
23	Demo on colorimeter

NOTE: * Mark indicates minor experiment. ** Mark indicates major experiment

Note: Three Sessional examinations to be conducted periodically throughout the year.

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. David T. Plummer. Introduction to Practical Biochemistry, 3rd ed.: Tata Mc Graw-Hill Education Pvt Ltd; 1988.
2. Pattabhiraman. Practical Biochemistry, 4th ed.: All India Pub (New Delhi); 2004
3. Practical Biochemistry-David T. Plummer.
4. Practical Biochemistry-Pattabhiraman.
5. Introduction of Practical Biochemistry by David T. Plummer (3rd Edition)
6. Practical Biochemistry by Harold Varley
7. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.

Program	Pharm. D
Year	First year
Name of the course	Pharmaceutical Organic Chemistry
Course Code	23PMD104
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

Pharmaceutical organic chemistry mainly deals with the knowledge about IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds, Some important physical properties of organic compounds, Free radical/ nucleophyllic [alkyl/ acyl/ aryl] /electrophyllic substitution, free radical/ nucleophyllic / electrophyllic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds, Some named organic reactions with mechanisms; and Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the knowledge of the inter-link of pharmaceutical sciences with pharmaceutical organic chemistry by learning.
CO 2: Describe IUPAC Common system of nomenclature, types of organic reactions, mechanisms and named reaction with mechanism.
CO 3: Apply the appropriate substrate, catalyst and reaction conditions in the design of chemical reaction.
CO 4: Analyze the fundamentals on behavior of chemical compounds in design of beneficial, economic and safe reaction for a new chemical entity.

Theory Course: Contents

Weeks	Topic
I (3weeks)	**Structures and Physical properties**: a. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non-ionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs, b. Acids and bases, Lowry bronsted and Lewis theories c. Isomerism including stereochemistry
II (3weeks)	a. Nomenclature of organic compound belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides and Cycloalkanes. b. Nomenclature of Bicyclic compounds, and heterocyclic ring systems. c. Free radicals chain reactions of alkane: Mechanism, relative reactivity and stability
III (3weeks)	a. Alicyclic compounds: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain. b. Nucleophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 reactions. Stereochemistry and stearic hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolysis, nucleophilic assistance by the solvents.
IV (3weeks)	**Dehydro halogenation of alkyl halides:** 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity,E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.
V (3weeks)	**Electrophilic and free radicals addition:** Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff's rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophilic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radicals addition, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.
VI (3weeks)	Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparison of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.
VII (3weeks)	**Theory of resonance:**Stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4- addition, 1,2- versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.

VIII (3weeks)	Electrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedal craft alkylation, friedal craft acylation, reactivity and orientation, activating and deactivating O,P,M directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogenation of alkyl benzene, resonance stabilization of benzyl radical.
IX (3weeks)	Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of carboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.
X (3weeks)	Mechanism of aldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation, crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.
XI (3weeks)	a. Hoffman rearrangement: Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer tieman's reactions. b. Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.
XII (3weeks)	Study of the following official compounds- Preparationand medicinal uses ofChlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Morrison and Boyd. Organic Chemistry. New YorkUniversity, Allyn and Bacon, Inc. Boston, London, Sydney, Toronto, ISBN 0-205-05838-8.
2. M. Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry. Ed: l. Oxford University Press: Delhi.
3. I. L. Finar. Organic Chemistry. Longman, Scientific & Technical, Co-published in USA with John Wiley & Sons, Inc. New York. ISBN 0-582-44257-5.
4. Arunbahl & B. S. Bahl. Advanced Organic Chemistry. Edition 2012, S. Chand & Company Pvt. Ltd: New Delhi; 2014 (ISBN: 81-219-3515-6).
5. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2, 6th ed, John Wiley & Sons, New York 2003.
6. T.W.Solomons. Organic Chemistry, University of SouthFlorida, John Wiley & Sons, Inc. New York, Chichester, Brisbane, Toronto, Singapore.
7. Jerry March. Advanced organic chemistry. John Wiley & Sons: New York.
8. EL Eliel and SH Wilen. Stereochemistry of Organic Compounds. Wiley: New York; 1994.
9. Organic chemistry- Brown
10. Organic chemistry- Cram and Hammered, Pine Hendrickson
11. Organic Chemistry by P. L. Soni

Program	**Pharm. D**
Year	**First year**
Name of the course	**Pharmaceutical Organic chemistry (Lab)**
Course Code	**23PMD110**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical organic chemistry laboratory course is aimed to train the students on experimental techniques through demonstration involving synthesis & purification of the various organic compounds. This course also deals with wet laboratory based experiments on identification of various chemical classes of organic compounds using basic principles of organic chemistry.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on determination of various physical properties of organic molecules.

CO 2: Differentiate various classes of organic compounds by experimental techniques.

CO 3: Perform chemical reaction and purification of organic compounds of pharmaceutical interest.

Practical Course: Contents

Week	Topics
1	Determination of the Melting point
2	Determination of the boiling point
3	Detection of extra elements by Lassaignes test – Test for Nitrogen, sulphur, and Halogen
4	Synthesis of meta-dinitro benzene (Nitration)
5	Synthesis of benzophenone oxime
6	Synthesis of picric acid
7	Synthesis of 1-phenylazo-2-naphthol (Diazotisation and coupling)
8	Synthesis of 9,10-anthraquinone (Oxidation)
9	Synthesis of phenyl benzoate (Benzoylation)
10	Detection of extra elements by Lassaigne's test
11	Qualitative organic analysis of Carbohydrates
12	Qualitative organic analysis of Carboxylic acids
13	Qualitative organic analysis of Salicylic acid
14	Qualitative organic analysis of Benzoic acid
15	Qualitative organic analysis of Cresol
16	Qualitative organic analysis of Resorcinol
17	Qualitative organic analysis of Aldehydes & ketones
18	Qualitative organic analysis of Amines
19	Qualitative organic analysis of Alcohols
20	Qualitative organic analysis of Anilides
21	Qualitative organic analysis of Ester
22	Stereo models

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. A.I. Vogel. Text Book of Practical Organic Chemistry. 5th Edition. Pearson Prentice Hall.
2. R.K. Bansal. Laboratory Manual of Organic Chemistry. 5th Edition, New Age International; 2007.
3. O.P. Agarwal.Advanced Practical Organic Chemistry. 3rdEdition,Goel Publication.
4. F.G.Mann& B.C. Saunders.Practical Organic Chemistry. 4thEdition, Pearson Prentice Hall.
5. Practical Organic Chemistry by Mann and Saunders.
6. Advanced Practical Organic Chemistry by N. K. Vishnoi.
7. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
8. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

Program	**Pharm. D**
Year	**First year**
Name of the course	**Pharmaceutical Inorganic Chemistry**
Course Code	**23PMD105**
Paper	**Theory**
Hours /week	**2+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

Pharmaceutical Inorganic chemistry course mainly deals with fundamentals of analytical chemistry and also the study of various classes of inorganic pharmaceuticals regarding their content of specifications according to monographs mentioned in pharmacopoeia. This course also deals with basic knowledge of various medicinal gases & radio pharmaceuticals towards their pharmaceutical & Medicinal or clinical applications.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: State the concept, preparations, and properties of various classes of inorganic compounds and also regarding the applications in the various fields.

CO 2: Demonstrate the various concepts of end point detection and also importance of various medicinal gases, trace elements and radio pharmaceuticals in the pharmaceutical / medicinal / clinical purposes.

CO 3: Analyze the standardization & purity evaluation of various pharmaceutical inorganic compounds as per IP with possible principle behind assays and the limit tests.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**Errors** Errors in quantitative analysis, classification of errors, concept of accuracy and precision, treatment of analytical results.
	Volumetric analysis Principle of volumetric analysis, different methods of analysis
	Different methods for expressing concentrations of solutions, primary and secondary standards.
II (12 Hours)	**Acid-base titrations** Acid- base concepts, relative strength of acids and bases, law of mass action.
	Common-ion effect, ionic product of water, Henderson-Hasselbalch equation & Buffer solutions
	Theory of indicators, neutralization curves, choice of indicators, mixed and universal indicators.
III (12 Hours)	**Redox titrations** Concepts of oxidation–reduction reactions, redox reactions, theory of redox titrations, redox indicators,
	Titrations involving iodometry and iodimetry, cerric sulphate
	Titrations involving potassium iodate, potassium bromate, potassium permanganate, titanous chloride.
IV (12 Hours)	**Non-aqueous titration** Theoretical basis, types of solvents, preparations and standardization of titrant solutions,
	Titration of weak acid, weak bases and indicators. Standardisation of

	perchloric acid, lithium and sodium methoxide, tetra butyl ammonium hydroxide.
	Complexometric titrations Introduction, principle, types of titrations, endpoint detection.
V (12 Hours)	**Precipitation titrations** Introduction, types of precipitation titrations, end point detection.
	Gravimetry Basic concepts, Precipitation techniques, co-precipitation
	Post–precipitation, various steps involved in gravimetric analysis, pharmaceutical applications.
VI (12 Hours)	**Limit tests** Definition, importance, general procedure for limit test for chlorides,
	Sulphates, iron, arsenic
	Lead and heavy metals.
VII (12 Hours)	**Medicinal Gases** Preparation and uses of the following Oxygen, Carbon dioxide, Helium, Nitrogen and Nitrous Oxide.
	Acidifiers Dilute hydrochloric acid, Sodium phosphate, Ammonium chloride.
	Antacids Classification, Qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity, Sodium bicarbonate, Potassium citrate
VIII (12 Hours)	Aluminium hydroxide gel, Dried aluminium hydroxide gel, Magnesium hydroxide, Light and heavy magnesium trisilicate

	light and heavy magnesium carbonate, Calcium carbonate, Magaldrate and Bismuth carbonate.
	Cathartics Magnesium hydroxide, Magnesium sulphate, Magnesium carbonate and Sodium phosphate.
IX (12 Hours)	**Electrolyte replenishers** *Electrolytes used for replacement therapy*: Sodium chloride, Potassium chloride, Calcium chloride, Calcium gluconate.
	Electrolytes used in the acid-base therapy: Sodium acetate, Potassium acetate, Sodium bicarbonate, Potassium bicarbonate, Sodium citrate, Sodium lactate, Ammonium chloride.
	Electrolyte combination therapy: Compound sodium chloride solution, Sodium chloride injection and Oral rehydration salt.
X (12 Hours)	**Essential Trace elements** Definition, Physiological role of Iron, Copper, Zinc, Chromium,
	Manganese, Molybdenum, Selenium, Sulphur and Iodine.
	Antimicrobials Hydrogen Peroxide, Potassium Permanganate, Chlorinated Lime, Iodine, Boric Acid, Silver Nitrate, Selenium Sulphide.
XI (12 Hours)	**Pharmaceutical Aids:** Sodium bisulphite, sodium metabisulphite, bentonite, magnesium stearate, zinc stearate, aluminium sulphate, sodium carboxy methyl cellulose, purified water, water for injection and sterile water for injection.
	Dental products *Anti-caries Agents*: Role of Fluorides as anti-caries agents, Sodium fluoride.
	Dentifrices: Calcium carbonate, dibasic calcium phosphate, Zinc chloride.

XII (12 Hours)	**Miscellaneous compounds.** **Sclerosing agents**: Hypertonic saline, Sodium tetra decyl sulphate. **Expectorants**: Potassium citrate and Potassium iodide.
	Sedative: Potassium bromide. **Antidotes**: Sodium nitrite, Sodium thiosulphate and Charcoal **Respiratory stimulant**: Ammonium carbonate.
	Radiopharmaceuticals. Introduction, measurement of radioactivity, clinical applications and dosage, hazards and precautions
	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. G.R. Chatwal. Pharmaceutical Chemistry – Inorganic. 5th edition. Himalaya Publishing House: Mumbai, India; 2014.
2. A.A. Napoleon. Pharmaceutical Titrimetric Analysis Theory and Practical. 2nd ed.Kalaimani Publishers & Distributers: Kanchipuram; 2013.
3. A.H.Beckett and J.B.Stenlake. Practical pharmaceutical chemistry. Part-I& II. The Athtone press: University of London; 1968.
4. P. Gundu Rao. Pharmaceutical and Medicinal Inorganic Chemistry. 1st edition. VallabhPrakashan Delhi; 2008.

5. Indian pharmacopoeia. Govt. of India; Ministry of health; 1996, 2010 & 2014.
6. Gary L. Miessler, Paul J. Fischer and Donald A. Tarr. Inorganic chemistry. 5th edition. Pearson education New Delhi; 2014.
7. G.D. Tuli, R.D. Madan, S.K. Basu and Satya Prakash. Advanced Inorganic Chemistry. Volume 1. Published by S. Chand & Company Ltd; 2014.
8. William L. Jolly. Modern Inorganic Chemistry. 2nd edition. Mc Graw-Hill: New York; 1984.
9. A text book Inorganic medicinal chemistry by Surendra N. Pandeya
10. M.L Schroff, Inorganic Pharmaceutical Chemistry
11. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
12. Pharmaceutical Inorganic chemistry by Dr.B.G.Nagavi
13. Analytical chemistry principles by John H. Kennedy
14. I.P.1985 and 1996, Govt. of India, Ministry of health
15. Bentley and Driver's Textbook of Pharmaceutical Chemistry

Program	**Pharm. D**
Year	**First year**
Name of the course	**Pharmaceutical Inorganic Chemistry (Lab)**
Course Code	**23PMD111**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The Pharmaceutical Inorganic Chemistry laboratory course is aimed to train the students on experimental techniques for the determination of impurities limits as per the pharmacopoeia. This course deals with standardization & assay methods for the various classes of drugs. This course deals with identification of various cations & anions of inorganic compounds by their chemical tests. This course also provides the laboratory skills related to preparation & purification of few inorganic medicinal compounds.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on limit tests, standardization and assay methods for the various inorganic pharmaceuticals.

CO 2: Differentiate various cations & anions by their chemical tests.

CO 3: Perform the preparations and purification of some inorganic compounds.

Practical Course: Contents

Week	Topics
1	Introduction to analytical balance
2	Calibration of burette & Pipette
3	Limit test for Chlorides
4	Limit test for Sulphates
5	Limit test for Iron
6	Limit test for Arsenic
7	Modified limit test for chlorides and sulphates
8	Assay of Ammonium chloride (Acid-base titration)
9	Assay of Ferrous sulphate (Ceriometry)
10	Assay of Copper sulphate (Iodometry)
11	Assay of Calcium gluconate (Complexometry)
12	Assay of Hydrogen peroxide (Permanganometry)
13	Assay of Sodium benzoate (Non-aqueous titration)
14	Assay of Sodium chloride (Modified Volhard's method)
15	Assay of KI-KIO_3titration
16	Gravimetric estimation of Barium as Barium sulphate
17	Assay of Sodium antimony gluconate/Antimony potassium tartarate
18	Estimation of mixture Sodium hydroxide and Sodium carbonate
19	Estimation of mixture Boric acid and Borax
20	Test for identity of cations & anions in Sodium bicarbonate, Barium sulphate, Ferrous sulphate and Potassium chloride.
21	Swelling power in Bentonite

22	Acid neutralizing capacity in Aluminium hydroxide gel
23	Preparation of Boric acid
24	Preparation of Potash alum
25	Conductometric titration – Demo
26	Revision

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. A.H.Beckett and J.B.Stenlake. Practical pharmaceutical chemistry. Part-I. The Athtone press: University of London; 1968.
2. Gary L. Miessler and Donald A. Tarr. Inorganic chemistry. 3rd edition, Pearson education: New Delhi.
3. P. Gundu Rao. Inorganic pharmaceutical chemistry. VallabhPrakashan; Delhi.
4. G.D.Tuli, Satya prakash, S.Chand. Advanced Inorganic Chemistry. 2006.
5. William L. Jolly Mc Graw-Hill. Modern inorganic chemistry. New York; 1984.
6. Indian Pharmacopoeia 1996, 2010, 2014.

Program	Pharm D
Year	First year
Name of the course	Remedial Mathematics
Course Code	23PMD106
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This is an introductory course in mathematics. This subject deal with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, Laplace transform.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define Trigonometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;

CO 2: Solve the problems of different types by applying theory

CO 3: Appreciate the important applications of mathematics in pharmacy.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**Algebra:** Matrices Definition, types of matrices, Addition of matrices, Scalar multiple matrix, Multiplication of matrices, Properties of matrices.
II (12 Hours)	Transpose of a matrix, Adjoint and inverse of a Matrix, Determinants, Solving the simultaneous linear equations by Cramer's rule

	Trigonometry: Basic concepts, Trigonometric ratios.
III (12 Hours)	Standard results, Signs of the Trigonometric functions, Compound angles, Multiple angles, submultiple angles, Solution of triangles.
IV (12 Hours)	**Analytical Geometry:** Rectangular Cartesian Coordinate system, Distance between two points, Triangles, Quadrilaterals, Section formula.
V (12 Hours)	Centroid of a triangle, Circum Centre of triangle, Ortho Centre of Triangle, In centre of Triangle Locus, Equation of Locus.
VI (12 Hours)	Straight lines, Inclination of line, slope of a line, Equation of straight lines in different forms.
VII (12 Hours)	Point of intersection of two lines, Angle between two lines, Foot of perpendicular from given point to a line Image of point with respect to line, Angular bisector of lines
VIII (12 Hours)	**Differential Calculus:** Limit of a function, Differential calculus, Differentiation of a sum product, Quotient composite function, Parametric, exponential, trigonometric functions
IX (12 Hours)	Logarithmic functions. Successive differentiation, Leibnitz's theorems, Partial differentiation, Euler's theorem on homogeneous functions of two variables
X (12 Hours)	**Integral Calculus:** Definite integrals, integration by substitution, integration by parts, Properties of definite integrals.
XI (12 Hours)	**Differential Equations:** Definition, order, degree Variable separable, homogeneous, Linear, heterogeneous Linear, differential equation with constant coefficient, Simultaneous linear equations of second order
XII (12 Hours)	**Laplace transforms:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books:

1. Riyaz Ahmad Khan Abdul Wadood Khan. Pharmacy and Biotechnology Mathematics. India: I.K. International Publishing House Private Limited; 2008.
2. Prabhakar Gupta, Vijay K Gupta. Remedial Mathematics. 5th ed. Meerut: Pragati Publications; 2008.
3. P Seshagiri Rao. A Textbook of Remedial Mathematics. Hyderabad: PharmaMed Press; 2008.
4. S S Rangi. Mathematics: For Students of Pharmacy. 1st ed. Jalandhar city: P K Jain. S Vikas & CO; 2008.
5. N P Bali, P N Gupta. C P Gandhi. A Textbook of Pharmaceutical Mathematics. 2nd ed. Vol II. New Delhi: Laxmi Publications (P) Ltd; 2008.
6. Shyam Patkar, Ramakant Bhardwaj Sarvesh Agrawal. Comprehensive Remedial Mathematics for B.Pharmacy. Hyderabad: PharmaMed Press; 2009.
7. Riyaz Ahmad Khan. A Textbook of Remedial Mathematics. 1sted. India: S Chand & Company Ltd; 2009.
8. Indrani Pramod Kelkar, J Jagan Mohan. A Textbook of Remedial Mathematics. Hyderabad: Biotech Pharma Publications; 2010.
9. G K Ranganath. A textbook of Remedial Mathematics. Mumabai: Himalaya Publishing House Pvt. Ltd; 2010.

Program	**Pharm D**
Year	**First year**
Name of the course	**Remedial Biology**
Course Code	**23PMD106**
Paper	**Theory**
Hours /week	**2 (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

This course gives a detail study about plant and animal origin. This subject has been introducing to the pharmacy course in order to make the student aware of various naturally occurring drugs and its General organization of plants and its inclusions. Plant kingdom nd its classification, Modifications of Stem, Roots, Leaves. Inflorescence & Pollination of Flower, Morphology of Fruits& Seeds, and this course also learn about Plant Physiology, Taxonomy of some important plants, Detail Study of Frog, Poisonous Animals, Study of Pisces &Reptiles, Aves. General Organizations of Mammals.

Course Learning Outcomes:

Upon successful completion of course, the student should be able to

CO 1: State about Morphological features fruits, Seeds, Modification of Leaf, Stem, Roots

CO 2: List about General organization of plants and its inclusions.

CO 3: Recognize the Histological structures and explain the importance of Plants and Animals

CO 4: Graduates will be able to have imperative knowledge on management in poisonous

Theory Course: Contents

S. No.	Topics
I (6 Hours)	Introduction to Biology, a brief introduction to plant kingdom and its classification. Study of plant cell, structure and functions of cell organelles, cell division.
II (6 Hours)	Types of tissues and tissue systems of plants Introduction and elaborative study on plant growth regulators.
III (6 Hours)	Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
IV (6 Hours)	Root, stem, and leaf modifications
V (6 Hours)	General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.
VI (6 Hours)	Taxonomy of Leguminosae, Umbelliferae, Solonaceae, Lilliaceae
VII (6 Hours)	Study of animal kingdom Study of Fungi, Yeast, Penicillin, Bacteria
VIII (6 Hours)	Animal Cell Structure and Functions of each and every Organelles of Cell Animal Tissues and Structure, Function, Types of Animal Tissues
IX (6 Hours)	**Human Body fluids and circulation** Composition of blood, blood groups, coagulation of blood Composition and functions of lymph **Human circulatory system** Structure of human heart and blood vessels Cardiac cycle, cardiac output and ECG **Digestion and Absorption** Human alimentary canal and digestive glands Role of digestive enzymes Digestion, absorption and assimilation of digested food
X (6 Hours)	**Breathing and respiration** Human respiratory system Mechanism of breathing and its regulation Exchange of gases, transport of gases and regulation of respiration Respiratory volumes **Excretory products and their elimination** Modes of excretion Human excretory system- structure and function Urine formation Rennin angiotensin system

XI (6 Hours)	**Nervous system and coordination** Definition and classification of nervous system, Structure of a neuron Generation and conduction of nerve impulse Structure of brain and spinal cord Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata **Chemical coordination and regulation** Endocrine glands and their secretions Functions of hormones secreted by endocrine glands
XII (6 Hours)	**Human reproduction** Parts of female reproductive system Parts of male reproductive system Spermatogenesis and Oogenesis Menstrual cycle

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Linda R Berg. A Textbook of Botany. Indian edition. New Delhi: Cengage Learning India Private Limited; 2009.
2. B.P. Pandey. College Botany. 5thed. Vol 1. New Delhi: S. Chand and Company Limited; 2007.
3. B.P. Pandey. College Botany. 7thed. Vol 2. New Delhi: S. Chand and Company Limited; 2007.

4. S B Gokhale, D S Bidarkar. A Textbook of Biology. 4th ed. Pune: Nirali Prakashan; 2006.
5. Elden D Enger, Frederick C Ross, David B Bailey. Concepts in Biology. 11th ed. New Delhi: Tata McGraw Hill Publication Company Limited; 200.5.
6. P.K.G Nair, K.P Achar, S.G Prabhu. A Textbook of Remedial Biology. 2nd ed. Mumabi: Himalaya Publishing House Private Limited; 2010.
7. Peter J Russell, Stephen L Wolfe, Paul E Hertz, Lecie Starr, Beverly Mcmillan. Cell and Molecular Biology. Indian edition. New Delhi: Cengage Learning India Private Limited; 2004.
8. Punam K Singh Remedial Biology. 1sted. New Delhi: S. Chand and Company Limited; 2012.

Program	**Pharm D**
Year	**First year**
Name of the course	**Remedial Biology (Lab)**
Course Code	**23PMD112**
Paper	**Practical**
Hours /week	**2 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

Focus on the biology experiments like study of cell wall constituents, inclusions, root, stem, leaf modifications and identification of fruits, seeds, animals.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Learn procedures that are standard practice in biology laboratory

CO 2: Dissect the different systems of the frog

Practical Course: Contents

Week	Topics
1	Introduction of Biological Experiments
2	Study of microscope
3	Study of cell wall constituents and cell inclusions
4	Study of monocot leaf
5	Study of dicot leaf
6	Study of monocot root
7	Study of dicot root

8	Study of monocot stem
9	Study of dicot stem
10	Study of Leaf Modification
11	Study of stem Modification
12	Study of root modification
13	Identification of fruits
14	Study of morphology of fruits
15	Identification of seeds
23	Study of morphology of seeds
17	T.S of Senna
18	T.S of Cassia or Cinnamon
19	T.S of Ephedra
20	T.S of Podophyllum
21	Preparation of permanent slides
22	Simple plant Physiological Experiments
23	Human Respiratory system
24	Human Digestive system
25	Human Cardiovascular system
26	Anatomical features of different organs of frog using charts
27	Identification of Animal tissues
28	Identification of Poisonous animals
29	Computer based tutorials
30	REVISION/Assessment

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Linda R Berg. A Textbook of Botany. Indian edition. New Delhi: Cengage Learning India Private Limited; 2009.
2. B.P. Pandey. College Botany. 5thed. Vol 1. New Delhi: S.Chand and Company Limited; 2007.
3. B.P. Pandey. College Botany. 7thed. Vol 2. New Delhi: S.Chand and Company Limited; 2007.
4. S B Gokhale, D S Bidarkar. A Textbook of Biology. 4th ed. Pune: Nirali Prakashan; 2006.
5. Elden D Enger, Frederick C Ross, David B Bailey. Concepts in Biology. 11th ed. New Delhi: Tata McGraw Hill Publication Company Limited; 200.5.
6. P.K.G Nair, K.P Achar, S.G Prabhu. A Textbook of Remedial Biology. 2nd ed. Mumabi: Himalaya Publishing House Private Limited; 2010.
7. Peter J Russell, Stephen L Wolfe, Paul E Hertz, Lecie Starr, Beverly Mcmillan. Cell and Molecular Biology. Indian edition. New Delhi: Cengage Learning India Private Limited; 2004.
8. Punam K Singh Remedial Biology. 1sted. New Delhi: S. Chand and Company Limited; 2012.

Program	**Pharm. D**
Year	**Second year**
Name of the course	**Pathophysiology**
Course Code	**23PMD201**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The pathophysiology course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions and understanding of basic pathophysiological mechanisms. The course covers the basics of cell biology, inflammation, mechanism of body defense, abnormal cell growth and focuses on the pathophysiology of common disease processes of human body system.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define the basic terminology related to pathophysiology.

CO 2: Describe the etiology and pathogenesis of the selected disease states.

CO 3: Name the signs, symptoms and complications of the diseases.

CO 4: Define the basic approach to diagnosis and diagnostic procedures of human diseases.

CO 5: Correlate the Pathophysiology with prognosis, medical treatment of the diseases.

CO 6: Evaluate medical journals, health articles and other forms of data related to Pathophysiology.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Basic principles of cell injury and Adaptation: Causes, Pathogenesis and morphology of cell injury, Abnormalities in lipoproteinemia glycogen infiltration, glycogen storage diseases
II (12 Hours)	Inflammation: Pathogenesis of acute inflammation, Chemical mediators in inflammation Types of chronic inflammation, Repairs of wounds in the skin, factors influencing healing of wounds
III (12 Hours)	Diseases of Immunity –I: Introduction to T and B cells, MHC proteins or transplantation antigens Immune tolerance-Hypersensitivity, Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs Autoimmunity - Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity
IV (12 Hours)	Diseases of Immunity –II: Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft. Acquired immune deficiency syndrome (AIDS) Amyloidosis.
V (12 Hours)	Cancer- I: differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, spread of malignant tumors.

VI (12 Hours)	Cancer- II: etiology and pathogenesis of cancer Types of shock, mechanisms, stages and management
VII (12 Hours)	Biological effects of radiation Environmental and nutritional diseases: Air pollution and smoking- SO2, NO, NO2, and CO; Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.
VIII (12 Hours)	Pathophysiology of common diseases-I: Parkinsonism, Schizophrenia, Depression and mania, Hypertension, Stroke (Ischaemic and haemorrhage), Angina, CCF, Atherosclerosis, Myocardial infarction.
IX (12 Hours)	Pathophysiology of common diseases-II: Diabetes Mellitus, Peptic ulcer and inflammatory bowel diseases, Cirrhosis and Alcoholic liver diseases, Acute and chronic renal failure, Asthma and chronic obstructive airway diseases.
X (12 Hours)	Infectious diseases-I: Sexually transmitted diseases (Syphilis, Gonorrhoea), Urinary tract infections, Pneumonia
XI (12 Hours)	Infectious diseases-II: Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis
XII (12 Hours)	Revision/ Assessment

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Robbins. Basic Pathologic.8th ed. Elsevier; 2007.
2. Harsh Mohan. Text book of Pathology.6th ed. India: Jaypee Brothers medical publishers (P) Ltd; 2010.
3. Roger Walker, Cate Whittlesea. Clinical Pharmacy and Therapeutics.4th ed. Churchill Livingstone ;2007
4. Porth, Carol. Essentials of Pathophysiology: Concepts of Altered Health States. Philadelphia: Lippincott Williams & Wilkins, 2004.
5. Stephen J McPhee; Gary D Hammer, Pathophysiology of Disease: An Introduction to Clinical Medicine 8E (A & L LANGE SERIES), 8th Edition
6. McCance, Kathryn L., and Sue E. Huether. Pathophysiology: The Biologic Basis for Disease in Adults and Children. 8th ed. Mosby Elsevier, 2010.

Program	Pharm D
Year	Second Year
Name of the course	Pharmaceutical Microbiology
Course Code	23PMD202
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The course deals with the various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. It also discusses with sterilization of pharmaceutical products, equipment, media etc. The course further discusses the immunological preparations, diseases its transmission, diagnosis, control and immunological tests.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Graduates will be able to know the anatomy, identification, growth factors and sterilization of microorganisms

CO 2: Assess the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect.

CO 3: Propose the reasons for microbial culture sensitivity testing.

Theory Course: Contents

S. No	Topics
I (12 Hours)	Introduction to science of Microbiology, Definition, history and scope of Pharmaceutical microbiology, Study of
II (12 Hours)	Different stages of development of Microbiology, Major divisions of microbial world. Different methods of Classification of Microbes, Study of Bacteria, Fungi, Virus, Study of Rickettsiae, Spirochaetes.
III (12 Hours)	Nutritional Requirements, Growth and cultivation of Bacteria, Virus Study of different types of Media. Special Medias, Maintenance of Lab cultures
IV (12 Hours)	Introduction to Isolation and Identification of MO Staining techniques, principles, classifications. Study of Biochemical reactions carried by MO Enumeration of Bacteria, Counting for Total and Viable technique
V (12 Hours)	Merits and Demerits of Sterilization, Sterilization of Pharmaceutical Products, Test for sterility, Validation.
VI (12 Hours)	Study of Disinfectants, Antiseptics, Fungicidal and Virucidal agents, Factors affecting and mechanism of action of Antimicrobial agents, Evaluation of bactericidal agents, bacteriostatic agents and preservatives in pharmaceutical preparations.
VII (12 Hours)	Introduction to Immunology, Immunity, Definition, classification, principles of Immunity. Study of classification, principles of Immunity. Phagocytosis, Acquired- Active and Passive immunity. Study of antigen, antibody, and Ag-Ab reactions. Bacterial exotoxins and endotoxins.

VIII (12 Hours)	Significance of toxoids, Immunization, Immunization programme Booster dose
IX	Diagnostic tests introduction, Schick's tests, western protein.
X (12 Hours)	Study of Mantoux peripheral smear test, Study of Malaria parasite. Microbial culture sensitivity testing, Principles, Microbiological assays of antibiotics.
XI (12 Hours)	Study of Infectious Diseases, Typhoid, TB, Malaria, Cholera, Study of Hepatitis, Meningitis, Syphilis, Gonorrhoea and HIV Revision
XII (12 Hours)	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Prescott. Microbiology, 8th ed. UK: McGraw Hill Education; 2013.
2. Sanjay Kumar Jain, Vandana Soni**.** Bentley's Textbook of Pharmaceutics, 1st ed.India: Elsevier India: 2012.
3. Pelczar Jr MJ, Chan ECS,Krieg NR. Microbiology, 5th ed. UK: Tata McGraw Hill; 2004.

4. AnanthaNarayan, JayramPanikar. Text Book of Microbiology, 7th ed. India: Orient Blackswan; 2005.
5. Dubey RC. A Textbook of Microbiology, 1st ed. India: S. Chand& Company Ltd; 2000.
6. Kishore Namdeorao Gujar, Suhasini Bhatnagar. Pharmaceutical Microbiology Theory, 1st ed. India: Himalaya Publishing House; 2010.
7. EugeneWN, MarthaTN, C.Evans Roberts, Denise Jr.GA, NancyN P. Student Study Guide to Accompany Microbiology: A Human Perspective, 3rd ed. UK: McGraw-Hill Higher Education; 2001.
8. Stephen P, Norman AH, Sean PG, Brendan FG. Hugo and Russell's Pharmaceutical Microbiology, 8th ed.UK: Wiley Publications; 2011.
9. Tortora GJ,Funke BR, Case CL. Microbiology: An Introduction. 12th ed. UK: Benjamin-Cummings Publishing Company; 2014.
10. Prescott SC,Gordon Dunn C. Industrial Microbiology, 1st ed. UK: Mc.Graww Hill; 1940.
11. Chandrakant RK. Pharmaceutical Microbiology Principles and Applications. 6th ed. India: Nirali Prakashan; 2008.

Program	**Pharm D**
Year	**Second year**
Name of the course	**Pharmaceutical Microbiology (Lab)**
Course Code	**23PMD207**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The course is designed to focus on identification, nutritional requirements of microorganisms. Since microbiology is an upcoming and fascinating branch of biological sciences, medical and pharmaceutical sciences, the approach of performing experiments will lead to success of learning the subject.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Learn procedure to cultivate and identification of the microorganisms in the laboratory.

CO 2: Propose the procedure for identification of diseases by performing the diagnostic tests.

Practical Course: Contents

Week	**Topics**
1	Introduction, Basic rules and requirements for laboratory.
2	Study of Equipments and Glassware's used in Microbiology laboratory.
3	Preparation and Sterilization of culture media.
4	Sterilization of Glassware, talcum powder, mineral oil etc.,
5	Distribution of microorganisms in nature.

6	Study of motility characters of microorganisms.
7	Cultivation and preservation of Bacteria from different methods by aseptic technique.
8	Simple staining
9	Negative staining
10	Gram's staining
11	Acid fast staining
12	Isolation of pure culture of microorganisms by Streak plate method
13	Isolation of pure culture of microorganisms by pour plate and spread plate method
14	Test for antibiotic sensitivity by disc method
15	Determination of minimum inhibitory concentration of antibiotic (MIC).
16	Sterility testing of injectables as per IP
17	Biochemical identification of microorganisms by Fermentation.
18	Biochemical identification of microorganisms by 'IMVIC' tests.
19	Biochemical identification of microorganisms by Starch hydrolysis test.
20	Microbiological assay of Streptomycin.
21	Diagnostic test for Malaria.
22	Diagnostic test for Typhoid
23	Determination of phenol co-efficient of disinfectant
24	Microbiological assay of vitamin B12 by turbidometric method.
25	Revision/Assessment

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Cappuccino J G, Natalie Sherman. Microbiology- a Laboratory Manual, 7th ed. India: Pearson Education; 2005.
2. Dubey RC, Maheswari DK. Practical Microbiology, 2nd ed. India: S.Chand& Company Ltd; 2006.
3. Gaud RS, Gupta GD. Practical Microbiology, ISBN8185790310. India: Nirali Prakashan; 2008.
4. Kishore Namdeorao Gujar, Suhasini Bhatnagar. Pharmaceutical Microbiology Theory, 1st ed. India: Himalaya Publishing House; 2010.
5. EugeneWN, MarthaTN, C.Evans Roberts, Denise Jr.GA, NancyN P. Student Study Guide to Accompany Microbiology: A Human Perspective, 3rd ed. UK: McGraw-Hill Higher Education; 2001.

Program	Pharm D
Year	Second year
Name of the course	Pharmacognosy and Phytopharmaceuticals
Course Code	23PMD203
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The pharmacognosy and phytopharmaceuticals course that provides an integrated presentation of pharmacognosy and phytopharmaceuticals. It gives detailed information about the introductory pharmacognosy. The course makes the student aware of medicinal uses of various naturally occurring drugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Record the basic principles of cultivation, collection and storage of crude drugs;

CO 2: List the source, active constituents and uses of various naturally occurring drugs

CO 3: Relate the applications of primary and secondary metabolites of the plant

CO 4: List the adulteration and its evaluation for the crude drugs

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Introduction Definition, history and scope of Pharmacognosy
II (12 Hours)	Classification of crude drugs
III (12 Hours)	Cultivation, collection, processing and storage of crude drugs
IV (12 Hours)	Detailed method of cultivation of crude drugs. Factors influencing cultivation
V (12 Hours)	Introduction to parts of medicinal plants, study of morphology and microscopy of a medicinal plant.
VI (12 Hours)	Microscopical and powder Microscopical study of crude drugs
VII (12 Hours)	Study of natural pesticides
VIII (12 Hours)	Introduction, classification, properties, chemical tests of carbohydrates. Biological source, chemical constituents, chemical test, uses of Agar, Acacia, Tragacanth, Honey, Ispagaol, Starch, Guargum.
IX (12 Hours)	Introduction, classification, properties, chemical tests of lipids. Biological source, chemical constituents, chemical test, uses of Castor oil, Chaulmoogra oil Linseed oil, Cocoa butter, Kokum butter, Bees wax, Wool fat.
X (12 Hours)	Introduction, classification, properties, chemical tests of proteins and enzymes. Biological source, chemical constituents, chemical test, uses of Gelatin, Papain, Casein, Serratio Peptidase, Pepsin Study of plants fibers used in surgical dressings and related products

XI (12 Hours)	Different methods of adulteration of crude drugs
XII (12 Hours)	Different methods of evaluation of crude drugs

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Evans WC, Trease. Pharmacognosy. 15th ed. Elsevier: Delhi; 2009.
2. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 44th ed. Nirali Prakashan: New Delhi; 2009.
3. James E Robbers, Varro E Tyler. Pharmacognosy and Pharmacobiotechnology. 9th ed. Williams & Wilkins: USA; 1988.
4. Wallies TE. Text book of Pharmacognosy. 5th ed. CBS Publishers & Distributors: Delhi; 1999.
5. Handa SS, Kapoor VK. Text book of Pharmacognosy. 1st ed. Vallabh Prakashan: Delhi; 2001.
6. Farooqui AA, Sreeramu BS. Cultivation and Utilization of Medicinal and Aromatic Crops. 1st ed. Universitites Press: Hyderabad; 2010.
7. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.

Program	**Pharm D**
Year	**Second year**
Name of the course	**Pharmacognosy and Phytopharmaceuticals (Lab)**
Course Code	**23PMD208**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

Focus on the macroscopic, microscopic and powder microscopic study of various therapeutically important crude drugs. Become familiar with microscopic examination of crude drugs. The course also deals with the chemical evaluation of the crude drugs under fixed oils both qualitative and quantitative.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: demonstrate the basic macro, micro and powder microscopic nature of crude drugs.

CO 2: Illustrate the chemical evaluation of the crude drugs

CO 3: List the determinations of the fixed oils

Practical Course: Contents

Week	Topics
1	Introduction to Pharmacognosy laboratory and experiments
2	Study of cell wall constituents and cell inclusions
3	Macro, powder and microscopic study of Datura
4	Macro, powder and microscopic study of Senna
5	Macro, powder and microscopic study of cinnamon

6	Macro, powder and microscopic study of cinchona
7	Macro, powder and microscopic study of ephedra
8	Macro, powder and microscopic study of quassia
9	Macro, powder and microscopic study of clove
10	Macro, powder and microscopic study of fennel
11	Macro, powder and microscopic study of coriander
12	Macro, powder and microscopic study of isabgol
13	Macro, powder and microscopic study of nux vomica
14	Macro, powder and microscopic study of rauwolfia
15	Macro, powder and microscopic study of liquorice
16	Macro, powder and microscopic study of ginger
17	Macro, powder and microscopic study of Podophyllum
18	Chemical test for acacia
19	Chemical test for tragacanth
20	Chemical test for agar
21	Chemical test for starch
22	Chemical test for lipid drugs
23	Chemical test for gelatin
24	Determination of iodine value
25	Determination of saponification value
26	Determination of ester value
27	Determination of acid value
28	REVISION/Assessment

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Kokate CK, Gokhale SB. Practical Pharmacognosy. 5th ed. Nirali Prakashan: Delhi; 2003.
2. Khandelwal KR, Vrunda Sethi. Practical Pharmacognosy. 25th ed. Nirali Prakashan: Delhi; 2015.
3. Evans WC, Trease. Pharmacognosy. 15th ed. Elsevier: Delhi; 2009.
4. Iyangar MA. Study of crude drugs. 12th ed. Manipal Press Limited: Manipal; 2004.
5. Biren N Shafi, Nayak BS. Experimental Pharmacognosy. 1st ed. S Vikas & Co: Pune; 2009.
6. Iyangar MA, Nayak SK. Anatomy of Crude drugs. 12th ed. Manipal Press Limited: Manipal; 2011.
7. James E Robbers, Varro E Tyler. Pharmacognosy and Pharmacobiotechnology. 9th ed. Williams & Wilkins: USA; 1988.
8. Wallies TE. Text book of Pharmacognosy. 5th ed. CBS Publishers & Distributors: Delhi; 1999.
9. Handa SS, Kapoor VK. Text book of Pharmacognosy. 1st ed. Vallabh Prakashan: Delhi; 2001.

Program	**Pharm. D**
Year	**Second year**
Name of the course	**Pharmacology – I**
Course Code	**23PMD204**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmacology I course is aimed to provide knowledge about the drugs with classification, pharmacokinetics & pharmacodynamics, route of administration, uses, dose, adverse effects, contra indications and drug interactions. This course deals with the study of general pharmacology, pharmacology of CNS, ANS, CVS, respiratory system and hormones.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Classify the drugs used in the treatment of various diseases.

CO 2: Describe the mechanism of actions, pharmacological actions, pharmacokinetics, route of administration, uses, dose, adverse effects, contra indications and drug interactions.

CO 3: Describe the mechanism of different types of receptors

CO 4: Apply the importance of pharmacology as a basis of therapeutics.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**1. General Pharmacology-I** a) Introduction, definitions and scope of pharmacology b) Routes of administration of drugs c) Pharmacokinetics (absorption, distribution, metabolism and excretion) Absorption: Mechanism of drug absorption, Factors modifying drug absorption Distribution: Physiological barriers, Volume of distribution Metabolism: First pass effect, Enzyme inhibition, Enzyme induction Excretion: Biological half-life, Clearance. d) Pharmacodynamics
II (12 Hours)	**2. General Pharmacology-II** a) Factors modifying drug effects b) Drug toxicity - Acute, sub- acute and chronic toxicity. c) Pre-clinical evaluations d) Drug interactions
III (12 Hours)	**3. Pharmacology of drugs acting on ANS- I** a) Adrenergic and anti adrenergic drugs b) Cholinergic and anti cholinergic drugs
IV (12 Hours)	**4. Pharmacology of drugs acting on ANS- II** a) Neuromuscular blockers b) Mydriatics and miotics c) Drugs used in myasthenia gravis d) Drugs used in Parkinsonism
V	5. **Pharmacology of drugs acting on cardiovascular system-I**

(12 Hours)	a) Antihypertensives b) Anti-anginal drugs c) Drugs used for therapy of Congestive Heart Failure
VI (12 Hours)	**6. Pharmacology of drugs acting on cardiovascular system-II** a) Anti-arrhythmic drugs b) Drugs used for hyperlipidaemias
VII (12 Hours)	**7. Pharmacology of drugs acting on Central Nervous System- I** a) General anesthetics b) Sedatives and hypnotics c) Anticonvulsants d) Analgesic and anti-inflammatory agents
VIII (12 Hours)	**8. Pharmacology of drugs acting on Central Nervous System- II** a) *Psychotropic drugs* i) Anti-Psychotics ii) Antidepressants iii) Hallucinogens b) Alcohol and methyl alcohol c) CNS stimulants and cognition enhancers d) Pharmacology of local anesthetics
IX (12 Hours)	**9. Pharmacology of Drugs acting on Respiratory tract** a) Bronchodilators b) Mucolytics c) Expectorants d) Anti tussives e) Nasal Decongestants

X (12 Hours)	10. **Pharmacology of Hormones and Hormone antagonists-I** a) Thyroid and Anti thyroid drugs b) Insulin, Insulin analogues and oral hypoglycaemic agents
XI (12 Hours)	11. **Pharmacology of Hormones and Hormone antagonists- II** a) Sex hormones and oral contraceptives b) Oxytocin and other stimulants and relaxants
XII (12 Hours)	12. **Pharmacology of autacoids and their antagonists** a) Histamines and Anti histamines b) 5-Hydroxytryptamine and its antagonists. c) Lipid derived autacoids and platelet activating factor

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics

4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Leon Shargel, Andrew Yub.C. Applied Biopharmaceutics and pharmacokinetics. 7th ed.New York: Mcgrawhill; 2023.
9. Hardman J.G, Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.
10. Satoskar RS, Bhandarkar SD and Nirmala N.Rege. Pharmacology and Pharmacotherapeutics.19th ed. Mumbai: Popular prakashan.2005.
11. David E.Golan, Armen H.Tashjian and April W. Armstrong. Principles of pharmacology: the pathophysiological basis of drug therapy.2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008.

Program	Pharm D
Year	Second year
Name of the course	Community pharmacy
Course Code	23PMD205
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counseling, health screening services for improved patient care in the community set up.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Effectively use the pharmacy's prescription filling software to fill prescriptions, check for drug interactions, retrieve patient profiles and retrieve drug information.

CO 2: Demonstrate the proper usage of the commonly used blood glucose meters and train patients how to use them properly.

CO 3: Proper usage of OTC products and explain to patients how to use them properly.

CO 4: Collaborate with physicians and other health care providers to provide recommendations to drug therapy to enhance quality of care and the patients quality of life.

CO 5: The schedules of control substances, storage requirements and dispensing and inventory procedures.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Definition, scope, of community pharmacy Roles and responsibilities of Community pharmacist
II (12 Hours)	Community Pharmacy Management : Selection of site, Space layout, and design Staff, Materials- coding, stocking and Legal requirements, Maintenance of various registers and Use of Computers: Business and health care soft wares
III (12 Hours)	Prescriptions – parts of prescription, legality identification of medication related problems like drug interactions. Essential Drugs concept and Rational Drug Therapy Role of community pharmacist
IV (12 Hours)	Inventory control in community pharmacy: Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock
V (12 Hours)	Pharmaceutical care Definition and Principles of Pharmaceutical care Patient counseling 1: Definition, outcomes, various stages
VI (12 Hours)	Patient counseling II : barriers, Strategies to overcome barriers Patient information leaflets- content, design, & layouts, advisory labels
VII (12 Hours)	Patient medication adherence Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.
VIII (12 Hours)	OTC Medication- Definition, OTC medication list & Counselling Code of ethics for community pharmacists

IX (12 Hours)	Health screening services Definition, importance, methods for screening Blood pressure/ blood sugar/ lung function and Cholesterol testing Health Education 1: WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients. Commonly occurring Communicable Diseases, causative agents,
X (12 Hours)	Health Education 2: Clinical presentations and prevention of communicable diseases – Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhea and AIDS
XI (12 Hours)	Health Education 3: Balance diet, and treatment & prevention of deficiency disorders Family planning – role of pharmacist Responding to symptoms of minor ailments 1: Relevant pathophysiology, common drug therapy to, Pain,
XII (12 Hours)	Responding to symptoms of minor ailments 2: GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhoea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Adepu Ramesh. Community Pharmacy Practice. Hyderabad: Pharma Med Press; 2015.
2. G. Parthasarathi, Karin Nyfor-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice: Essential concepts and skills.2nd ed. India: Universities Press (India) Private Limited; 2012.
3. Leon Shargel, Alan H Mutnick, Paul F Souney, Larry N S Wanson. Comprehensive Pharmacy Review. 7th ed. India: Wolters Kluwer (India) Private Limited. 2010.
4. Atmaram Pawar, R S Gaud. Modern Dispensing Pharmacy. 3rd ed. India: Career Publications; 2009.
5. Atmaram Pawar. Handbook for Community Pharmacists. 1st ed. India: Career Publications; 2007.
6. A J Winfield, R M E Richards, editors. Pharmaceutical Practice. 3rd ed. Churchill Livingstone; 2004.

Program	Pharm D
Year	Second Year
Name of the course	Pharmacotherapeutics – I
Course Code	23PMD206
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality, rational use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualised therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);

CO 7: Summaries the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**Introduction to rational drug use:** Definition, Role of pharmacist in rational drug use, Rational drug formulations, Essential drug concept – NLEM, NFI
II (12 Hours)	**Introduction to Pharmacotherapeutics** **Cardiovascular system:** Hypertension, Heart failure
III (12 Hours)	Ischemic heart diseases: Angina Pectoris, Myocardial infarction,
IV (12 Hours)	Hyperlipidaemias, Electrophysiology of heart and Arrhythmias
V (12 Hours)	**Respiratory system:** Introduction to Pulmonary function test, Asthma,
VI (12 Hours)	Chronic obstructive airways disease, Drug induced pulmonary diseases
VII (12 Hours)	**Endocrine system:** Diabetes, Thyroid diseases,
VIII (12 Hours)	Oral contraceptives, Hormone replacement therapy, Osteoporosis
IX (12 Hours)	**General prescribing guidelines for** a. Pediatric patients
X (12 Hours)	Geriatric patients c. Pregnancy and breast feeding
XI (12 Hours)	**Ophthalmology:** Glaucoma,
XII (12 Hours)	Conjunctivitis- viral & bacterial

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams;2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Marie A, Terry L.S, Patrick M.M, Pharmacotherapy: Principles and Practice. 5th Edition. McGraw-Hill Education.
7. Christopher P.M, Robert L.T. Pharmacotherapy: Bedside Guide. McGraw-Hill Education.

Program	Pharm D
Year	Second Year
Name of the course	Pharmacotherapeutics - I (Lab)
Course Code	23PMD209
Paper	Practical
Hours /week	3 hours (Laboratory)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality and rational use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualised therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);

CO 6: Collect subjective and objective evidence related to patient, medications, allergies/adverse reactions, and disease, by performing patient assessment from chart/electronic health records, laboratory tests, pharmacist records and patient/family interviews.

CO 7: Interpret evidence and patient data.

CO 8: Assess the healthcare status and identify the treatment needs of a targeted patient population.

CO 9: Prepare and deliver patient case presentation and document and communicate patient care activities clearly, concisely, and accurately using appropriate medical terminology.

Practical Course: Contents

Unit	Topic
I	Introduction to the Healthcare System: Healthcare delivery system in the India and the role of the pharmacist within that system. The concepts, systems, and processes of healthcare.
II	Patient Assessment and the Pharmacist Role: Pharmaceutical Care as Professional Practice, Patient Care Process, Documentation (SOAP, FARM Notes). Principles and Methods of the Basic Physical Examination and General Assessment and Vital Signs.
III	Pharmacist Assessment of Body Systems: Cardiovascular System, Respiratory System, Endocrine System.
IV	Case Presentation on Selected Diseases-Cardiovascular System: Hypertension, Hear Failure, Ischemic Heart Disease (Angina Pectoris, Myocardial Infarction), Dyslipidaemia, Cardiac Arrhythmias.
V	Case Presentation on Selected Diseases-Respiratory System: Asthma, Chronic Obstructive Pulmonary Disease, Drug Induced Pulmonary Disorders.
VI	Case Presentation on Selected Diseases-Endocrine System: Diabetes Mellitus, Thyroid Disorders, Hormone Replacement Therapy, Osteoporosis.
VII	Case Presentation on Selected Diseases-Ocular System: Glaucoma-Open Angle, Angle Closure Glaucoma, Bacterial and Viral Conjunctivitis.
VIII	Objective Structure Pharmacotherapy Evaluation (OSPE).

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources (Latest editions)

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams; 2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Rhonds Jones. Patient Assessment in Pharmacy Practice. Wolters Kluwer. 3rd Edition.
7. Sherif Hanafy M. Patient Assessment in Clinical Pharmacy: A Comprehensive guide. Springer.
8. Lynn S. Bickley. BATE's Guide to Physical Examination and History taking. Wolters Kluwer. 12th Edition.
9. Karen J. Tietze. Clinical Skills for Pharmacists: A patient focused approach. 3rd Edition. Elsevier.
10. Soraya D, Rebekha R. Pharmacy Case Studies. Pharmaceutical Press.
11. Pharmacotherapy casebook: A patient focused approach. 10th Edition. McGrawHill Education.
12. Michael DK, Kathryn RM, Marie ACB, Pharmacotherapy Principles & Practice Study Guide: A Case-Based Care Plan Approach.

Program	**Pharm D**
Year	**Second Year**
Name of the course	**Dietary supplements and Nutraceuticals (Elective)**
Course Code	**23PMD210E1**
Paper	**Theory**
Hours /week	**2+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Course Learning Outcomes:

At completion of this subject, it is expected that students will be able to explain

CO 1: Understand the need of supplements by the different group of people to maintain healthy life.

CO 2: Understand the outcome of deficiencies in dietary supplements.

CO 3: Appreciate the components in dietary supplements and the application.

CO 4: Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Theory Course: Contents

S. No	**Topics**
I (3 weeks)	a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer,

	heart disease, stress, osteoarthritis, hypertension etc.
II (3weeks)	Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.
III (3 weeks)	Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds
IV (3weeks)	**Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following** a. Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin b. Sulfides: Diallyl sulfides, Allyl trisulfide. c. Polyphenolics: Reservetrol d. Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
V (3weeks)	**Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following** e. Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum f. Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans g. Tocopherols h. Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.
VI (3 weeks)	Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

VII (3 weeks)	Dietary fibres and complex carbohydrates as functional food ingredients.
VIII (3 weeks)	Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals' involvement in other disorders. Free radicals' theory of ageing.
IX (3 weeks)	**Antioxidants:** Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin **Synthetic antioxidants:** Butylated hydroxy Toluene, Butylated hydroxy Anisole.
X (3 weeks)	Functional foods for chronic disease prevention
XI (3 weeks)	Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.
XII (3 weeks)	Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors 2000 Functional foods Woodhead Publ.Co.London.
7. Goldberg, I. Functional Foods. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in Essentials of Functional Foods M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 Modern Nutrition in Health and Disease. Eighth edition. Lea and Febiger

Program	**Pharm D**
Year	**Second Year**
Name of the course	**Social and Preventive Pharmacy (Elective)**
Course Code	**23PMD210E2**
Paper	**Theory**
Hours /week	**2+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Course Learning Outcomes:

At completion of this subject, it is expected that students will be able to

CO 1: Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.

CO 2: Have a critical way of thinking based on current healthcare development.

CO 3: Evaluate alternative ways of solving problems related to health and pharmaceutical issues

Theory Course: Contents

S. No	Topics
I (3 weeks)	**Concept of health and disease:** Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social

	causes of diseases and social problems of the sick.
II (3weeks)	**Social and health education:** Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.
III (3 weeks)	**Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health
IV (3weeks)	**Hygiene and health:** personal hygiene and health care; avoidable habits
V (3weeks)	**Preventive medicine:** General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, and lymphatic filariasis
VI (3 weeks)	**Preventive medicine:** General principles of prevention and control of pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse
VII (3 weeks)	**National health programs, its objectives, functioning and outcome of the following:** HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program
VIII (3 weeks)	**National health programs, its objectives, functioning and outcome of the following:** National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme
IX (3 weeks)	National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria

	Prevention Program, National programme for the health care for the elderly, social health programme; role of WHO in Indian national program
X (3 weeks)	Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission,
XI (3 weeks)	Health promotion and education in school.
XII (3 weeks)	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

Program	Pharm D
Year	Second Year
Name of the course	Environmental Sciences (Elective)
Course Code	23PMD210E3
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Course Learning Outcomes:

CO 1: Create the awareness about environmental problems among learners.

CO 2: Impart basic knowledge about the environment, its allied problems and develop an attitude of concern for the environment.

CO 3: Motivate learner to participate in environment protection and environment improvement.

CO 4: Acquire skills to help the concerned individuals in identifying and solving environmental problems.

Theory Course: Contents

S. No	Topics
I (3 weeks)	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems of the following-In context to INDIA. a) Forest resources: Types, distribution, Uses and deforestation and its consequences. Conservation of Forests.
II (3weeks)	b) Water resources: Types, distribution and conservation of water sources c) Mineral resources: Distribution and conservation d) Food resources: Sources of food, supply and security context
III (3 weeks)	e) Energy resources: overview on types. f) Land resources: overview on types, Distribution and conservation
IV (3weeks)	Ecosystems Concept of an ecosystem. Structure and function of an ecosystem.
V (3weeks)	*Introduction, types, characteristic features, structure and function of the ecosystems* Forest ecosystem
VI (3 weeks)	Grassland ecosystem; Desert ecosystem, Desertification causes and consequence. Aquatic Ecosystem: Fresh water and marine ecosystem.
VII (3 weeks)	Biodiversity: Levels of biodiversity and its conservation methods, Role of International organization like UNFCCC, IUCCD, IUCBD and etc. in Ecosystem.
VIII (3 weeks)	Environmental Pollution: Causes, consequences and overview on preventive measures in India for the following Air pollution, Water pollution, Soil pollution
IX (3 weeks)	Exercise 1
X (3 weeks)	Exercise 2
XI (3 weeks)	Exercise 3
XII (3 weeks)	Exercise 4

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. BharuchaErach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.

4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

5. Clark R.S., Marine Pollution, Clanderson Press Oxford

6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p

7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down of Earth, Centre for Science and Environment

8. Shankar IAS, Environment.2021, Shankar IAS Academy, Chennai.

9. Goh Cheng Leong, Certificate Physical and Human Geography, Oxford University Press

Program	Pharm D
Year	Third year
Name of the course	Pharmacology-II
Course Code	23PMD301
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, drugs acting on blood & blood forming agents, renal system, immune system. In addition, pharmacology of chemotherapeutic agents and dynamic cell, genome structure, function.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Classify the drugs used in the treatment of various diseases.

CO 2: Describe the mechanism of actions, pharmacological actions, pharmacokinetics, route of administration, uses, dose, adverse effects, contra indications and drug interactions.

CO 3: Apply the knowledge of gene study in the treatment of various diseases.

CO 4: Apply the importance of pharmacology as a basis of therapeutics.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**Pharmacology of Drugs acting on Blood and blood forming agents-I** a) Coagulants & Anticoagulants b) Thrombolytics and antiplatelet agents
II (12 Hours)	**Pharmacology of Drugs acting on Blood and blood forming agents-II** Haemopoietics and plasma expanders **Pharmacology of drugs acting on Renal System** a) Diuretics b) Antidiuretics
III (12 Hours)	**Chemotherapy-I** a) Introduction, mechanism of antibiotic resistance b) Sulfonamides and co-trimoxazole c) Penicillins
IV (12 Hours)	**Chemotherapy-II** a) Cephalosporins, Tetracyclines and Chloramphenicol b) Macrolides, Aminoglycosides, Polyene& Polypeptide antibiotic
V (12 Hours)	**Chemotherapy-III** a) Fluoroquinolones b) Antifungal agents c) Antiviral agents
VI (12 Hours)	**Chemotherapy-IV** a) Chemotherapy of tuberculosis and leprosy b) Chemotherapy of cancer
VII (12 Hours)	**Chemotherapy-V** Chemotherapy of Parasitic infections (Malaria, Helminthic infestations, Amoebiasis and Giardiasis) **Immunopharmacology** Pharmacology of immunosuppressants and immune stimulants
VIII (12 Hours)	**The dynamic cell: The structures and functions of the components of the cell** Chromosome structure: Pro and eukaryotic chromosome structures, genome complexity

IX (12 Hours)	a) The cell cycle: Restriction point, cell cycle regulators and modifiers. b) Cell signalling: Communication between cells and their environment, signal transduction pathways
X (12 Hours)	**The Gene: Genome structure and function:** a) Gene structure: Organization and elucidation of genetic code. b) Gene expression: Expression systems (pro and eukaryotic), genetic elements that control gene expression (Nucleosomes, Histone's modifications such acetylation, HDACS and DNA binding protein families.)
XI (12 Hours)	Transcription and Transcription factors: Basic principles of transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes. Post transcription processing of RNA
XII (12 Hours)	Altered gene functions: Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes. The gene sequencing, mapping and cloning of human disease genes. Introduction to gene therapy and targeting. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

Recommended Text books:

1.Tripathi KD. Essentials of Medical Pharmacology. 7th ed. New Delhi: Jaypee Brothers; 2014.

2.Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill

3. Rang H.P, Dale M.M and Ritter J.M.Pharmacology. 8th ed .Edinburgh: Elsevier Churchill living stone; 2023.

4. David E.Golan, Armen H.Tashjian and April W. Armstrong. Principles of pharmacology: the pathophysiological basis of drug therapy.2nd ed. Philadelphia: Lippincott Williams & Wilkins; 2008.

5. Satoskar RS, Bhandarkar SD and Nirmala N.Rege. Pharmacology and Pharmacotherapeutics.19th ed. Mumbai: Popular prakashan.2005.

6. Sharma. H.L, Sharma K. K. Principles of pharmacology. 2nd ed. Hyderabad: Paras 2011.

Reference books:.

1. Hardman J.G, Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.
2. Leon Shargel, Andrew Yub.C. Applied Bio pharmaceutics and pharmacokinetics. 7th ed.New York: Mcgrawhill; 2023.
3. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
4. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
5. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,

Program	**Pharm D**
Year	**Third Year**
Name of the course	**Pharmacology-II (Lab)**
Course Code	**23PMD307**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

Deals with study of laboratory animals and their handling, Physiological salt solutions, laboratory appliances, anaesthetics, route of administration of drugs and Pharmacodynamic experiments on isolated tissues and intact animals.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the Basic skills regarding Handling of Experimental animals, Routes of administration of drugs.

CO 2: Perform the *Invitro* experiments on isolated Tissues.

CO 3: Perform the bioassays of drugs by using suitable isolated tissues or organs

CO 4: Perform the Experiments on intact animals related to screening of drugs acting on CNS

CO 5: Correlate the preclinical studies with clinical studies.

Practical Course: Contents

Week	Topics
1	Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).
2	Study of physiological salt solutions used in experimental pharmacology
3	Study of laboratory appliances used in experimental pharmacology.
4	Study of use of anesthetics in laboratory animals.
5	To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.
6	To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by interpolation method.
7	To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method.
8	To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by matching method.
9	Study of agonistic and antagonistic effects of drugs using isolated ileum/rectus abdominis muscle preparation
10	To study the routes of administration of drugs in animals (Rats, Mice, Rabbits)
11	Analgesic property of drug using analgesiometer
12	Anti-inflammatory effect of drugs using rat-paw edema method.
13	Anticonvulsant activity of drugs using maximal electroshock and pentylenetetrazol methods
14	Antidepressant activity of drugs using swim test apparatus
15	Locomotor activity evaluation of drugs using actophotometer and rotarod

16	Cardiotonic activity of drugs using isolated frog heart.
17	Assignment
18	Demo on semi Autoanalyser
19	Demo on collection of blood samples
20	Demo on homogenizer
21	Class test
22	Demo on Histamine chamber
23	Demo on metabolic cage
24	Assignment

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

Recommended Text books (Latest editions)

1. Ramesh k.Goyal, Natvar M.Patel, Prabhakar MC, Rajendra V.Bhatt and Anitha A.Mehta. Practicals in pharmacology.8th ed. Ahmendabad: B.S.Shah Prakashan ; 2009.
2. Kulakarni SK. Handbook of Experimental Pharmacology. 4th ed. New Delhi: vallabh Prakashan; 2012.
3. Ghosh MN. Fundamentals of Experimental pharmacology. 6th ed. Kolkata: Hilton& company; 2008.
4. Parmar NS, Shiv Prakash. Screening Methods in Pharmacology. New Delhi: Narosa Publishing House; 2011.

Reference books (Latest Editions)

6. Hardman J.G, Lee E. Limbard, Good Man & Gilmans. The Pharmacological basis of therapeutics. 11 th ed.USA: Mc Grawhill; 2006.
7. Leon Shargel, Andrew Yub.C. Applied Bio pharmaceutics and pharmacokinetics. 7th ed.New York: Mcgrawhill; 2023.
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,

Program	**Pharm D**
Year	**Third year**
Name of the course	**Pharmaceutical Analysis**
Course Code	**23PMD302**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

Pharmaceutical Analysis is mainly designed to impart a very good knowledge about different chromatographic methods, spectrophotometric methods with their instrumentations, applications towards the Pharmaceutical analysis of compounds or pharmaceuticals. It also describes the different guidelines ICH, quality control and validation parameters.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define the fundamentals on conventional methods of drug analysis used in laboratories and also the basic principles of other analytical techniques used in analytical industry.

CO 2: Demonstrate the applications of various analytical methods to the drugs & pharmaceuticals as per the standards.

CO 3: Analyze various chromatographic techniques for the separation of mixtures.

CO 4: Apply the analytical data of various spectroscopic techniques for their identification, quantification and in structural illustration.

Theory Course: Contents

S. No.	Topic
I (12 Hours)	**Quality Assurance:** a. Introduction, sources of quality variation, control of quality variation. b. Concept of statistical quality control. c. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration. d. GLP, ISO 9000. e. Total quality management, quality review and documentation. f. ICH- international conference for harmonization-guidelines. g. Regulatory control.
II (12 Hours)	**Chromatography:** Introduction, history, classification, separation techniques, choice of methods. The following techniques be discussed with relevant examples of pharmaceutical products involving principles and techniques of separation of drugs from excipients. a. **Column Chromatography**: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography. b. **TLC**: Introduction, principle, techniques, Rf value and applications.
III (12 Hours)	**PC:** Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications. d. **Ion-exchange chromatography**: Introduction, principles, types of ion exchange synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.

	e. **HPLC**: Introduction, theory, instrumentation, and applications. f. **HPTLC**: Introduction, theory, instrumentation, and applications.
IV (12 Hours)	**Gas Chromatography**: Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors-Flame ionization detectors, electron capture detector, thermal conductivity detector. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography, applications. h. **Electrophoresis**: Principles of separation, equipment for paper and gel electrophoresis, and application. i. **Gel filtration** and **affinity chromatography**: Introduction, technique, applications.
V (12 Hours)	**Electrometric Methods:** Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics. a. **Potentiometry**: Electrical potential, electrochemical cell, reference electrodes, indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point, Karl Fischer titration. b. **Conductometry**: Introduction, conductivity cell, conductometric titrations and applications.
VI (12 Hours)	**c. Polarography**: Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications. d. **Amperometric Titrations:** Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and

	disadvantages of Amperometry over potentiometry. Pharma application
VII (12 Hours)	**Spectroscopy:** Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on: a. **Absorption Spectroscopy:** - Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer- Lambert's Law, application and its deviation, limitation of Beer law, application of the law to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic shift, hypsochromic shift, hyperchromic and hypochromic effect, effect of solvent on absorption spectra, molecular structure and infrared spectra. **Instrumentation** – Photometer, U.V.-Visible spectrophotometer – sources of U.V.-Visible radiations, collimating systems, monochromators, samples cells and following detectors- Photocell, Barrier layer cell, Phototube, Diode array, applications of U.V.-Visible spectroscopy in pharmacy and spectrophotometric titrations.
VIII (12 Hours)	**Infrared Spectroscopy**: Vibrational transitions, frequency – structure correlations, Infrared absorption bands, Instrumentation–IR spectro-meter – sources of IR, Collimating systems, monochromators, sample cells, sample handling in IR spectroscopy and detectors– Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy.
IX (12 Hours)	**Fluorimetric Analysis:** Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation, Applications, fluorescent indicators, study of

	pharmaceutically important compounds estimated by fluorimetry. **b. Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.
X (12 Hours)	c. **Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation and applications. d. **Atomic Emission Spectroscopy**: Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection.
XI (12 Hours)	**e. NMR & ESR (introduction only):** NMR: Principle, Instrumentation and applications ESR: Introduction, theoretical aspects and applications f. **Mass Spectroscopy**: (**Introduction only**) Principle, Fragmentation, types of ions Instrumentation and applications. g.**Polarimetry: (Introduction only**) – Introduction to optical rotatory dispersion, circular dichroism, polarimeter.
XII (12 Hours)	h. **X-RAY Diffraction: (Introduction only**) – Theory, reciprocal lattice concept, diffraction patterns and applications. i. **Thermal Analysis**: Introduction, instrumentation, applications, and DSC and DTA. Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

Reference books (Latest Editions):

1. Higuchi. T and Hasen. E. B. Text Book of Pharm. Analysis. Inter Science Publishers: New York.
2. Jenkins. Quantitative Pharma. Analysis. The Blakiston division: New York.
3. Garrot. D. Quantitative Drug Analysis. Chapman & Hall Ltd: London.
4. James. E. Undergraduate Instrumental Analysis. CBS Publishers.
5. Willard and Merritt. Instrumental Analysis. East West Press Ltd: Delhi/Madras.
6. Skoog DA, James HF, Crouch SR. Principles of Instrumental Analysis. 6th ed. India: Cengage Learning; 2007. ISBN-13: 978-0495012023, ISBN-10: 0495012017.
7. Vogel AI. Text book of quantitative chemical analysis. 5th ed. Newyork: Longman Scientific & Technical; 1989. ISBN 0582446937
8. Connors KA. A textbook of Pharmaceutical Analysis. 3rd ed. India: Wiley India Pvt. Ltd; 1982. ISBN: 8LGYW9TY5P8.

   Silverstein RM, Webster FX, Kiemle DJ, Bryce DL. Spectrometric identification of organic compounds. 8th ed. New Jersey: John Wiley & Sons; 2004. ISBN: 9780470914014.
9. Remington. The Science & Practice of Pharmacy. Vol-I & II. Mack Publishing Co. Pennsylvania.

10. Chatten. Text Book of Pharm. Chemistry. CBS Publications.
11. William Kemp. Spectroscopy. ELBS with Macmillan Press: Hampshire.
12. Monographs: Indian Pharmacopoeia, British Pharmacopoeia, United States of Pharmacopoeia, European Pharmacopoeia, Japanese Pharmacopoeia.
13. Kemp W. Organic spectroscopy. 3rd ed. London: Palgrave Macmillan; 1991. ISBN-10: 033351954X, ISBN-13: 9780333519547.
14. Sharma BK. Instrumental chemical analysis, 28th ed. India: Goel publishing house; 2014. ISBN: 9788182830998.
15. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
16. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
17. Bentley and Driver's Textbook of Pharmaceutical Chemistry
18. John H. Kennedy, Analytical chemistry principles

Recommended Books (Latest Editions):

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

Program	**Pharm D**
Year	**Third year**
Name of the course	**Pharmaceutical Analysis (Lab)**
Course Code	**23PMD308**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical analysis laboratory course is aimed to train the students on experimental techniques for the determination, separation, comparision and estimation of various pharmaceuticals by chromatographic, electrometric and spectroscopic methods. This course also provides the interpretation of various spectra and helps in the structural identification by their absorbance, functional groups, Resonance etc.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Identify the compounds present in the samples by various analytical techniques like chromatography and spectroscopy.

CO 2: Analyze the various drugs by electrometric methods.

CO 3: Demonstration of various analytical techniques, spectra of drugs towards its applications in the analytical chemistry.

Practical Course: Contents

Week	Topics
1	Introduction to analysis
2	Pharmacopoeial considerations
3	Introduction & Calibration of analytical glass ware
4	Potentiometric titration of strong acid and strong base
5	Conductometric titration of mixture of acids and strong base
6	Introduction to chromatography
7	Preparation and activation of TLC plates
8	Identification of Paracetamol tablets by TLC
9	Identification of amino acids by ascending paper chromatographic technique
10	Identification of amino acids by Radial paper chromatographic technique
11	Determination of p^{ka} of salicylic acid by pH meter
12	Demonstration of HPLC with Binary pump
13	Determination of maximum wavelength of given drug
14	Determination of Isobestic point
15	Effect of pH on UV spectrum for given compound
16	Interpretation of IR spectrum
17	Interpretation of HPLC chromatogram
18	Determination of quenching effect of quinine sulphate
19	Estimation of drug by Fluorimetry
20	Assay of Ciprofloxacin tablet by colorimetry using 0.5% $FeCl_3$
21	Flame photometry
22	Limit Test for sulphates in Calcium gluconate by Nephelo turbidimeter
23	Demonstration of GC
24	Revision

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Vogel AI. Text book of quantitative chemical analysis. 5th ed. Newyork: Longman Scientific & Technical; 1989. ISBN 0582446937
2. A. H. Beckett and J. B. Stenlake. Practical pharmaceutical chemistry. Part-I & II. The Athtone press: University of London; 1968.
3. Sethi PD. Quantitative analysis of drugs in pharmaceutical formulations. 3rd ed. India: CBS Publishers; 2007. ISBN-10: 8123905602.
4. Silverstein RM, Webster FX, Kiemle DJ, Bryce DL. Spectrometric identification of organic compounds. 8th ed. New Jersey: John Wiley & Sons; 2004. ISBN: 9780470914014.

Program	Pharm D
Year	Third year
Name of the course	Pharmacotherapeutics II
Course Code	23PMD303
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualised therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summaries the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

CO 10: Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Theory Course: Contents

S. No.	Topics
I (12 Hours)	Musculoskeletal disorders: Rheumatoid arthritis, Osteoarthritis, Spondylitis
II (12 Hours)	Gout, Systemic Lupus Erythematous Infectious diseases: Guidelines for rational use of antibiotics and surgical prophylaxis
III (12 Hours)	Respiratory tract infections, Tuberculosis, Meningitis , Malaria
IV (12 Hours)	Gastroenteritis, Fungal Infections, HIV & Opportunistic Infections
V (12 Hours)	Urinary tract infections, Syphillis Renal System: Acute Renal Failure, Renal Dialysis
VI (12 Hours)	Chronic Renal Failure, Drug induced renal disorders Endocarditis, Viral infections, Septicemia
VII	Gonorrhea

(12 Hours)	Dermatology: Scabies, Eczema, Impetigo, Psoriasis
VIII (12 Hours)	Oncology: Introduction and Basic principles of Cancer Therapy
IX (12 Hours)	General Introduction to cancer chemotherapeutic agents
X (12 Hours)	Chemotherapy of Breast Cancer, Pathophysiology of breast cancer Management of chemotherapy induced nausea and emesis
XI (12 Hours)	Types, pathophysiology and pharmacotherapy of Leukemia
XII (12 Hours)	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

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Learning Resources/Recommended Texts/Reference books/web resources

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams; 2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Rhonds Jones. Patient Assessment in Pharmacy Practice. Wolters Kluwer. 3rd Edition.
7. Sherif Hanafy M. Patient Assessment in Clinical Pharmacy: A Comprehensive guide. Springer.
8. Lynn S. Bickley. BATE's Guide to Physical Examination and History taking. Wolters Kluwer. 12th Edition.
9. Karen J. Tietze. Clinical Skills for Pharmacists: A patient focused approach. 3rd Edition. Elsevier.
10. Soraya D, Rebekha R. Pharmacy Case Studies. Pharmaceutical Press.
11. Pharmacotherapy casebook: A patient focused approach. 10th Edition. McGrawHill Education.
12. Michael DK, Kathryn RM, Marie ACB, Pharmacotherapy Principles & Practice Study Guide: A Case-Based Care Plan Approach.

Program	Pharm D
Year	Third year
Name of the course	Pharmacotherapeutics II (Lab)
Course Code	23PMD309
Paper	Practical
Hours /week	3 hours (Laboratory)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualised therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summaries the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis

Practical Course: Contents

Week	**Topics**	
1	Introduction to soap Analysis, FARM notes	**Clinical skills**
2	Case presentation on GASTROENTRIRITS.	Assessing drug related problems
3	Case presentation on BREAST CANCER	Pharmaceutical care process
4	Case presentation on LRTI with GE with protein energy malnutrition	Medication therapy management
5	Case presentation on Malaria with thrombocytopenia	Monitoring plan
6	Case presentation on tuberculosis	Patient counseling
7	Case presentation on LRTI with sepsis with hypochromic microcytic anemia	ADR monitoring
8	Case presentation on Dengue with thrombocytopenia	Drug counseling
9	Case presentation on myocardial infraction	Clinical pharmacokinetics
10	Case presentation on Rheumatoid Arthritis	Medication review / medication history interview
11	Case presentation on post meningitis sequalor with seizures	Ward round participation
12	Case presentation on impetigo	Drug information
13	Case presentation on COPD with anasarka corpurmonal	Medication adherence
14	Case presentation on Acute renal failure.	Pharmacotherapy work up [drug therapy assessment]
15	Case presentation on exacerbation of bronchiectasis	Medication safety assessment

16	Case presentation on liver cirrhosis	Rational drug use
17	Case presentation on UTI with anemia	Medication effective assessment
18	Case presentation on OP compound poisoning	Evidence based medicine
19	Case presentation on malaria with thrombocytopenia with clinical jaundice	Pediatric clinical practice
20	Case presentation on chronic kidney failure with electrolyte disturbance	Medical ward-clinical practice
21	Case presentation on COPD with gastroenteritis	Medication errors
22	Case presentation on Rational use of drugs	Geriatric/OB&GYN Clinical practice

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams; 2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.

4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Rhonds Jones. Patient Assessment in Pharmacy Practice. Wolters Kluwer. 3rd Edition.
7. Sherif Hanafy M. Patient Assessment in Clinical Pharmacy: A Comprehensive guide. Springer.
8. Lynn S. Bickley. BATE's Guide to Physical Examination and History taking. Wolters Kluwer. 12th Edition.
9. Karen J. Tietze. Clinical Skills for Pharmacists: A patient focused approach. 3rd Edition. Elsevier.
10. Soraya D, Rebekha R. Pharmacy Case Studies. Pharmaceutical Press.
11. Pharmacotherapy casebook: A patient focused approach. 10th Edition. McGrawHill Education.
12. Michael DK, Kathryn RM, Marie ACB, Pharmacotherapy Principles & Practice Study Guide: A Case-Based Care Plan Approach.

Program	Pharm D
Year	Third Year
Subject	Pharmaceutical Jurisprudence
Course Code	23PMD304
Paper	Theory
Hours /week	2 hours (lectures)
Pre /co-requisite(s)	Nil

Course Description:

This course exposes the student to several important legislations related to the profession of pharmacy in India. The Drugs and Cosmetics Act, along with its amendments are the core of this course. Other acts, which are covered, include the Pharmacy Act, dangerous drugs, Medicinal and Toilet preparation Act etc. Besides this the new drug policy, professional ethics, DPCO, patent and design Act will be discussed.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to -

CO1: Know the history and significance of pharmaceutical legislations in India and practice professional ethics, responsibilities.

CO2: Know the administrative bodies, authorities, officers, inspectors' roles and responsibilities.

CO3: Understand the procedures for import, manufacturing and sale of drugs, cosmetics, other substances along with schedules.

CO4: Know the constitution, functions of central, state councils, registration procedure and importance of education regulations.

CO5: Know the policy, procedures, and control of pricing drugs.

CO6: Other laws and amendments as prescribed by the Central and State Councils from time to time including International Laws.

Theory Course: Contents

S.No	Topics
I (3 weeks)	**Introduction:** Legislation, types and legal terminology. **Pharmaceutical Legislations** – A brief review.
II (3 weeks)	**Principle and Significance of professional ethics**. Critical study of the code of pharmaceutical ethics drafted by PCI.
III (3 weeks)	**Drugs and Cosmetics Act, 1940, and its rules 1945:** Objectives, Legal definition,General study of schedules to the Act (First, Second schedule) and Rules (A, B, C, C1, D, D-I, D-II, D-III, E1, F, F-I, F-II, F-III, FF, G, H, H1, J, K, L1, M, M-I, M-II, M-III, N, O, P, P1,Q, R, R1, S, T, U, U1, V, W, X, Y) with recent amendments. Administration of the Act and Rules – Drugs Technical Advisory Board (DTAB), Central drugsLaboratory (CDL), Drugs Consultative Committee (DCC), Government drug analysts, Licensingauthorities, Controlling authorities, Drugs Inspectors. Import, Sales, Labelling and packaging of Drugs and Cosmetics. Offences and penalties.
IV (3 weeks)	Provisions Relating to Indigenous Systems. **Pharmacy Act, 1948:** Objectives, Legal Definitions, General Study, Constitution and Functions of Central Council, State and Joint state councils. Registration and Procedure, Educational Regulations (ER), Pharmacy Practice regulations. Offences and penalties.
V (3 weeks)	**Medicinal and Toilet Preparation Act, 1955**: Objectives, Legal Definitions, Licensing, Bonded and Non-Bonded Laboratory, Ware Housing, Manufacture ofAyurvedic, Homeopathic, Patent & Proprietary Preparations. Levy and collection of duties. Offences and Penalties.
VI (3 weeks)	**Narcotic Drugs and Psychotropic substances Act, 1985 and Rules:** Objectives, Legal Definitions, General Study, Constitution and Functions of Narcotic & Psychotropic Consultative Committee, National Fund for Controlling

	the Drug Abuse, Prohibition, Control and regulations, and Schedules to the Act. Offences and Penalties.
VII (3 weeks)	Study of Salient Features of Drugs and magic remedies Act and its Rules. Schedules to the Act. Offences and Penalties.
VIII (3 weeks)	Study of Essential Commodities Act Relevant to drugs price control Order. Offences and Penalties.
IX (3 weeks)	**National Pharmaceutical Pricing Authority (NPPA):** National Pharmaceutical Pricing Policy (NPPP) Drug Price Control Order. Schedules to DPCO, Offences and Penalties.
X (3 weeks)	**Prevention Of Cruelty to animals Act, 1960:** Objectives, Definitions, Brief study on Institutional Animal Ethics Committee (IAEC), Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines for experimenting animals. Offences and Penalties.
XI (3 weeks)	**Intellectual property rights:** Patents &Design Act-1970 and brief study on Copyright, Trademarks, Trade Secrets, Geographical indications, Plant variety rights. Briefstudy on**Medical Termination of Pregnancy Act 1971.**
XII (3 weeks)	**Right to Information Act 2005:**Objectives, Definitions, right to information and obligations of public authorities, procedure in filing RTI application and supply of information, information exempted from disclosure. **Medical Device and Diagnostics:** Medical Device Rules, 2017. Brief study of prescription and Non-prescription Products.

Case studies relating to

1. Drugs and Cosmetics Act and rules along with its amendments, Dangerous Drugs Act, Medicinal and Toilet preparation Act, New Drug Policy, Professional Ethics, Drugs (Price control) Order, Patent and Design Act.
2. Various prescription and non-prescription products.

3. Medical and surgical accessories.
4. Diagnostic aids and appliances available in the market.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Mithal, B M. Textbook of Forensic Pharmacy. 10th ed. Delhi: Vallabh Prakashan; 2006.
2. S P Agarwal, Rajesh Knanna. Phamraceutical Jurisprudence and Ethics. 5th ed. Delhi: Birla Publications Pvt Ltd. 2009.
3. Binay Kumar JHA. Pharmaceutical Jurisprudence. Jalandhar city: S Vikas & CO.
4. Singh, KK, Beotra's the Laws of Drugs, Medicines & cosmetics. Allahabad: Law Book House; 1984.
5. Jain NK. A Textbook of forensic pharmacy. Delhi: Vallabh prakashan; 1995.
6. Reports of the Pharmaceutical enquiry Committee.
7. I.D.M.A., Mumbai. DPCO 1995.
8. Various reports of Amendments.
9. Deshapande, S.W. The drugs and magic remedies act 1954 and rules 1955. Mumbai: Susmit Publications; 1998.
10. Eastern Book Company. The narcotic and psychotropic substances act 1985, Lucknow: Eastern; 1987.
11. B. S. Kuchekar. Forensic Pharmacy. Pune: NiraliPrakashan.
12. Vijay Malik, Law relating to Drugs and Cosmetics. 26th Edition, 2021. Eastern Book Company.
13. Drugs and Cosmetics Act, 1940 with Medical Devices Rules 2017. 2021 Edition. Eastern Book Company.
14. The Complete Drugs and Medical Laws Referencer by Surendra Malik, Sudeep Malik and Vijay Malik, 2023 Edition. Eastern Book Company.
15. INDIA CODE (https://www.indiacode.nic.in/)

    (It is an official database of all Central enactments which are in force and their subordinate legislations made from time to time. It also contains Legislations enacted by the States and Union Territory Administrations along with their relevant subordinate legislations.)

Program	**Pharm D**
Year	**Third year**
Name of the course	**Medicinal chemistry**
Course Code	**23PMD305**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical Medicinal chemistry course will explore role of organic chemistry in the design and action of drugs, it is helpful for discussing principles of drug discovery, drug development, drug receptor interactions and structure activity relationships and it is helpful to understand the relationship between the biological, chemical physical properties of medicinal compounds.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define the drug targets and molecular mechanism action.

CO2: Encourage the development of problem – solving skills and knowledge related to chemotherapy which is necessary to provide pharmaceutical care.

CO 3: Build a knowledge base of chemotherapy principles for various disease states.

CO 4: applied the knowledge in discussing principles of drug discovery, drug development, drug/receptor interactions and structure/activity relationships.

Theory Course: Contents

S. No.	Topics
I (12 Hours)	**Drug metabolism:** Introduction, classification with suitable examples.
II (12 Hours)	**Modern concept of rational drug design**: A brief introduction to Quantitative Structure Activity Relationship (QSAR), Prodrug, Combinatorial chemistry, computer aided drug design (CADD) and concept of Antisense molecules.
III (12 Hours)	**Anti-infective agents** a) **Local anti-infective agents:** P – Chloro m-xylenol, Chlorocresol, Halozane*, Benzalkonium chloride*, Methylene blue, Methyl paraben*. b) **Antifungal agents** **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Miconazole*, Ketoconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*. c) **Urinary tract anti-infectives** **Quinolones**: SAR of quinolones, Nalidixic SAR of quinolones, Nalidixic Acid, Norfloxacin, Ciprofloxacin*, Ofloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin **Miscellaneous**: Furazolidine, Nitrofurantoin*, Methanamine.
IV (12 Hours)	d) **Antitubercular agents** **Synthetic anti tubercular agents:** Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* **Anti tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine, Streptomycin. e) **Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.
V (12 Hours)	f) **Antiviral agents and Anti AIDS agents** Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Ribavirin, Saquinavir, Indinavir. g) **Antiprotozoal agents** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol. h) **Antiscabies and antipedicular agents:** Benzylbenzoate, Gammexane, Chlorophenothane(DDT)*.

VI (12 Hours)	**a) Antimalarials**: Life cycle of malarial parasite **Quinolines**: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil. **Miscellaneous**: Pyrimethamine, Artesunete, Artemether, Atovaquone **b) Sulphonamides and sulphones** Chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. **Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole. **Sulfones**: Dapsone*.
VII (12 Hours)	**Antibiotics** : Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. **β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams **Aminoglycosides**: Streptomycin, Neomycin, Kanamycin **Tetracyclines**: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline **Macrolide**: Erythromycin Clarithromycin, Azithromycin. **Miscellaneous**: Chloramphenicol*, Clindamycin
VIII (3 weeks)	**Antineoplastic agents** **Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa **Antimetabolites**: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine **Antibiotics**: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate Miscellaneous: Cisplatin, Mitotane.
IX (3 weeks)	**Cardiovascular agents** **a) Antihypertensive agents:** Atenolol, Propronolol***,*** Timolol, Captopril, Enalapril, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Minoxidil, Reserpine, Hydralazine hydrochloride. b) **Antianginal agents and vasodilators** **Vasodilators**: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. c) **Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine*, Amlodipine, Felodipine. d) **Antiarrhythmic agents :** Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Mexiletine hydrochloride, Amiodarone. e) **Antihyperlipidemic agents:** Clofibrate, Lovastatin, Cholesteramine and Cholestipol

X (3weeks)	**Diuretics** **Carbonic anhydrase inhibitors:** Acetazolamide*, Methazolamide, Dichlorphenamide. **Thiazides**: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, **Loop diuretics:** Furosemide*, Bumetanide, Ethacrynic acid. **Potassium sparing Diuretics:** Spironolactone, Triamterene, Amiloride. **Osmotic Diuretics:** Mannitol
XI (3 weeks)	**Hypoglycemic agents** : Insulin and its preparations **Sulfonyl ureas:** Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. **Biguanides**: Metformin. **Thiazolidinediones**: Pioglitazone, Rosiglitazone. **Meglitinides**: Repaglinide, Nateglinide. **Glucosidase inhibitors**: Acrabose, Voglibose.
XII (3 weeks)	**Drugs acting on Endocrine system** Nomenclature, Stereochemistry and metabolism of steroids **Sex hormones**: Testosterone, Nandralone, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol*. **Drugs for erectile dysfunction:** Sildenafil, Tadalafil. **Oral contraceptives:** Mifepristone, Norgestril, Levonorgestrol **Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone **Thyroid and antithyroid drugs**: L-Thyroxine, L-Thyronine, Propylthiouracil*, Methimazole, Carbimazole.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Surendra N Pandeya. A textbook of Medicinal chemistry: Synthesis and Biochemical Approach. 3rd ed. Vol.I. Varanasi: S G Publisher; 2004.

2. Surendra N Pandeya. A textbook of Medicinal chemistry: Synthesis and Biochemical Approach. 1st ed. Vol.II. Varanasi: S G Publisher; 2001.
3. Robert F Doerge, editor. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry. 8th ed. Philadelphia: J B Lppncott Company.
4. S S Kadam, K R Mahedik, K G Bothere. Principles of Medicinal Chemistry. 18th ed. Vol I. Pune: Nirali Prakashan; 2007.
5. S S Kadam, K R Mahedik, K G Bothere. Principles of Medicinal Chemistry. 18th ed. Vol II. Pune: Nirali Prakashan; 2007.
6. Ashutoshkar. Medicinal Chemistry. 3rd ed. New Delhi: New Age International (P)Limited, Publishers: 2005.
7. K Ilango, P Valentina. Textbook of Medicinal Chemistry. 1st ed. Vol I. Chennai: Keerthi Publishers; 2007.
8. K Ilango, P Valentina. Textbook of Medicinal Chemistry. 1st ed. Vol II. Chennai: Keerthi Publishers; 2007.
9. Harkishan Singh. V K Kapoor. Medicinal and Pharmaceutical Chemistry. 2nd ed. Delhi: Vallabh Prakashan. 2010.
10. William O. Foye. Textbook of Medicinal Chemistry,5th ed: Lea Febiger, Philadelphia.
11. John M Beale, John H Block, editors. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry. 12th ed. India: Wolters Kluwer (India) Pvt Ltd. 2011.
12. Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wileyinterscience Publication, New York, Toranto.
13. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.

14. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.
15. V Alagarswamy. Textbook of Medicinal Chemistry. 2nd ed. Vol I. India: Elsevier; 2014.
16. V Alagarswamy. Textbook of Medicinal Chemistry. 2nd ed. Vol II. India: Elsevier; 2014.
17. Remington. The science and Practice of Pharmacy. 22nd ed. Vol I. Pharmaceutical Press; 2013.
18. Remington. The science and Practice of Pharmacy. 22nd ed. Vol II. Pharmaceutical Press; 2013.

Program	**Pharm D**
Year	**Third year**
Name of the course	**Medicinal chemistry (Lab)**
Course Code	**23PMD310**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The Medicinal chemistry laboratory course is aimed to train the students on experimental techniques for the determination and Synthesis of different biologically active compound libraries and evaluation of their biological activity using cytotoxicity assays. Analysis of structure activity relationships using the data generated. This course also provides the laboratory skills related to reaction design, chemical synthesis and purification process for few medicinal compounds.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on determination of various physical properties of organic molecules related to biological activity.

CO 2: Differentiate various classes of medicinal compounds by experimental design.

CO 3: Perform chemical reaction and purification of medicinal compounds of pharmaceutical interest.

Practical Course: Contents

Week	Topics
01	Assays of important drugs from the course content.
02	Preparation of medicinally important compounds or intermediates required for synthesis of drugs.
03	Monograph analysis of important drugs.
04	Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis.
	Revision

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources (Latest editions)

1. A.I. Vogel, Text Book of Practical Organic Chemistry. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry. Pearson Publishers.
3. Indian Pharmacopoeia

Program	Pharm D
Year	Third year
Name of the course	Pharmaceutical formulations
Course Code	23PMD306
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The pharmaceutical formulations course is aimed to present fundamental in formulation of drug into dosage forms. It emphasizes on physical and chemical properties of drugs and additives and their role in creating high –quality and efficacious dosage forms. The course deals with formulation and evaluation of various pharmaceutical preparations. This course also provides the knowledge of novel drug delivery systems to identifying potential drug delivery routes.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define various types of pharmaceutical dosage forms and Novel drug delivery system.

CO 2: Explain principles involved in formulation and preparation of various pharmaceutical preparations

CO 3: Apply the principles for preparation of dosage forms with highest standards.

CO 4: Evaluate of pharmaceutical dosage forms by various official tests.

Theory Course: Contents

S. No	Topics
I (3 weeks)	Tablets 1: Tablet excipients, Formulation of different types of tablets,Granulation techniques ,Tablet coating,
II (3weeks)	Tablets 2:Type of coating, quality control tests for coated tablet and evaluation of tablets
III (3 weeks)	Tablets 3: quality control tests for coated tablet and evaluation of tablets Capsules 1:Raw material for shell, production of hard gelatin capsules,filling of hard gelatin capsules and finishing
IV (3weeks)	Capsules 2: Production of soft gelatin capsules, Filling of soft gelatin capsules, Quality control tests for hard and soft gelatin capsules.
V (3weeks)	Ophthalmic Preparations 1: Formulation and preparation of eye drops, eye ointment, eye lotion
VI (3 weeks)	Ophthalmic Preparations 2: Formulation and preparation of contact lens solutions,evaluation and packing of ophthalmic preparations. Parenterals 1: Introduction,formulation of large volume parenterals
VII (3 weeks)	Parenterals 2: Formulation of small volume Parenterals, sterilization. Containers used for Parenterals.(including official tests)
VIII (3 weeks)	Semi-Solids 1:Introduction and classification, anatomy of skin and factors affecting absorption, Formulation ,preparation, packaging, labeling and storage of ointments
IX (3 weeks)	Semi-Solids 2: Formulation, preparation, packaging, labeling and storage of jellies, creams, pastes.
X (3 weeks)	Definition and concept of controlled and novel Drug delivery system 1-parentral,transdermal

XI (3 weeks)	Drug delivery system 2: Buccal, rectal, nasal.
XII (3 weeks)	Drug delivery system 3: Implants,ocular. Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Lean Lachman, Herbert A Lieberman, Kenneth E Avis, editors. Pharmaceutical Dosage Forms. 2nd ed. Vol I, II, III. New York: Marcel Dekker. 2005.
2. M.E.Aulton Pharmaceutics. The science of dosage form design. – 2nd ed. Churchill-Livingstone, 2002.
3. B.M.Mithal. A text book of pharmaceutical formulations, 6th ed. New Delhi, Vallabh Prakashan, 2010.
4. N.K.Jain, Advances in control and Novel drug delivery. CBS Publishers.
5. USP/BP/IP
6. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.
7. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

Program	**Pharm D**
Year	**Third year**
Name of the course	**Pharmaceutical formulation (Lab)**
Course Code	**23PMD311**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

The pharmaceutical formulations laboratory course is aimed to train the students to prepare different pharmaceutical dosage forms. This course also deals with evaluation of the prepared formulations by various official tests.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills in preparation of different pharmaceutical formulations by various methods.

CO2: Operate tablet compression machine, capsule filling machine, disintegration and dissolution test apparatus.

CO 3: Evaluate the pharmaceutical formulations by various official and unofficial tests.

Practical Course: Contents

Week	Topics
1	Introduction to laboratory safety techniques and the use of glass wares and chemicals.
2	Preparation of Paracetamol tablets by wet granulation method.

3	Preparation of Diclofenac tablets by direct compression method.
4	Preparation of soluble Acetylsalicylic acid tablets.
5	Preparation of Chewable tablets.
6	Quality control test for paracetamol tablets.
7	Quality control test for paracetamol tablets.
8	Quality control test for paracetamol tablets.
9	Quality control test for diclofenac tablets.
10	Quality control test for diclofenac tablets.
11	Quality control test for diclofenac tablets.
12	Quality control test for soluble acetylsalicylic acid tablets.
13	Quality control test for soluble acetylsalicylic acid tablets.
14	Quality control test for soluble acetylsalicylic acid tablets.
15	Quality control test for chewable tablets.
16	Quality control test for chewable tablets.
17	Quality control test for chewable tablets.
18	Filling of hard gelatin capsules.
19	Evaluation of hard gelatin capsules.
20	Evaluation of hard gelatin capsules.
21	Evaluation of hard gelatin capsules.
22	Parenterals- Ascorbic acid injection.
23	Calcium gluconate injection.
24	Sodium chloride intravenous infusion.
25	Dextrose and sodium chloride infusion.
26	Evaluation of Ascorbic acid injection.

27	Evaluation of Calcium gluconate injection.
28	Evaluation of Sodium chloride intravenous infusion.
29	Evaluation of Dextrose and Sodium chloride infusion.
30	Semi solids- Salicylic acid and benzoic acid ointment.
31	Diclofenac gel preparation.
32	Evaluation of Diclofenac gel.
33	Cold cream.
34	Vanishing cream.
35	Toothpaste.
36	Revision

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. L.Lachman, H.A, Lieberman and J.L. Kanig, Theory and Practice of industrial pharmacy, Lea and Febieger, Philadelphia Latest Edn.
2. USP/BP/IP

3. M.E.Aulton Pharmaceutics. The science of dosage form design.- 2nd ed. Churchill-Livingstone,2002.
4. B.M.Mithal. A text book of pharmaceutical formulations, 6th ed. New Delhi, Vallabh Prakashan, 2010.
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.
6. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.

Program	Pharm D
Year	Fourth Year
Name of the course	Pharmacotherapeutics III
Course Code	23PMD401
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management

Course Learning Outcomes:

At completion of this subject it is expected that students will be able to explain

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualized therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (Including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse Effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

CO 10: Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Theory Course: Contents

S. No	Topics
I (3 weeks)	**Gastrointestinal system:** Peptic ulcer disease, Gastro Esophageal Reflux Disease, Inflammatory bowel disease.
II (3weeks)	**Liver disorders -** Alcoholic liver disease, Viral hepatitis including jaundice
III (3 weeks)	**Hematological system:** Anaemias, Venous thromboembolism,
IV (3weeks)	**Nervous system:** Epilepsy, Parkinsonism.
V (3weeks)	**Nervous system:** Stroke, Alzheimer's disease.
VI (3 weeks)	**Psychiatry disorders :** Schizophrenia, Affective disorders,
VII (3 weeks)	**Psychiatry disorders**: Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders
VIII (3 weeks)	Pain management including Pain pathways.
IX	Neuralgias and headache.

(3 weeks)	
X (3 weeks)	Evidence Based Medicine
XI (3 weeks)	Drug induced liver disorders
XII (3 weeks)	Drug induced blood disorders.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams;2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press:2008

Program	**Pharm D**
Year	**Fourth year**
Name of the course	**Pharmacotherapeutics III (Lab)**
Course Code	**23PMD407**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management

Course Learning Outcomes: At completion of this subject it is expected that students will be able to understand –

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualized therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (Including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse Effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

CO 10: Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Practical Course: Contents

Week	**Topics**
1	Introduction to ward round participation and case collection.
2	Peptic Ulcer
3	Gastro- esophageal reflex disorder
4	Inflammatory bowel disorder
5	Hepatitis
6	Alcoholic Liver disorder
7	Drug induced liver disorder
8	Anemia
9	Venous thromboembolism
10	Drug induced hematological disorder
11	Epilepsy
12	Parkinsonism
13	Stroke
14	Alzheimer's disease
15	Schizophrenia
16	Affective disorder
17	Anxiety disorders

18	Sleep disorders
19	Obsessive Compulsive disorders
20	Pain management
21	Neuralgia
22	Head ache
23	Case studies on Multiple disorders
24	Case studies on Multiple disorders
25	Case studies on Multiple disorders
26	Case studies on Multiple disorders
27	Drug club I
28	Drug club II
29	Drug club III
30	Journal club I
31	Journal Club II
32	Journal club III
33	Evidence based medicine (Critical appraisal of RCT)
34	Evidence based medicine (Critical appraisal of Cohort study)
35	Evidence based medicine (Critical appraisal of Case control study)
36	REVISION/Assessment

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources (Latest editions)

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams; 2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Rhonds Jones. Patient Assessment in Pharmacy Practice. Wolters Kluwer. 3rd Edition.
7. Sherif Hanafy M. Patient Assessment in Clinical Pharmacy: A Comprehensive guide. Springer.
8. Lynn S. Bickley. BATE's Guide to Physical Examination and History taking. Wolters Kluwer. 12th Edition.

9. Karen J. Tietze. Clinical Skills for Pharmacists: A patient focused approach. 3rd Edition. Elsevier.
10. Soraya D, Rebekha R. Pharmacy Case Studies. Pharmaceutical Press.
11. Pharmacotherapy casebook: A patient focused approach. 10th Edition. McGrawHill Education.
12. Michael DK, Kathryn RM, Marie ACB, Pharmacotherapy Principles & Practice Study Guide: A Case-Based Care Plan Approach.

Program	Pharm D
Year	Fourth Year
Name of the course	Hospital Pharmacy
Course Code	23PMD402
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The Hospital Pharmacy course is aimed to present fundamentals in understanding hospital pharmacy set up, organization and functioning at hospital settings dedicated in providing primary, secondary and tertiary care for the patients, emphasizing on basic requirements, working and helping hands, committees, interdependencies of all the departments, inventory management, drugs distribution, unit dose and bulk dose preparation and storage, management of radiopharmaceuticals, and as a practicing pharmacist how one can play active role in continuing pharmacy and medical education.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Abide by the policies and procedures, as well as rules and regulations affecting general pharmacy operations including inventory management.

CO 2: Describe the role of the pharmacist on hospital committees that have pharmacist representation and its impact or application to patient care.

CO 3: Demonstrate good aseptic technique to compound sterile dosage forms and IV medications.

CO 4: Professionally communicate and document recommendations and interventions to various healthcare professionals.

Theory Course: Contents

S. No.	Topics
I (3 weeks)	• **Hospital - its Organisation and functions** • **Hospital pharmacy-Organisation and management** a) Organizational Structure-Staff, Infrastructure & work load statistics b) Management of materials and finance c) Roles & responsibilities of hospital pharmacist
II (3 weeks)	• **The Budget – Preparation and implementation** • **Hospital drug policy** a) Pharmacy and Therapeutic committee (PTC) b) Hospital formulary c) Hospital committees - Infection committee
III (3 weeks)	• **Hospital drug policy** - Research and ethical committee d) Developing therapeutic guidelines e) Hospital pharmacy communication – Newsletter
IV (3 weeks)	• **Hospital pharmacy services** a) Procurement & warehousing of drugs and Pharmaceuticals b) Inventory control Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock

V (3 weeks)	• **Hospital pharmacy services** c) Drug distribution in the hospital i) Individual prescription method ii) Floor stock method iii) Unit dose drug distribution method
VI (3 weeks)	• Investigational use of drugs- Description, principles involved, classification, control, identification, role of hospital pharmacist
VII (3 weeks)	• **Hospital pharmacy services** d) Distribution of Narcotic and other controlled substances e) Central sterile supply services – Role of pharmacist
VIII (3 weeks)	• **Manufacture of Pharmaceutical preparations** a) Sterile formulations – large and small volume parenterals b) Manufacture of Ointments, Liquids, and creams c) Total parenteral nutrition
IX (3 weeks)	Drug store management organization of drug store, type of material stocked and stocked condition, purchase procedure
X (3 weeks)	• **Continuing professional development programs** Education and training
XI (3 weeks)	• **Radio Pharmaceuticals – Handling and packaging** • **Professional Relations and practices of hospital pharmacist**
XII (3 weeks)	Revision / Assessment

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Merchant & Qadrys.A textbook of hospital pharmacy.ed:10th .B.S.Shah Prakashan.
2. William Hassan.E, Hospital Pharmacy.ed:5th Phialdelphia:Lea and Febiger;1986.
3. Parthasarathi .G.Karin Nyfort-Hansen,Milap C Nahata.A textbook of clinical pharmacy practice: essential concept and skills:ed.2nd :university press:2012.
4. Prathibha Nand,Roop khar.K . A text book of Hospital and Clinical pharmacy.ed:6th ,birla:2008.

Program	Pharm D
Year	Fourth Year
Name of the course	Hospital Pharmacy (Lab)
Course Code	23PMD408
Paper	Practical
Hours /week	3 hours (laboratory)
Pre / co-requisite/s	Nil

Course Description:

The Hospital pharmacy laboratory course is aimed to train the students on investigational techniques for the determination of inventory of drugs and pharmaceuticals. This course also deals with unit dose conversions and bulk infusion preparation and storage. This course also provides the skills related to identification, detection, assessment and reporting of adverse reactions clinically during the ward rounds participation.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on determination of inventory related to drugs and pharmaceuticals.

CO2: Differentiate various classes of drugs along with their procurement and storage conditions.

CO 3: Perform lab activities related to the unit dose and bulk dose preparations.

CO 4: Demonstrate skills related to the identification, assessing and reporting of adverse drug reactions.

Practical Course: Contents

Week	Topics
1	Introduction to laboratory safety techniques and the use of glass wares and chemicals.
2	Preparation of sterile water for injection. (500 ml)
3	Preparation of 5% dextrose solution for injection. (500 ml)
4	Preparation of 0.9% Normal saline solution for injection. (500 ml)
5	Preparation of N Dextrose-Normal saline solution for injection. (500 ml)
6	Preparation of Compound Normal saline solution for injection. (500 ml)
7	Preparation of Compound Normal saline solution for injection and ampoule sealing technique. (5 ml)
8	Preparation of salicylic acid dusting powder. (10 gms)
9	Preparation of ORS. (10 gms)
10	Introduction to Adverse Drug Reactions and Drug – Drug Interactions.
11	Identification and causality assessment of Clinically identified Adverse Drug Reaction.
12	Identification and causality assessment of Clinically identified Adverse Drug Reaction.
13	Identification and reporting of Drug – Drug reaction.
14	Identification and reporting of Drug – Drug reaction.
15	Inventory management through ABC, VED, EOQ, Lead time and Buffer stock
16	Responding drug information query in hospital
17	**Revision**

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Merchant & Qadrys.A textbook of hospital pharmacy.ed:10th .B.S.Shah Prakashan.
2. William Hassan.E, Hospital Pharmacy.ed:5th Phialdelphia:Lea and Febiger;1986.
3. Parthasarathi .G.Karin Nyfort-Hansen,Milap C Nahata.A textbook of clinical pharmacy practice: essential concept and skills:ed.2nd :university press:2012
4. Prathibha Nand,Roop khar.K . A text book of Hospital and Clinical pharmacy.ed:6th ,birla:2008

Program	Pharm D
Year	Fourth Year
Name of the course	Clinical Pharmacy
Course Code	23PMD403
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

Clinical Pharmacy Practice demonstrate a professional attitude (a desire for life-long learning and ethical conduct) in all activities related to clinical pharmacy practice; confidently assume a progressive role on an interdisciplinary health care team; use appropriate interpersonal skills, work harmoniously with others and display compassion for patients.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Monitor drug therapy of patient through medication chart review and clinical review and counsel the patients.

CO 2: Detection, assessment, monitoring, reporting and documentation of ADR's.

CO 3: Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states and designing appropriate drug therapy regimen.

CO 4: Identify and resolve drug related problems.

CO 5: Apply their knowledge and practice clinical decision-making.

CO 6: Use a systematic approach in retrieve, analyze, interpret, formulate and provide of drug or medicine information.

Theory Course: Contents

S. No	Topics
I (3 weeks)	Definitions, development and scope of clinical pharmacy Introduction to daily activities of a clinical pharmacist
II (3weeks)	Introduction to daily activities of a clinical pharmacist: Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions) b. Ward round participation c. Adverse drug reaction management
III (3 weeks)	Introduction to daily activities of a clinical pharmacist: Drug information and poisons information e. Medication history f. Patient counselling.
IV (3weeks)	Introduction to daily activities of a clinical pharmacist: Drug utilisation evaluation (DUE) and review (DUR) h. Quality assurance of clinical pharmacy services
V (3weeks)	**Patient data analysis** The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.
VI (3 weeks)	**Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results:** a. Haematological, Liver function, Renal function, thyroid function tests b. Tests associated with cardiac disorders.
VII (3 weeks)	**Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results:** Fluid and electrolyte balance d. Microbiological culture sensitivity tests e. Pulmonary Function Tests
VIII	**Drug & Poison information:** a. Introduction to drug information resources

(3 weeks)	available b. Systematic approach in answering DI queries c. Critical evaluation of drug information and literature & Preparation of written and verbal reports e. Establishing a Drug Information Centre f. Poisons information- organization & information resources
IX (3 weeks)	**Pharmacovigilance** a. Scope, definition and aims of pharmacovigilance b. Adverse drug reactions - Classification, mechanism, predisposing factors, causality assessment [different scales used] c. Reporting, evaluation, monitoring, preventing & management of ADRs d. Role of pharmacist in management of ADR.
X (3 weeks)	Communication skills, including patient counselling techniques, medication history interview, presentation of cases. Pharmaceutical care concepts
XI (3 weeks)	Critical evaluation of biomedical literature Medication error
XII (3 weeks)	Revision/Assessment

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources (Latest editions)

Text Books (Theory)

1. A textbook of Clinical Pharmacy Practice; Essential concepts and skills. Dr. G. Parthasarathi et al. Second Edition. Orient Orient Langram Pvt. Ltd 2012. ISBN-13: 978-8173717567.
2. Pathology and Therapeutics for Pharmacists: A basis for clinical pharmacy practice. Greene, Russell J; Harris, Norman D. Third Edition. Pharmaceutical Press 2008. ISBN 978-0-85369-690-2.
3. Applied Biopharmaceutics and Pharmacokinetics. Leon Shargel and Andrew Yu. Seventh Edition. McGraw Hill Medical 2023. ISBN-13: 978-9814670241.
4. Basic Skills in Interpreting Laboratory Data. Mary Lee. American Society of Health-System Pharmacists; Fifth Edition (1 May 2013). ISBN-13: 978-1585283439.
5. Clinical pharmacy and therapeutics. Eric T Herfindal; D R Gourley; Linda Lloyd Hart. Fifth Edition. Baltimore: Williams and Wilkins 1992. ISBN-13: 978-0683039665.

References

1. Whittlesea C, Hodson K. Clinical pharmacy and therapeutics. Sixth edition. Elsevier Ltd. 2019. ISBN: 978-0-7020-7011-2.
2. Applied Therapeutics: The Clinical Use of Drugs. Caroline S. Zeind, Michael G. Carvalho. Eleventh Edition. Lippincott Williams and Wilkins. ISBN-13: 978-1496318299.
3. Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications. Malcolm Rowland and Thomas N. Tozer. Lippincott Williams and Wilkins; Fourth Edition (5 February 2010). ISBN-13: 978-0781750097.
4. Pharmaceutical Statistics Practical And Clinical Applications. Bolton Sanford. CRC Press Third Edition (28 February 1997). ISBN-13: 978-0824798123.

Program	**Pharm D**
Year	**Fourth Year**
Name of the course	**Clinical Pharmacy (Lab)**
Course Code	**23PMD409**
Paper	**Practical**
Hours /week	**3 hours (laboratory)**
Pre / co-requisite/s	**Nil**

Course Description:

Clinical Pharmacy Practice demonstrate a professional attitude (a desire for life-long learning and ethical conduct) in all activities related to clinical pharmacy practice; confidently assume a progressive role on an interdisciplinary health care team; use appropriate interpersonal skills, work harmoniously with others and display compassion for patients.

C**ourse Learning Outcomes:**

Upon successful completion of this course, the student should be able to:

CO 1: Monitor drug therapy of patient through medication chart review and clinical review and counsel the patients.

CO 2: Detection, assessment, monitoring, reporting and documentation of ADR's.

CO 3: Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states and designing appropriate drug therapy regimen.

CO 4: Identify and resolve drug related problems.

Practical Course: Contents

Week	Topics
1 to 10	Answering Drug Information Query
11 & 12	PMHI (Patient Medication History Interview)
13 to 18	
19 to 28	Case Presentations
29 to 36	Patient Counseling

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.
2. Scott LT. Basic skills in interpreting laboratory data. American Society of Health System Pharmacists Inc.
3. David H Lawson, R Michael E. Richards. Clinical Pharmacy and Hospital Drug Management – 1982. Champan and Hall.
4. Dr. H.P.Tipnis, Dr. Amrita Bajaj. Clinical Pharmacy – 1st ed. Career Publications.
5. Leon Shargel, Susanna Wu Pong, Andrew B C Yu. Applied Biopharmaceutics and Pharmacokinetics. 5th ed. McGrawHill Companies; 2005.

6. G. Parthasarathi, Karin Nyfor-Hansen, Milap C Nahata. A textbook of Clinical Pharmacy Practice: Essential concepts and skills.2nd ed. India: Universities Press (India) Private Limited; 2012.
7. Mary Lee. Basic skills in interpreting laboratory data – 5th ed. American Society of Health System Pharmacist®.
8. Rowland M, Tozer TN. Clinical Pharmacokinetics: Concepts and Applications: Lippincott Williams & Wilkins; 1995.
9. Susan Foran. Australian drug information - Procedure manual – 1996. Society of Hospital Pharmacists of Australia.
10. Pharmaceutical statistics. Practical and clinical applications. Sanford Bolton, Marcel Dekker, Inc.

Program	Pharm D
Year	Fourth year
Name of the course	Bio-Statistics and Research Methodology
Course Code	23PMD404
Paper	Theory
Hours /week	2+1 hrs (lectures)
Pre / co-requisite/s	Nil

Course Description:

The Bio Statistics and Research methodology course that provides an integrated presentation of Statistical methods and Research Methodologies. Information about each method is presented to explain the processes involved in Research Methodology and Bio statistical methods so that students will develop an understanding of the usage of the methods in Hospital Pharmacy. Students are able to interpret testing of hypothesis and Statistical methods and Computer applications in epidemiology and Pharmacy.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Define Research Methodology, Biostatistics, data graphics, Basics of Testing of hypothesis

CO 2: Recognize types of clinical studies, types of data distribution, and Data graphics Statistical and computer applications in Pharmacy.

CO 3: Formulate Students test, chi-square test, Analysis of variance (One-way and two-ways)

Theory Course: Contents

S. No	Topics
I (3 weeks)	**Research Methodology-I** Types of clinical study designs: Case studies, Observational studies, interventional studies.
II (3weeks)	**Research Methodology-II** Designing the methodology, Sample size determination and power of a study Determination of sample size for simple comparative experiments.
III (3 weeks)	**Research Methodology-III** determination of sample size to obtain a confidence interval of specified width, power of a study, report writing and presentation of data
IV (3weeks)	**Biostatistics-I** Introduction, Types of data distribution, Measures describing the central tendency distributions-average, median, mode.
V (3weeks)	**Biostatistics-II** Measurement of the spread of data-range, variation of mean, standard deviation variance, coefficient of variation, standard error of mean.
VI (3 weeks)	**Biostatistics-III** **Data graphics** Construction and labelling of graphs, histogram, pie charts, scatter plots, semilogarthimic plots **Basics of testing hypothesis** Null hypothesis, level of significance, power of test.
VII (3 weeks)	**Biostatistics-IV** P value, statistical estimation of confidence intervals Level of significance (Parametric data)-students t test (paired and unpaired),chi Square test, Analysis of Variance(One way and two way)
VIII (3 weeks)	**Biostatistics-V** Level of significance (Non-Parametric data)-Sign test, Wilcoxon's signed test (Wilcoxon) rank sum test, Mann Whitney U test, Kruskal-Wall is test(One way ANOVA)
IX (3 weeks)	**Biostatistics-VI** Linear regression and correlation-Introduction, Pearson's and Spearman's

	correlation and correlation co efficient. Introduction to statistical soft ware: SPSS, Epi Info, SAS.
X (3 weeks)	**Biostatistics-VI** **Statistical methods in epidemiology** Incidence and prevalence, relative risk, attributable risk **Computer applications in Pharmacy-I** Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy – Patient record
XI (3 weeks)	**Computer applications in Pharmacy-II** database management, Medication order entry – Drug labels and list – Intravenous solution and admixture, Patient medication profiles, Inventory control, Management report & Statistics. Computer In Community Pharmacy
XII (3 weeks)	**Computer applications in Pharmacy-III** Use of Computers for Pharmaceutical Care in community pharmacy Accounting and General ledger system Drug Information Retrieval & Storage : Introduction – Advantages of Computerized Literature Retrieval Use of Computerized Retrieval

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Pharmaceutical statistics- practical and clinical applications, Sanford Bolton 3rd ed. publisher Marcel Dekker Inc. New York.
2. Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich, 3rd ed. McGraw Hill Publications.

Program	Pharm D
Year	Fourth Year
Name of the course	Biopharmaceutics & Pharmacokinetics
Course Code	23PMD405
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course includes a study of the physicochemical, physiological, pathological and pharmaceutical factors affecting the absorption, distribution and elimination of drugs from the body. The course will also include detailed discussion of interpretation of plasma drug concentrations, protein binding and its effect on the disposition of drugs, non compartmental pharmacokinetics, nonlinear pharmacokinetics bioavailability, bioequivalence and principles of therapeutic drug monitoring. The course will also include elementary compartmental modeling, mechanisms of renal clearance, and assessment of drug bioavailability.

Course Learning Outcomes: Upon successful completion of this course, the student should be able to:

CO 1: Underline the basic concepts of pharmacokinetics and biopharmaceutics.

CO 2: Explain the physiological, physicochemical and dosage form-related factors that affects drug absorption from different dosage forms.

CO 3: Describe the different pharmacokinetic models.

CO 4: Differentiate between compartmental and non-compartmental analysis.

CO 5: Estimate the basic pharmacokinetic parameters that describe drug absorption and disposition.

Theory Course: Contents

S. No.	Topics
I (3 weeks)	**Introduction to Biopharmaceutics** a. Absorption of drugs from gastrointestinal tract.
II (3weeks)	b. Drug Distribution.
III (3weeks)	c. Drug Elimination
IV (3 weeks)	**Introduction to Pharmacokinetics** a. Mathematical model b. Drug levels in blood. c. Pharmacokinetic model
V (3weeks)	d. Compartment models e. Pharmacokinetic study.
VI (3weeks)	**One compartment open model** a. Intravenous Injection (Bolus) b. Intravenous infusion.
VII (3weeks)	c. Extravascular administration
VIII (3weeks)	**Multicompartment models** a. Two compartment open model. b. IV bolus and oral administration
IX (3 weeks)	**Nonlinear Pharmacokinetics** a. Introduction

	b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters.
X (3weeks)	**Multiple – Dosage Regimens** a. Repetitive Intravenous injections – One Compartment Open Model b. Repetitive Extravascular dosing – One Compartment Open model
XI (3 weeks)	**Noncompartmental Pharmacokinetics** a. Statistical Moment Theory. b. MRT for various compartment models. c. Physiological Pharmacokinetic model.
XII (3 weeks)	**Bioavailability and Bioequivalence** a. Introduction. b. Bioavailability study protocol. c. Methods of Assessment of Bioavailability

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA

4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: ByMilo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, ByMilo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Rowland M, Tozer TN. Clinical Pharmacokinetics: Concepts and Applications: Lippincott Williams & Wilkins; 1995.
9. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
10. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
11. Remington's Pharmaceutical Sciences, ByMack Publishing Company, Pennsylvnia

Program	Pharm D
Year	Fourth year
Name of the course	Biopharmaceutics & Pharmacokinetics (Lab)
Course Code	23PMD410
Paper	Practical
Hours /week	3 hours (laboratory)
Pre / co-requisite/s	Nil

Course Description:

The Biopharmaceutics and Pharmacokinetics laboratory course is designed to provide the students on laboratory skill for the demonstration of instrumentation based on principles of dissolution and solubility such as dissolution test apparatus, orbital shaker incubator etc. This course also deals with wet laboratory based experiments on dissolution enhancement, comparative dissolution, protein binding and *in vitro* absorption studies etc. This course also provides the skills for interpretation of plasma and urine drug concentration data after various routes of administration to determine necessary pharmacokinetic parameters.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: Demonstrate the skills on instrumentation related to dissolution and solubility.

CO 2: Compare the dissolution profiles of different marketed dosage forms and prepared formulations.

CO 3: Estimate various pharmacokinetic parameters of drugs following various compartment models after different routes of administration.

Practical Course: Contents

Week	Topics
1	Determination of solubility of the given drug by gravimetric and spectrophotometric method.
2	Determination of pK_a of the given drug by half neutralization method.
3	Improvement of dissolution characteristics of slightly soluble drugs by solid dispersion technique.
4	Improvement of dissolution characteristics of slightly soluble drugs by solid dispersion technique.
5	Improvement of dissolution characteristics of slightly soluble drugs by solvent deposition technique.
6	Improvement of dissolution characteristics of slightly soluble drugs by solvent deposition technique.
7	Improvement of solubility dissolution characteristics of slightly soluble drugs by micellar solubilization technique.
8	Improvement of solubility dissolution characteristics of slightly soluble drugs by micellar solubilization technique.
9	Comparison of dissolution studies of two different marketed products of same drug.
10	Comparison of dissolution studies of two different marketed products of same drug.
11	Influence of polymorphism on solubility and dissolution of poorly soluble drug.
12	Influence of polymorphism on solubility and dissolution of poorly soluble drug.

13	Influence of complexation on solubility and dissolution of poorly soluble drug.
14	Influence of complexation on solubility and dissolution of poorly soluble drug.
15	Protein binding studies of a highly protein bound drug.
16	Protein binding studies of a highly protein bound drug.
17	Protein binding studies of a poorly protein bound drug.
18	Protein binding studies of a poorly protein bound drug.
19	Extent of plasma-protein binding studies on the same drug (i.e. highly and poorly protein bound drug) at different concentrations in respect of constant time.
20	Extent of plasma-protein binding studies on the same drug (i.e. highly and poorly protein bound drug) at different concentrations in respect of constant time.
21	Effect of contact time on the plasma protein binding of drugs.
22	Effect of contact time on the plasma protein binding of drugs.
23	Absorption studies in animal inverted intestine using various drugs.
24	Absorption studies in animal inverted intestine using various drugs.
25	Calculation of Ka, K_E, $t_{1/2}$, C_{max}, AUC, AUMC, MRT etc. from blood profile data.
26	Calculation of Ka, K_E, $t_{1/2}$, C_{max}, AUC, AUMC, MRT etc. from blood profile data.
27	Calculation of bioavailability from urinary excretion data for given drug.
28	Calculation of bioavailability from urinary excretion data for given drug.

29	Calculation of AUC and bioequivalence from the given data for the given drug.
30	Calculation of AUC and bioequivalence from the given data for the given drug.
31	Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
32	Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
33	Determination of absorption rate constant by Wagnor-Nelson method.
34	Determination of various pharmacokinetic parameters of a drug that is following two compartment model after IV bolus administration.
35	REVISION/Assessment

Assessment methods and weightage (Practical)

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Shargel L, Wu-Pong S, Yu AB. Applied biopharmaceutics & pharmacokinetics: McGraw-Hill; 2007.
2. Gibaldi M, Perrier D. Pharmacokinetics. Second ed: Marcel Dekker; 1975.

3. Wagner JG. Fundamentals of Clinical Pharmacokinetics: Drug Intelligence Publications; 1975.
4. Abdou HM. Dissolution, bioavailability & bioequivalence: Mack; 1989.
5. Gibaldi M, Gibaldi M. Biopharmaceutics and Clinical Pharmacokinetics: Laurier Books Limited; 2005.
6. Notari RE. Biopharmaceutics and pharmacokinetics: an introduction: M. Dekker; 1975.
7. Rowland M, Tozer TN. Clinical Pharmacokinetics: Concepts and Applications: Lippincott Williams & Wilkins; 1995.
8. https://www.boomer.org/c/p1/

Program	Pharm D
Year	Fourth year
Name of the course	Clinical Toxicology
Course Code	23PMD406
Paper	Theory
Hours /week	2+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course will establish the scientific principles underlying the toxic actions of various substances and will introduce the various challenges within the field of toxicology. The chemical nature of injurious substances, their uptake and metabolism by non-target organisms, and their mode of toxic action will be studied in addition to the methods used in safety evaluations and risk assessment.

Course Learning Outcomes:

Upon completion of this course, the student will:

CO 1: Discuss the epidemiologic and demographic parameters that characterize toxic exposures in the United States.

CO 2: Discuss the role of the pharmaco-therapist in the evaluation and management of poisoned patients

CO 3: Utilize historical information and clinical patient assessments in the evaluation of the poisoned patient.

CO 4: Formulate a treatment plan based on history, time course of the exposure, presenting symptomatology, toxidrome recognition, and assessment of toxic potential.

CO 5: Discuss current philosophies, and cite the risks associated with, the use of various methods of gastrointestinal decontamination for ingested toxins. Choose the appropriate modality for specific poisoned/overdosed patients.

CO 6: Initiate appropriate diagnostic laboratory analyses and recommend the appropriate laboratory and physical assessments to aid in monitoring the progress of the toxic or suspected toxic exposure, correctly interpreting the results of such interventions.

CO 7: Discuss the indications for use and the risks associated with the various methods utilized to enhance elimination in the poisoned patient. Select the appropriate therapy based on the exposure and symptoms.

CO 8: Develop a therapeutic management and monitoring plan when the use of a pharmacologic antidote is indicated for the poisoned/overdosed patient.

CO 9: Define economic and therapeutic outcomes in poisoned patients

Theory Course: Contents

S. No.	Topics
I (3 weeks)	General principles involved in the management of poisoning Antidotes and the clinical applications
II (3 weeks)	Supportive care in clinical Toxicology Gut Decontamination
III (3 weeks)	Elimination Enhancement Toxicokinetics
IV (3 weeks)	Clinical symptoms and management of acute poisoning with the following agents - a) Pesticide poisoning: organophosphorus compounds, carbamates, organochlorines, pyrethroids

	b) Opiates overdose
V (3 week)	Clinical symptoms and management of acute poisoning with the following agents - c) Antidepressants d) Barbiturates and benzodiazepines e) Alcohol: ethanol, methanol
VI	Clinical symptoms and management of acute poisoning with the following agents - f) Paracetamol and salicylates g) Non-steroidal anti-inflammatory drugs h) Hydrocarbons: Petroleum products and PEG
VII (3 weeks)	Clinical symptoms and management of acute poisoning with the following agents - i) Caustics: inorganic acids and alkali j) Radiation poisoning
VIII (3 weeks)	Clinical symptoms and management of chronic poisoning with the following agents -Heavy metals: Arsenic, lead, mercury, iron, copper
IX (3weeks)	Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries
X (3 weeks)	Plants poisoning. Mushrooms, Mycotoxins Food poisonings Envenomation - Arthropod bites and stings

XI (3 weeks)	Substance abuse: Signs and symptoms of substance abuse and treatment of dependence a) CNS stimulants: amphetamine b) Opioids
XII (3 weeks)	a) Substance abuse: Signs and symptoms of substance abuse and treatment of dependence b) CNS depressants c) Hallucinogens: LSD d) Cannabis group e) Tobacco

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Matthew J Ellenhorn. Ellenhorns Medical Toxicology – Diagnosis and Treatment of Poisoning. 2nd ed. Williams and Willkins publication, London.
2. V VPillay. Handbook of Forensic Medicine and Toxicology. 13th ed. 2003 Paras Publication, Hyderabad.
3. Narayana reddy. Medical toxicology.13th edition.
4. A Text book of Modern Toxicology by Ernest Hodgson

5. Casarett and Doull’s, Toxicology the Basic Science of Poisons.
6. Clinical Forensic Medicine: A Physician's Guide, Second Edition edited by Margaret M. Stark, 2005
7. Clinical Toxicology-Principles and Mechanisms BY FRANK A. BARILE
8. Encyclopedia of Toxicology, Four-Volume Set, 1-4 Philip Wexler, Bethesda, MD Bruce Anderson, Ann de Peyster

Program	Pharm D (P.B)
Year	First year
Name of the course	Pharmacotherapeutics I & II
Course Code	23PMD411
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management

Course Learning Outcomes:

At completion of this subject it is expected that students will be able to describe

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualized therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (Including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse Effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

CO 10: Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Theory Course: Contents

S. No.	Topics
I (3 weeks)	**Cardiovascular system:** Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction
II (3weeks)	Hyperlipidaemias, Electrophysiology of heart and Arrhythmia
III (3 weeks)	**Respiratory system:** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases
IV (3weeks)	**Endocrine system:** Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis
V (3weeks)	**General prescribing guidelines for** a. Pediatric patients b. Geriatric patients. Pregnancy and breast feeding **Ophthalmology:**

	Glaucoma,
VI (3 weeks)	Conjunctivitis **Introduction to rational drug use** Definition, viral & bacterial (Eye Infections)
VII (3 weeks)	Role of pharmacist Essential drug concept Rational drug formulations **Dermatology:** Psoriasis, Scabies, Eczema, Impetigo
VIII (3 weeks)	**Infectious disease:** Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningitis, Respiratory tract infections, Gastroenteritis, Endocarditic, Septicemia,
IX (3 weeks)	Urinary tract infections, Protozoal infection- Malaria, HIV & Opportunistic infections, Fungal infections, Viral infections, Gonorrhoea and Syphilis
X (3 weeks)	**Musculoskeletal disorders** Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic lupus erythematosus.
XI (3 weeks)	**Renal system** Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders
XII (3 weeks)	**Oncology:** Basic principles of Cancer therapy, General introduction to cancer Chemotherapeutic agents, Chemotherapy of breast cancer, leukemia. Management of chemotherapy nausea and emesis & REVISION.

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams;2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green, Russells, Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press:2008.

Program	Pharm D (P.B)
Year	First year
Name of the course	Pharmacotherapeutics I & II (Lab)
Course Code	23PMD412
Paper	Practical
Hours /week	3 hours (laboratory)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to describe the pathophysiology of common diseases and their management.

Course Learning Outcomes:

At completion of this subject it is expected that students will be able to understand –

CO 1: The pathophysiology of selected disease states and the rationale for drug therapy;

CO 2: The therapeutic approach to management of these diseases;

CO 3: The controversies in drug therapy;

CO 4: The importance of preparation of individualized therapeutic plans based on diagnosis;

CO 5: Needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (Including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse Effects);

CO 6: Describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

CO 7: Summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;

CO 8: Discuss the controversies in drug therapy;

CO 9: Discuss the preparation of individualized therapeutic plans based on diagnosis; and

CO 10: Identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Practical Course: Contents

Week	**Topics**
1	Introduction to ward round participation and case collection
2	Hypertension
3	CCF (congestive cardiac failure)
4	Activity I
5	Hypothyroidism
6	Acute renal failure
7	Activity II (Drug utilization review).
8	Asthma
9	Depression diseases
10	Activity III
11	Epilepsy
12	Parkinson's disease
13	Activity IV
14	Infectious diseases [any five].
15	Chronic renal failure

16	Gastroenteritis,
17	Activity V
18	Malaria
19	Fungal infections
20	Activity VI
21	Anxiety
22	Psoriasis
23	Activity VII
24	Spondylitis
25	Hyperthyroidism
26	Activity VIII
27	Septicemia.
28	Osteoarthritis
29	Glaucoma
30	Activity IX
31	Tuberculosis.
32	Activity X
33	Stroke
34	HIV
35	Angina Pectoris
36	Revision/Assessment

Assessment methods and weightage (Practical)

Assessment type	Assessment tool	Distribution
Continuous Assessment	Midterm examination	20%
	Lab work and record	5%
	Regular viva voce	5%
End Assessment	End Practical examination	70 %
TOTAL		**100%**

Note: Three Midterm practical examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Eric Herfindal T. Textbook of therapeutics: drug and disease. 8th ed. lippincot Williams; 2008.
2. Joseph Dipiro. Pharmacotherapy a pathophysiology approach.9th ed. Mcgraw-hill education; 2012.
3. Koda-kimble. Applied therapeutics: The clinical use of drugs. 10th ed. lippincot Williams;2012.
4. Roger walker, Clinical pharmacy and therapeutics. 5th ed. Churchill livingstone;2011
5. Green,Russells,Harris. Pathology and therapeutics for pharmacist: A basis for clinical pharmacy practice. 3rd ed. Pharmaceutical press: 2008.
6. Rhonds Jones. Patient Assessment in Pharmacy Practice. Wolters Kluwer. 3rd Edition.
7. Sherif Hanafy M. Patient Assessment in Clinical Pharmacy: A Comprehensive guide. Springer.
8. Lynn S. Bickley. BATE's Guide to Physical Examination and History taking. Wolters Kluwer. 12th Edition.

9. Karen J. Tietze. Clinical Skills for Pharmacists: A patient focused approach. 3rd Edition. Elsevier.
10. Soraya D, Rebekha R. Pharmacy Case Studies. Pharmaceutical Press.
11. Pharmacotherapy casebook: A patient focused approach. 10th Edition. McGrawHill Education.
12. Michael DK, Kathryn RM, Marie ACB, Pharmacotherapy Principles & Practice Study Guide: A Case-Based Care Plan Approach.

Program	Pharm D
Year	Fifth Year
Name of the course	Clinical Research
Course Code	23PMD501
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

The Clinical research course is aimed to present fundamental of animal and human research through clinical trials, emphasizing on basic pharmacological and toxicological research, drug characterization, all the phases of clinical trials including informed consent process, post marketing surveillance under the lights of ICH GCP Guidelines for the better outcomes.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO 1: These courses provide students with a theoretical and practical understanding of the issues involved in the design, conduct, analysis and interpretation of preclinical and clinical trials in living beings.

CO 2: Skills to examine information, for critical analyses and carry out research, and to communicate effectively.

CO 3: Develop the capacity to understand and analyze the application of ICH – GCP guidelines clinically.

Theory Course: Contents

S. No.	Topics
I (3 weeks)	• **Drug development process:** Introduction Various Approaches to drug discovery 1. Pharmacological 2. Toxicological
II (3 weeks)	• **Drug development process:** Introduction Various Approaches to drug discovery 1. Drug characterization 2. Dosage form 3. IND Application
III (3 weeks)	• **Clinical development of drug:** 1. Introduction to Clinical trials 2. Various phases of clinical trial.
IV (3 weeks)	• **Clinical development of drug:** 1. Methods of post marketing surveillance 2. Abbreviated New Drug Application submission.
V (3 weeks)	• **Clinical development of drug:** 1. Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines
VI (3 weeks	2. Challenges in the implementation of guidelines 3. Ethical guidelines in Clinical Research

VII (3 weeks)	• **Clinical development of drug:** 1. Composition, responsibilities, procedures of IRB / IEC 2. Overview of regulatory environment in USA, Europe and India.
VIII (3 weeks)	• **Clinical development of drug:** Role and responsibilities of clinical trial personnel as per ICH GCP a. Sponsor b. Investigators c. Clinical research associate d. Auditors e. Contract research coordinators f. Regulatory authority
IX (3 weeks)	• **Clinical development of drug:** 1. Essential document required in Clinical trials, Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment) 2. Informed consent Process
X (3 weeks)	• **Clinical development of drug:** 1. Data management and its components
XI (3 weeks)	• **Clinical development of drug:** 1. Safety monitoring in clinical trials.
XII (3 weeks)	Revision / Assessment

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
2. International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
4. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
5. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
6. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
7. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.
8. David Machin, Simon Day, Sylvan Green, Brian S. Everitt, Stephen George. Textbook of Clinical Trials. Wiley. 2nd Edition

Program	Pharm D
Year	Fifth Year
Name of the course	Pharmacoepidemiology and Pharmacoeconomics
Course Code	23PMD502
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to improve knowledge regarding usage of pharmaco epidemiological methods to identify, assess, evaluate and manage drug induced risks. This course will enable the student about usage of Pharmacoeconomic principles in therapeutic decision making process.

Course Learning Outcomes: At completion of this subject it is expected that students will be able to understand

CO 1: Epidemic measures and outcome measures in drug use

CO 2: Application of Pharmacoepidemiology

CO 3: Designing of Pharmacoepidemiological methods

CO 4: Special application of Pharmacoepidemiological methods

CO 5: Sources of data to conduct Pharmacoepidemiological studies

CO 6: Usage Pharmacoeconomic tools in various conditions

CO 7: Application of Pharmacoeconomic principles in decision making

CO 8: Software's used in pharmacoeconomics and Pharmacoepidemiology

Theory Course: Contents

S. No.	Topics
I (3 weeks)	**Pharmacoepidemiology:** **Definition and scope:** Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.
II (3weeks)	**Measurement of outcomes in Pharmacoepidemiology** Outcome measure and drug use measures
III (3 weeks)	Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement
IV (3weeks)	**Concept of risk in pharmacoepidemiology** Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio
V (3weeks)	**Pharmacoepidemiological methods** Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods Drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control studies, case –cohort studies.
VI (3 weeks)	**Pharmacoepidemiological methods** Meta – analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.
VII (3 weeks)	**Sources of data for Pharmacoepidemiological studies** Ad Hoc data sources and automated data systems

VIII (3 weeks)	**Selected special applications of pharmacoepidemiology** Studies of vaccine safety, hospital pharmacoepidemiology.
IX (3 weeks)	**Selected special applications of pharmacoepidemiology** Pharmacoepidemiology and risk management, drug induced birth defects.
X (3 weeks)	**Pharmacoeconomics:** **Definition, history, needs of pharmacoeconomic evaluations** Role in formulary management decisions
XI (3 weeks)	**Pharmacoeconomic evaluation** Outcome assessment and types of evaluation Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost – minimization, cost- benefit, cost – effectiveness, cost utility
XII (3 weeks)	**Applications of Pharmacoeconomics** Software and case studies

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Brian L Storm. Pharmacoepidemiology. 3rd ed. England: John Wiley & Sons Ltd. 2000.
2. F Randy Vogenberg. Introduction to Applied Pharmacoeconomics. McGraw-Hill. 2011.
3. Essentials of Pharmacoeconomics by Karen Rascati
4. Pharmacoeconomics: http://www.ispor.org/
5. Pharmacoepidemiology: http://www.pharmacoepi.org/

Program	**Pharm D**
Year	**Fifth Year**
Name of the course	**Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring**
Course Code	**23PMD503**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring course is designed to provide the student with exposure to the application of pharmacokinetic and pharmacodynamic principles of a variety of drug classes to clinical situations. The course will provide a review of clinical pharmacokinetic principles and provide background for the student to develop an approach to therapeutic drug monitoring. Situations and clinical conditions that are likely to alter the concentration: time and/or concentration: effect relationship will be emphasized. The remainder of the course will deal more specifically with the most common drug classes where therapeutic drug monitoring is applied in clinical practice.

Course Learning Outcomes:

Upon successful completion of this course, the student should be able to:

CO: 1 Define important concepts of clinical pharmacokinetic and pharmacodynamic.

CO: 2 Understand the effect of pharmacokinetics and pharmacodynamic parameters and the observed drug concentration and clinical response.

CO: 3 Recommend dose adjustments of drugs based on renal and hepatic functions.

CO: 4 Provide patient-specific initial dosage recommendations for therapeutically monitored drugs and dosage adjustment based on plasma concentration.

Theory Course: Contents

S. No	Topics
I (3 weeks)	**Introduction to Clinical pharmacokinetics.**
II (3weeks)	**Design of dosage regimens:** Nomograms and Tabulations in designing dosage regimen, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals,
III (3weeks)	**Design of dosage regimens:** Drug dosing in the elderly and pediatrics and obese patients.
IV (3 weeks)	**Pharmacokinetics of Drug Interaction:** a. Pharmacokinetic drug interactions
V (3weeks)	**Pharmacokinetics of Drug Interaction:** Inhibition and Induction of Drug metabolism c. Inhibition of Biliary Excretion.
VI (3weeks)	**Therapeutic Drug monitoring:** a. Introduction b. Individualization of drug dosage regimen (Variability – Genetic, Age and Weight, disease, Interacting drugs). c. Indications for TDM. Protocol for TDM.
VII (3 weeks)	**Therapeutic Drug monitoring:** d. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy. e. TDM of drugs used in the following disease conditions: cardiovascular disease, Seizure disorders, Psychiatric conditions, and Organ transplantations
VIII (3 weeks)	**Dosage adjustment in Renal and hepatic Disease:** a. Renal impairment b. Pharmacokinetic considerations, General approach for dosage adjustment in Renal disease.

IX (3 weeks)	**Dosage adjustment in Renal and hepatic Disease:** Measurement of Glomerular Filtration rate and creatinine clearance. e. Dosage adjustment for uremic patients. f. Extracorporeal removal of drugs. g. Effect of Hepatic disease on pharmacokinetics
X (3 weeks)	**Population Pharmacokinetics.** a. Introduction to Bayesian Theory. b. Adaptive method or Dosing with feedback. c. Analysis of Population Pharmacokinetic Data.
XI (3 weeks)	**Pharmacogenetics** a. Genetic polymorphism in Drug metabolism: Cytochrome P-450 Isoenzymes. b. Genetic Polymorphism in Drug Transport and Drug Targets.
XII (3 weeks)	**Pharmacogenetics:** Pharmacogenetics and Pharmacokinetics/ Pharmacodynamic considerations

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Larry A. Bauer. Applied Clinical Pharmacokinetics. McGraw-Hilll/Appleton & Lange. 2001.
2. Michael E. Winter. Basic Clinical Pharmacokinetics.3rd edition. Applied Therapeutics. 1994

3. Joseph T. Dipiro, William J. Spruill, Robert A. Bloum, Jane M. Pruemer, American Cancer Society, (Joan Heimann editors). Concepts in Clinical Pharmacokinetics. 3rd. edition. American Hospital Association. 2002.
4. Malcolm Rowland, Thomas N. Tozer, Randy Rowland (Editors). Clinical Pharmacokinetics: Concepts and Applications. 3rd edition. Lippincott1Williams & Wilkins. 1995
5. William E. Evans, Jerome J. Schentag, William J. Jusko (Editors). Applied Pharmacokinetics: Principles of Therapeutic Drug Monitoring. 3rd edition. Applied Therapeutics. 1992

Program	Pharm D
Year	Fifth Year
Name of the course	Entrepreneurship Development (Elective)
Course Code	23PMD506E1
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

This course is designed to impart knowledge and skills necessary to train the students on entrepreneurship management.

Course Learning Outcomes:

At completion of this subject, it is expected that students will be able to

CO 1: The Role of enterprise in national and global economy

CO 2: Dynamics of motivation and concepts of entrepreneurship

CO 3: Demands and challenges of Growth Strategies and Networking

Theory Course: Contents

S. No	Topics
I (3 weeks)	Conceptual Frame Work: Concept need and process in entrepreneurship development. Role of enterprise in national and global economy. Types of enterprise – Merits and Demerits.
II (3weeks)	Government policies and schemes for enterprise development. Institutional support in enterprise development and management

III (3 weeks)	Entrepreneur: Entrepreneurial motivation – dynamics of motivation. Entrepreneurial competency – Concepts. Developing Entrepreneurial competencies - requirements and understanding the process of entrepreneurship development, self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur role.
IV (3weeks)	Launching And Organising An Enterprise: Environment scanning – Information, sources, schemes of assistance, problems. Enterprise selection, market assessment, enterprise feasibility study, SWOT Analysis. Resource mobilisation - finance, technology, raw material, site and manpower.
V (3weeks)	Costing and marketing management and quality control. Feedback, monitoring and evaluation.
VI (3 weeks)	Growth Strategies And Networking: Performance appraisal and assessment. Profitability and control measures, demands and challenges. Need for diversification.
VII (3 weeks)	Future Growth – Techniques of expansion and diversification, vision strategies. Concept and dynamics. Methods, Joint venture, co-ordination and feasibility study
VIII (3 weeks)	Preparing Project Proposal To Start On New Enterprise Project work – Feasibility report; Planning, resource mobilisation and implementation
IX (3 weeks)	Exercise 1

X (3 weeks)	Exercise 2
XI (3 weeks)	Exercise 3
XII (3 weeks)	Exercise 4

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

REFERENCES

1. Akhauri, M.M.P.(1990): Entrepreneurship for Women in India, NIESBUD, New Delhi.
2. Hisrich, R.D & Brush, C.G.(1996) The Women Entrepreneurs, D.C. Health & Co., Toranto.
3. Hisrich, R.D. and Peters, M.P. (1995): Entrepreneurship – Starting, Developing and Managing a New Enterprise, Richard D., Inwin, INC, USA.
4. Meredith, G.G. etal (1982): Practice of Entrepreneurship, ILO, Geneva. Patel, V.C. (1987): Women Entrepreneurship – Developing New Entrepreneurs, Ahmedabad EDII.

Program	Pharm D
Year	Fifth Year
Name of the course	Pharmacological Screening Methods (Elective)
Course Code	23PMD506E2
Paper	Theory
Hours /week	3+1 hours (lectures)
Pre / co-requisite/s	Nil

Course Description:

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

Course Learning Outcomes:

At completion of this subject, it is expected that students will be able to

CO 1: Appraise the regulations and ethical requirement for the usage of experimental animals.

CO 2: Describe the various animals used in the drug discovery process and good laboratory practices in maintenance and handling of experimental animals

CO 3: Describe the various newer screening methods involved in the drug discovery process

CO 4: Appreciate and correlate the preclinical data to humans

Theory Course: Contents

S. No	Topics
I (3 weeks)	Laboratory Animals Common laboratory animals: Description, handling and applications of different species and strains of animals.
II (3weeks)	Transgenic animals: Production, maintenance and applications Anaesthesia and euthanasia of experimental animals. Maintenance and breeding of laboratory animals. CPCSEA guidelines to conduct experiments on animals
III (3 weeks)	Good laboratory practice. Bioassay-Principle, scope and limitations and methods
IV (3weeks)	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. General principles of preclinical screening. CNS Pharmacology: behavioural and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti-epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimer's and multiple sclerosis. Drugs acting on Autonomic Nervous System.
V (3weeks)	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Respiratory Pharmacology: anti-asthmatics, drugs for COPD and anti-allergic. Reproductive Pharmacology: Aphrodisiacs and antifertility agents Analgesics, anti-inflammatory and antipyretic agents. Gastrointestinal drugs: anti-ulcer, anti -emetic, anti- diarrheal and laxatives.
VI	Preclinical screening of new substances for the pharmacological activity using

(3 weeks)	in vivo, in vitro, and other possible animal alternative models. Cardiovascular Pharmacology: antihypertensives, antiarrhythmics, antianginal, antiatherosclerosis agents and diuretics. Drugs for metabolic disorders like anti-diabetic, antidyslipidemic agents. Anti-cancer agents. Hepatoprotective screening methods.
VII (3 weeks)	Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. Immunomodulators, Immunosuppressants and immunostimulants
VIII (3 weeks)	General principles of immunoassay: theoretical basis and optimization of immunoassay, heterogeneous and homogenous immunoassay systems.
IX (3 weeks)	Immunoassay methods evaluation; protocol outline, objectives and preparation. Immunoassay for digoxin and insulin
X (3 weeks)	Limitations of animal experimentation and alternate animal experiments.
XI (3 weeks)	Extrapolation of in vitro data to preclinical and preclinical to humans
XII (3 weeks)	Revision

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources

1. Biological standardization by J.H. Burn D.J. Finney and I.G. Goodwin

2. Screening methods in Pharmacology by Robert Turner. A

3. Evaluation of drugs activities by Laurence and Bachrach

4. Methods in Pharmacology by Arnold Schwartz.

5. Fundamentals of experimental Pharmacology by M.N.Ghosh

6. Pharmacological experiment on intact preparations by Churchill Livingstone

7. Drug discovery and Evaluation by Vogel H.G.

8. Experimental Pharmacology by R.K.Goyal.

9. Preclinical evaluation of new drugs by S.K. Guta

10. Handbook of Experimental Pharmacology, SK.Kulkarni

11. Practical Pharmacology and Clinical Pharmacy, SK.Kulkarni, 3 rd Edition.

12. David R.Gross. Animal Models in Cardiovascular Research, 2 nd Edition, Kluwer Academic Publishers, London, UK.

13. Screening Methods in Pharmacology, Robert A.Turner.

14. Rodents for Pharmacological Experiments, Dr.Tapan Kumar chatterjee.

15. Practical Manual of Experimental and Clinical Pharmacology by Bikash Medhi (Author), Ajay Prakash (Author)

Program	**Pharm D**
Year	**Fifth Year**
Name of the course	**Scientific Writing (Elective)**
Course Code	**23PMD506E3**
Paper	**Theory**
Hours /week	**3+1 hours (lectures)**
Pre / co-requisite/s	**Nil**

Course Description:

The objective of scientific writing is to formalize the students to communicate and get the research work published

Course Learning Outcomes:

At completion of this subject, it is expected that students will be able to

CO 1: Analyze scientific writing concepts

CO 2: Understand the concept of publication

CO 3: Evaluate the journals and the work for publication

Theory Course: Contents

S. No	Topics
I (3 weeks)	**Introduction skills:** Getting ideas, designing the research work, Types of papers, Structure of a typical paper, how to write an introduction, essentials of language and academic editing
II (3weeks)	**Effective Literature Review:** Databases (Medline, Science direct, Springer, PubMed, Google Scholar, and others), Collection of the information, Inclusion, and sequencing of authors based on their roles,

	Preparation of title and abstract of manuscript, Discussion, and conclusion.
III (3 weeks)	**Skills in writing Methodology:** Purpose of the Methods section, Preparation of Experimental Design, Conventions regarding style, Designing and labelling tables, how to use Excel for graphs, how to use Pivot Tables in Excel
IV (3weeks)	**Results and discussion:** Purpose of the Results, how to write the results, Purpose of the discussion, Preparation of Experimental Design How to write the discussion and conclusion **References:** Referencing styles: Vancouver, others, Referencing software: EndNote, Zotero etc.
V (3weeks)	**Ethics:** Copyright, Plagiarism, Conflict of interest and disclosure. **English in writing skills:** Errors in grammar, punctuation.
VI (3 weeks)	**Communication:** How to write an abstract, Graphical abstract/Image representation Selection of journal, Guide for SCOPUS/WOS/SCI Journals and Predatory Journals, Respond to the reviewer's comments
VII (3 weeks)	Guidelines for proposal writing towards national and international funding agencies
VIII (3 weeks)	Exercise 1
IX (3 weeks)	Exercise 2
X	Exercise 3

(3 weeks)	
XI (3 weeks)	Exercise 4
XII (3 weeks)	Exercise 5

Assessment methods and weightage

Assessment type	**Assessment tool**	**Distribution**
Continuous Assessment	Midterm examination	20%
	Assignment	5%
	Student-teacher interaction (Seminar & Group Discussion)	5%
End Assessment	End theory examination	70%
TOTAL		**100%**

Note: Three Midterm examinations to be conducted periodically throughout the year.

Learning Resources/Recommended Texts/Reference books/web resources:

1. Sin and Syntax, Constance Hale, Successful Scientific Writing: A step-by-step guide for biomedical scientists, Matthews and Bowen

2. The Scientist's Guide to Writing: How to Write More Easily and Effectively throughout your Scientific Career.

3. Writing Science in Plain English. Greene, Anne E.

4. How to Write and Publish a Scientific Paper, 8th Edition

INTERNSHIP

3) **SPECIFIC OBJECTIVES:**

i) To provide patient care in cooperation with patients, prescribers, and other members of an inter professional health care team based upon sound therapeutic principles and evidence-based data, taking into account relevant legal, ethical, social cultural, economic, and professional issues, emerging technologies, and evolving biomedical, pharmaceutical, social or behavioural or administrative, and clinical sciences that may impact therapeutic outcomes.

ii) To manage and use resources of the health care system, in cooperation with patients, prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.

iii) To promote health improvement, wellness, and disease prevention in co-operation with patients, communities, at-risk population, and other members of an inter professional team of health care providers.

iv) To demonstrate skills in monitoring of the National Health Programme s and schemes, oriented to provide preventive and promotive health care services to the community.

v) To develop leadership qualities to function effectively as a member of the health care team organised to deliver the health and family welfare services in existing socio-economic, political and cultural environment.

vi) To communicate effectively with patients and the community.

4) **OTHER DETAILS:**

i) All parts of the internship shall be done, as far as possible, in institutions in India. In case of any difficulties, the matter may be referred to the Pharmacy Council of India

to be considered on merits.

ii) Where an intern is posted to district hospital for training, there shall be a committee consisting of representatives of the college or university, and the district hospital administration, who shall regulate the training of such trainee. For such trainee, a certificate of satisfactory completion of training shall be obtained from the relevant administrative authorities which shall be countersigned by the Principal or Dean of College.

iv) Every candidate shall be required, after passing the final Pharm. D. or Pharm. D. (Post Baccalaureate) examination as the case may be to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of twelve months so as to be eligible for the award of the degree of Pharm. D. or Pharm. D. (Post Baccalaureate) as the case may be.

4. ASSESSMENT OF INTERNSHIP:

i) The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practitioner) under whom he works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training, following which the university shall award the degree or declare him eligible for it.

ii) Satisfactory completion of internship shall be determined on the basis of the following:

(1) Proficiency of knowledge required for each case management SCORE 0-5

(2) The competency in skills expected for providing Clinical Pharmacy Services SCORE 0-5

(3) Responsibility, punctuality, work up of case, involvement in patient care SCORE 0-5

(4) Ability to work in a team (Behaviour with other healthcare professionals including medical doctors, nursing staff and colleagues). SCORE 0-5

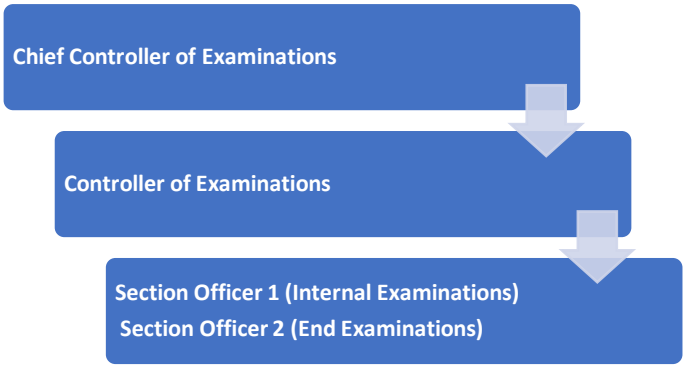
(5) Initiative, participation in discussions, research aptitude. SCORE 0-5

Poor	Fair	Below Average	Average	Above Average	Excellent
0	1	2	3	4	5

A Score of less than 3 in any of above items will represent unsatisfactory completion of internship.

Examination Cell – Structure, Rules and Regulations

a) **Organization structure**



b) **Infra-structure / Security / confidential zone**

- Single entry with complete partitions for various sections of examinations under CCTV surveillance
- Single door entry & exit
- Confidential room attached to Controller of examinations

- Separate strong room for Used and Un-used examination material
- Evaluation Hall with toilet facility / water facility etc.
- Repo-graphic area
- Office section

C) Assurance of confidentiality

- Free entry is restricted in the premises.
- Question paper selection and Question paper moderation will be done just 30 minutes before the examination commencement. During moderation, electronic gadgets including mobiles and internet facility will not be entertained during question paper moderation.
- Question paper setting from Outside the University with minimum PG or preferably Ph.D. having five years of teaching experience in relevant subject. The obtained sets of question paper will be under the custody of controller of examinations.
- Question paper moderation will be done if required after consultation with the Chief controller of examination & after receiving inputs from of HOD's of concerned departments in CE chamber.
- All the experts involed in the moderation will be asked to be present in the chamber till the examination commences.
- Question papers will be carried in sealed covers by CE and will be handed over to Invigilators ten minutes before commencement examination.

d**) Eligibility criteria for experts in examination and evaluation.**

End Examinations	**B. Pharm**	**M.Pharm***	**Pharm. D**
Theory Paper Evaluator	M. Pharm with 3 Years of Experience	Ph. D with 2 years of Experience	M. Pharm with 3 Years of Experience / Pharm. D with two years of Experience
Q. Paper Setter	M. Pharm with 10 Year of Experience / Ph. D with 2 years	Ph. D with 5 years of Experience	M. Pharm with 10 Years of Experience / Pharm. D with three years of Experience / Ph.D with 2 years
Practical Examiner Internal	M. Pharm with 2 Years of Experience	M. Pharm with 5 Years of Experience	M. Pharm with 2 Years of Experience / Pharm. D with one year of Experience
Practical Examiner External	M. Pharm with 3 Years of Experience	Ph. D with 2 years of Experience	M. Pharm with 3 Years of Experience / Pharm. D with two years of Experience
Project Evaluators	Ph. D with 2 years	Ph. D with 5 years	M. Pharm with 10

	of Experience	of Experience / equivalent with industrial experience	Years of Experience / Pharm. D with three years of Experience / Ph. D with 2 years

NOTE:

*Double Evaluation for M. Pharm, if there is a discrepancy of 15 % deviation between two evaluations, there will be third evaluation.

Challenge valuation will be adapted for end examinations results of all programs as per awarding university.

e) **Recommended assessment tools**

B. Pharm	**M.Pharm**	**Pharm. D**
Assignment	Assignment	Assignment
Seminar	Seminar	Seminar
Mid – Examination	Mid - Examination	Mid - Examination
End Examinations	End Examinations	End Examinations
Comprehensive exam (Quiz)	Journal club Participation	Presentations
MOOCs	PBL Assignment	Clerkship
Research Project / VIVA	Research Project / VIVA	Research Project / Internship
Participation	Participation	Participation

Note: Class tests & three Sessional examinations to be conducted periodically throughout the year.

Annexure-I: Rubrics for Assignment / Seminar

Raghavendra Institute of Pharmaceutical Education and Research (Autonomous)

Awarding University: JNT University, Anantapur (JNTUA

Assignment - Evaluation / Marking Schemes (10 Marks) – Converted to 5 M

Parameter	**Very good (2)**	**Good (1)**	**Satisfactory (0.5)**	**Not satisfactory (0)**
Relevance of content to Topic (2)				
Reliable resources used (2)				
Presentation of content (2)				
Similarity Index (2)				
Total				
Total (8)				
Submission Date	**Before Due date (2)**		**After due date (1)**	

Annexure – II: Research Project / Presentation Rubrics

Project / Presentation - Marking Schemes (10 Marks)

Parameter	**Very good (2)**	**Good (1)**	**Satisfactory (0.5)**	**Not satisfactory (0)**
Skill in Experiment and presentation of data (2)				
Adequacy of literature (2				
Performance / efficiency in Interpretation of data (2)				
Presentation of content / Result (2)				
VIVA (2)				
Total				
Total (10)				

Annexure – III: Rubrics for Grading and Ranking

Year Grade Point Average (GPA) and Cumulative Grade point average (CGPA) as per awarding university. Gold medal and ranking will be declared for those students who have passed all semesters in single attempt only.

Annexure IV: Malpractices / Punishments

As per the regulations and guidelines, of awarding university the malpractices and punishments will be changed from time to time.