Academic Programme Guide

Of

Pharm. D
(6 years)

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

w.e.f.
Academic Year: 2025-2026

Index

Chitkara University

Vision and Mission

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

Institute Vision and Mission

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

1. General Information

The academic program Guide is a comprehensive document detailing course scheme, associated credits per course and the distribution of each course in lecture, tutorial and Practical hours. It also details the eligibility criteria for admission, for award of doctorate degree, the assessment and evaluation procedures along with a glimpse of the pedagogical aspects of the programs. This Guide is to be used in association with the Academic Regulations of the University to make a complete rule set. The course schemes given in this document are approved by respective Board of Studies and the Academic Council of Chitkara University. Pharm. D. as academic discipline makes for an enriching learning experience as it perfectly combines technology and health care system. The profession of pharmacy has transformed into a hub for the "Global Healthcare" and evolved as a multidisciplinary, multifaceted curriculum. Learning and working in harmony with other members of health care are the immediate needs for the ideal role and social relevance of pharmacist in the health care system of our country. So, the academic system at Chitkara College of Pharmacy has been framed taking into consideration the responsibility of undergraduate students to meet the demands of hospital and hi-tech pharmaceutical industry, at the same time ensuring that they confidently serve the requirements of patient care and pharmacy practice. Conscious efforts to inculcate research aptitude in its students through elective research projects to keep them abreast of the requirements of the industry.

Program Objectives:

a. To provide exemplary education in a stimulating environment where delivery of superb pharmaceutical knowledge is integrated with nationally and internationally recognized research data to enable students to conduct and publish cutting-edge multidisciplinary research in the discovery, utilization and evaluation of therapeutic agents.
b. To prepare competent pharmacists at various levels for India.
c. To prepare globally capable pharmaceutical scientists.
d. To become efficient leaders in various stages of pharmaceutical production, marketing and distribution.

2. Program Outcomes (Graduate Attributes)

The proposed outcomes for the Pharm. D. program focus on the ability of a graduating student to develop himself/herself as a competent professional with appropriate scientific innovative skills in Pharmacotherapeutics, drug discovery and development, Clinical operations management skills. They are further classified as follows:

University Mission:

M1: To carry out the academic processes in accordance with global standards through active teacher-student-industry participation.
M2: To promote research, innovation and entrepreneurship in collaboration with industry, research laboratories and academic institutions of global repute.
M3: To inculcate high moral, ethical and professional values amongst our students, faculty & staff.
M4: To contribute in building skillful society by preparing competent pharmacist.

M5: To prepare globally recognized pharmaceutical professional who can effectively contribute in new molecule research, formulation, preclinical and clinical growth and regulatory submissions.
M6: To become efficient leaders providing academic and other interactions in various stages of pharmaceutical operations, marketing and distribution.

Table 1: PO-Mission-Vision Mapping Matrix

PO No.	PO Statement	Mission Statement	Vision Statement
PO1	Life Sciences Knowledge: Impart fundamental knowledge of physiology, anatomy, formulation science, and applied biochemistry, Chemistry of organic and inorganic compounds as per the monographs.	**M1**	To be a globally recognized organization promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.
PO2	Pathophysiology and Pharmacology knowledge: Impart a thorough knowledge of relevant aspects of pathophysiological mechanisms, application of microbiology in pharmacy field, medical uses of natural drugs, and Pharmacological aspects of drugs.	**M1** **M2**	
PO3	Community Pharmacotherapeutics knowledge and Expertise: To improve skills such as dispensing of drugs, ensure safe medication usage, patient counseling and improve patient care in community pharmacy set up.	**M2** **M3**	
PO4	Clinical Pharmacist Knowledge: To enhance practical clinical discussions, attending ward rounds, follow-up progress of patients, case presentation at discharge are imbibed through hospital postings.	**M4**	
PO5	Environment, sustainability and Pharmaceutical Regulations: To understand the instrumental techniques applied in Good	**M2**	

	Laboratory Practice and following ICH-GCP guidelines, total quality management, quality review and documentation and study of regulatory bodies such as Drugs and Cosmetics Act, CDSCO guidelines, pertaining to regulatory environment.		
PO6	Design/Development of solutions: To study the modern concept of rational drug design such as Quantitative Structure Activity Relationship, Computer Aided Drug Design, development, industrial technology and concept of antisense molecules.	**M4**	
PO7	Conduct investigations of complex problems: To understand biopharmaceutical principles and pharmacokinetic principles through different compartment models, multiple dosage regimens, non-linear pharmacokinetics, and assessment of bioavailability and bioequivalence.	**M5**	
PO8	Toxicology Knowledge: To understand the toxicological aspects of microbes, pesticides, opiates, NSAIDs, Caustics, radiation, heavy metals, plant, food poisonings, snake bites, and envenomations.	**M2**	
PO9	Ethics: To understand the clinical aspects of drug development, such as phases, ethical issues, and roles and responsibilities of clinical trial personnel, design of clinical study documents, data management and safety monitoring in clinical trials.	**M5**	

PO10	Problem analysis and learning: In house scientific and social poster competition, Case study presentations, prescription auditing, and contribution to drug information centre.	**M6**	
PO11	The Clinical Pharmacist and society – Participation in hospital camps, disease awareness programs will inculcate the social responsibility of the clinical pharmacists.	**M6**	

The graduating students are prepared for demonstrating knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative sciences, health policy and legal issues in the practice of pharmacy. Each year, experts from different universities and Pharmaceutical industry across the globe visits Chitkara College of Pharmacy, Chitkara University, Punjab to provide international exposure to students.

Aiming at developing student's personality through community service, NSS activities are offered to students to instill the idea of social welfare and to provide service to society without bias. To enrich student's interpersonal skills, variety of extracurricular activities have been inculcated in the course curriculum in the form of national level technical and cultural festivals such as Pharma-fest, International Pharmacist Day and National Pharmacy Week respectively on a yearly basis. A vital role is played by the institutional technical cell Forum for professional and other skill development in pharmaceutical sciences (FPSDPS) department for overall progress & grooming of the student through organizing industrial visits, workshops, debate, technical quizzes and research project paper presentation competitions in events like Pharma tech Trends, Pharmacy Practice Module & international conferences. The students are motivated to participate or organize such events. These value-added activities have been designed taken into account various Programme Objectives (POs) such as PO3, PO8, PO9, PO10 and PO11.

The main aim of service training with focus on good health and well-being is accomplished by delivering sport-related events, NSS and NCC. The programme also aims to develop professional with awareness of international standards as of global health has transcended beyond the idea of confining the pharmacist's work to a specific geographical location and broadened it to the global level. PO1, PO2, PO4, PO5 and PO6 promotes development of skills in graduates for pharmaceutical formulations, analytical experts, regulatory and dispensing skills for good practices in global health system. Pharmacists have the opportunity to play an important role in both public health and global health. In particular, pharmacists can look at the varied global health practices established in medicine and use this as a framework to understand the potential role of the pharmacist within global health practice and program delivery, research, and policy. According to the Consortium of Universities for Global Health, global health shouldrefer to the scope of a

wider problem rather than a geographical location. The scope of work of pharmacists in diverse settings faces challenges of global health such as self-care & self-medication, management of diseases through medication therapy management, resistance to existing drugs or recreational drugs being abused, medicines supplied through unregistered online pharmacies, online advertising of prescription drugs, direct-to-consumer websites and the distribution of substandard & spurious, falsely-labeled, falsified or counterfeit medicines. POs are designed and oriented to meet the mission of university in professional ethics. These ensure that the graduating students are well equipped with pharmaceutical technical knowledge, to promote the development of trained human resource in Pharmaceutical Sciences for dissemination of quality education with highly professional and ethical attitude, strong communication and effective skills to work in a team with a multidisciplinary approach. Thus, the objective of the programme is to produce pharmacy graduates with strong fundamental concepts and high technical patient-centered care to diverse patients using the best available evidence and in consideration of patients' circumstances to devise, modify, implement, document and monitor pharmacotherapy care plans, either independently or as part of healthcare teams. To enhance the competence of the student pharmacists to design, implement and assess initiatives to improve health and wellness with medication use systems management. The POs helps to graduating students engage in innovative activities by using creative thinking to envision better ways of accomplishing professional goals.

3. Eligibility for Admission and Migration

A pass in any of the following examinations

a. 10+2 examination with Physics and Chemistry as compulsory subjects along with one of the following subjects: Mathematics or Biology.
b. A pass in D. Pharm course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.
c. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

Provided that a student should complete the age of 17 years on or before 31st December of the year of admission to the course. 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.

The admission is based purely on merit.

During admission process, the University follows reservation policy as decided by the State.

Migration/Credit Transfer Policy

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

"The credits earned by the student from the other universities in India or abroad shall be transferred as such. The Degree shall only be awarded to candidate subject to the condition that student earned the minimum no. of credit defined by Academic Regulation/APG of the Programme run by the Chitkara University".

In case a student undergoes international exchange programme or internship for 1 semester/1 year, then the courses, credits and grades earned by the student in abroad during that period should be reflected on the grade card issued by the Chitkara University. The courses will be marked as (*) on the grade card/transcript. The description of the (*) will be "credits and grades as adopted university/institute name . . . . . during international exchange programme. The minimum credits requirement for being eligible for Pharm D degree will be 191 credits. If consolidated credits are less than 191 credits, then the student has to earn extra credits to attain minimum credits requirement for Pharm D degree. The instructions regarding this will be informed to the students by the department from time to time.

4. Programme Duration

The duration of the course shall be six academic years (five years of study and one year of internship or residency) full time with each academic year spread over a period of not less than two hundred working days. The period of six years duration is divided into two phases:

a. Phase I – consisting of First, Second, Third, Fourth and Fifth academic year.
b. 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 practiceor clinical pharmacy services and acquires skill under supervision so that he or she may become capable of functioning independently.

The maximum duration of completion of degree is 8 years.

5. Pedagogical Aspects

The structural layout of the program and its courses requires that each course be divided in lecture, tutorial and practical sessions. Duration of each session as given in the column against the course in the course scheme is 60 minutes.

Lecture sessions: Lectures are delivered by traditional - chalk board method, supplemented by modern Information Communication technology (ICT) methods. The students are encouraged to ask questions and involve in group discussion to the extent allowed by the teacher. In some subjects where case study based methodology is adopted, the lectures are supplemented by discussions on case studies.

Tutorial Sessions: The tutorial sessions are small groups of students interacting with the teacher, solving application oriented analytical problems. The tutorial sessions are very interactive and inculcate problem solving skills in the students.

Lab / Practical Sessions: During lab / practical sessions, the students work on prescribed list of experiments and do what they have learnt in the Lecture / Tutorial sessions.

6. Apprenticeship/Internship embedded degree programs (AEDP)

6.1 Research Project: In the 5th year of Pharm.D. course, the students work on a unique integrated project allotted to them by an allotted project guide at hospital. The project is aimed at carrying out extensive review and summarization on the work done in the area in the past and proposes a new possible dimension and method to carry out research and then actually carry out their research work and present asresearch report. The evaluation is as per academic program guide for these. The projects may also be allotted to them in 5th year, depending on the interest of students but are not evaluated by the usual grade but by letter

grades. All projects are designed by the faculty keeping in mind the courses the students have studied so far and are currently studying. Thus, the project statements are made such a way that the students while working on these projects apply the concepts learned so far and the deliverables are multi- faceted. The students work on the Integrated Project during their hospital clerkship hours.

6.2 Practical training. 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, thirdand fourth year course. 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 halfa day in the morning hours attending ward rounds on daily basis as a part of clerkship. Theory teaching may be scheduled in the afternoon.

A. Project work

a. 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. Project work shall be presented in a written report and as a seminar atthe end of the year. External and the internal examiners shall do the assessment of the project work.
b. Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

B. Objectives of project work – The main objectives of the project work is to

a. Show the evidence of having made accurate description of published work of others and of having recorded the findings in an impartial manner; and
b. Develop the students in data collection, analysis and reporting and interpretation skills.

C. Methodology – To complete the project work following methodology shall be adopted, namely:

a. Students shall work in groups of not less than *two* and not more than *four* under an authorised teacher;
b. Project topic shall be approved by the Head of the Department or Head of the Institution;
c. 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;
d. Project work shall be approved by the institutional ethics committee;
e. Student shall present at least three seminars, one in the beginning, one at middle and one at the end of the project work; and
f. 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.

D. Reporting

a. 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 authorised teacher, Head of the Department as well as by the Head of the

Institution

b. 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 authorised teacher with font size 14.
c. Submission of the project report shall be done at least one month prior to the commencement of annual or supplementary examination.

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

a. Project work shall be evaluated by internal and external examiners.
b. Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of four students).
c. Three seminars presented by students shall be evaluated for twenty marks each and the average of best two shall be forwarded to the university with marks of other subjects.
d. **Evaluation shall be made on the following items:** **Marks**

i.	Write up of the seminar	(7.5)
ii.	Presentation of work	(7.5)
iii.	Communication skills	(7.5)
iv.	Question and answer skills	(7.5)
Total		(30 marks)

e. **Final evaluation of project work shall be done on the following items:** **Marks**

i.	Write up of the seminar	(17.5)
ii.	Presentation of work	(17.5)
iii.	Communication skills	(17.5)
iv.	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.

7. Programme Structure

Eligibility to Award the Degree.

In addition to the conditions given in section 8 of Academic Regulations, a CGPA of 6.0 is required to receive degree. The minimum credits to be earned are given in table 2. Every student is allotted a definite academic hour every week called as credit hour. On the basis of no. of subjects and allotted hours, every year is assigned definite credit hours which hour which will be conducted as academic activity in that year. A student has to complete the credit hours with allowed attendance criteria.

Table 2: *Minimum Credit Requirements to Award Degree under* degree in Pharm D *Programm*

S. No.	Course / Year	Pharm. D
1.	Year I	36 (With Biology)/34 (With Mathematics)
2.	Year II	32
3.	Year III	35
4.	Year IV	37
5.	Year V	27
6.	Year VI	36
7.	Total	203 (With Biology)/201 (With Mathematics)

Year I			
Course Code	**Title of the Course**	**Hours (L+T+P)**	**Credit**
PDL 4101	HUMAN ANATOMY & PHYSIOLOGY	3+1+0 = 4	4
PDL 4102	PHARMACEUTICS	3+1+0 = 4	4
PDL 4103	MEDICINAL BIOCHEMISTRY	3+1+0 = 4	4
PDL 4104	PHARMACEUTICAL ORGANIC CHEMISTRY	3+1+0 = 4	4
PDL 4105	PHARMACEUTICAL INORGANIC CHEMISTRY	3+1+0 = 4	4
PDL 4106	REMEDIAL MATHEMATICS	3+1+0 = 4	4
PDL 4107	REMEDIAL BIOLOGY	3+1+0 = 4	4
PDP 2101	HUMAN ANATOMY AND PHYSIOLOGY	0+0+3 = 3	2
PDP 2102	PHARMACEUTICS	0+0+3 = 3	2
PDP 2103	MEDICINAL BIOCHEMISTRY	0+0+3 = 3	2
PDP 2104	PHARMACEUTICAL ORGANIC CHEMISTRY	0+0+3 = 3	2
PDP 2105	PHARMACEUTICAL INORGANIC CHEMISTRY	0+0+3 = 3	2
PDP 2107	REMEDIAL BIOLOGY	0+0+3 = 3	2
Total			**34/36**

Note:

a. Credit hours for student opting for Remedial Biology (40 Credits) and those opting for Remedial Mathematics (38 Credits).
b. Remedial Biology students appear for Theory and Practical both and Remedial Mathematics students appear for Theory only.

Year II			
Course Code	**Title of the Course**	**Hours (L+T+P)**	**Credit**
PDL 4201	PATHOPHYSIOLOGY	3+1+0 = 4	4
PDL 4202	PHARMACEUTICAL MICROBIOLOGY	3+1+0 = 4	4
PDL 4203	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	3+1+0 = 4	4
PDL 4204	PHARMACOLOGY – I	3+1+0 = 4	4
PDL 4205	COMMUNITY PHARMACY	3+1+0 = 4	4
PDL 4206	PHARMACOTHERAPEUTICS – I	3+1+0 = 4	4
PDP 2202	PHARMACEUTICAL MICROBIOLOGY	0+0+3 = 3	2
PDP2203	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	0+0+3 = 3	2
PDP 2204	PHARMACOLOGY – I	0+0+3 = 3	2
PDP 2206	PHARMACOTHERAPEUTICS – I	0+0+3 = 3	2
Total		**36**	**32**

Year III			
Course Code	**Title of the Course**	**Hours (L+T+P)**	**Credit**
PDL 4301	PHARMACOLOGY – II	3+1+0 = 4	4
PDL 4302	PHARMACEUTICAL ANALYSIS	3+1+0 = 4	4
PDL 4303	PHARMACOTHERAPEUTICS – II	3+1+0 = 4	4
PDL 4304	PHARMACEUTICAL JURISPRUDENCE	3+1+0 = 4	4
PDL 4305	MEDICINAL CHEMISTRY	3+1+0 = 4	4
PDL 4306	PHARMACEUTICAL FORMULATIONS	3+1+0 = 4	4

PDP 2301	PHARMACOLOGY – II	0+0+3 = 3	2
PDP 2302	PHARMACEUTICAL ANALYSIS	0+0+3 = 3	2
PDP 2303	PHARMACOTHERAPEUTICS – II	0+0+3 = 3	2
PDP 2305	MEDICINAL CHEMISTRY	0+0+3 = 3	2
PDP 2306	PHARMACEUTICAL FORMULATIONS	0+0+3 = 3	2
CPY101	CLINICAL PSYCHOLOGY	1+0+0 = 1	1
Total		**40**	**35**

Year IV			
Course Code	**Title of the Course**	**Hours (L+T+P)**	**Credit**
PDL 4401	PHARMACOTHERAPEUTICS – III	3+1+0 = 4	4
PDL 4402	HOSPITAL PHARMACY	3+1+0 = 4	4
PDL 4403	CLINICAL PHARMACY	3+1+0 = 4	4
PDL 4404	BIOSTATISTICS AND RESEARCH METHODOLOGY	3+1+0 = 4	4
PDL 4405	BIOPHARMACEUTICS AND PHARMACOKINETICS	3+1+0 = 4	4
PDL 4406	CLINICAL TOXICOLOGY	3+1+0 = 4	4
DM 101	DISASTER MANAGEMENT	3+0+0 = 3	3
NSW1301	CLINICAL SKILLS-AND EMERGENCY INTERVENTIONS	2+0+0 = 2	2
PDP 2401	PHARMACOTHERAPEUTICS – III	0+0+3 = 3	2
PDP 2402	HOSPITAL PHARMACY	0+0+3 = 3	2
PDP 2403	CLINICAL PHARMACY	0+0+3 = 3	2
PDP 2405	BIOPHARMACEUTICS AND PHARMACOKINETICS	0+0+3 = 3	2
Total		**41**	**37**

Year V

Course Code	Title of the Course	Hours (L+S+P)	Credit
PDL 4501	CLINICAL RESEARCH	3+1+0 = 4	4
PDL 4502	PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS	3+1+0 = 4	4
PDL 4503	CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING	3+1+0 = 4	4
HR 101	HUMAN VALUES AND PROFESSIONAL ETHICS	2+0+0 = 2	2
AMR 1201	AWARENESS ON ANTIMICROBIAL RESISTANCE	2+0+0 = 2	2
PDP 4504	CLERKSHIP	0+1+0 = 1	1
PDP 4505	PROJECT WORK (SIX MONTHS)	0+0+20 = 20	10
Total		**38**	**27**

Year VI			
Course Code	**Title of the Course**	**Hours (L+S+P)**	**Credit**
PDP 6661	INTERNSHIP	6 hours per day 6X6=36 Hour per week	36
Total			**36**

8. Rules for attendance

As detailed in PharmD Regulations 2008, a minimum attendance of 80% is compulsory for the student to be eligible to appear for end semester examination. 10% concession in this mandatory requirement is possible only in extreme circumstances and at the sole discretion of the Vice Chancellor.

There is no weightage for attendance in evaluation criteria.

Students are encouraged to participate in co-curricular activities conducted by prestigious institutions at national/International level. Such students would be eligible for grant of special Duty Leaves (limited by a cap decided by the Vice Chancellor) to make up for the attendance, in case any class work is missed

during this period. This privilege extended to students will not be termed as right and is limited to just the attendance benefit.

9. Grading System

Sample Course Code						
P	**D**	**L**	**4**	**1**	**0**	**4**

First two letters would indicate the academic Unit offering the course
Third letter would indicate the type of Course.
First Number = Credits of the course = **Round up (Lecture hours per wk * 1 + Tutorial Hours per wk * 0.5 + Lab hours per wk * 0.5)**
Second Number = Year of Program
Last Two numbers = Sequencing of course

Allotment of first two letters	
AM	Math
PY	Physics
CH	Chemistry
GE	General Education
CL	Languages
CS	Computer Science
EC	Electronics

E	Electrical
ME	Mechanical
CE	Civil
CA	Computer Applications
BS	Business Studies
AR	Architecture
ED	Education
PH	Pharmacy

PC	M.Pharm. Pharmaceutics
PT	M.Pharm. Pharmaceutical Technology
PG	M.Pharm. Pharmacology
AS	Applied Science
PE	Physical Education
COMP	Courses of GBC(Canada)
HS	Health Sciences
JM	Journalism and Mass Communication
HM	Hotel management
PD	Pharm D
Third letter	
L	Course with only theory component
P	Course with only Lab component
T	Training, Dissertation
S	Self Study, Project, Seminar
W	Workshop course
First numeral	
1	1 credit course
2	1.5 or 2 credit course
3	2.5 or 3 credit course
4	3.5 or 4 credit course
5	4.5 or 5 credit course
6	5.5 or 6 credit course
7	6.5 or 7 credit course
8	7.5 or 8 Credit Course
9	8.5 or 9 or more credit course
Second Numeral (this number indicates the incremental year of study after 12th class)	
0	For courses are after 10th
1	Year 1
2	Year 2

3	Year 3
4	Year 4
5	Year 5
6	Year 6
7	Year 7
Third and Fourth Numerals (Sequencing of Course)	
01	Course Number 1
02	Course Number 2
03	Course Number 3
04	Course Number 4
05	Course Number 5
06	Course Number 6
07	Course Number 7

Table 3: Grade and grade points

% Marks Range of total	Grade	Grade Point	Qualitative Meaning
90.00 - 100	O	10	Outstanding
80.00-89.99	A	9	Excellent
70.00-79.99	B	8	Good
60.00-69.99	C	7	Fair
50.00-59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

9.1. Computation of GPA and CGPA

Calculation of CGPA: The CGPA (calculated on a 10-point scale) would be used to describe the overall performance of a student (from the semester of admission till the point of reckoning) in all courses for which LETTER GRADES will be awarded. GPA will indicate the performance of a student for any particular semester. Formulas for calculation of GPA and CGPA have been provided as below:

$$GPA_i = \frac{\sum_{j=1}^{n} C_{ij} G_j}{\sum_{j=1}^{n} C_{ij}} \qquad CGPA = \frac{\sum_{i=1}^{N} \left(GPA_i * \sum_{j=1}^{n} C_{ij} \right)}{\sum_{i=1}^{N} \left(\sum_{j=1}^{n} C_{ij} \right)}$$

Where n = number of subjects in the semester; N = number of semesters; GPA_i = GPA for the ith semester; C_{ij} = number of credits for the jth course in ith semester; and G_j = Grade point corresponding to the grade obtained in the jth course.

9.2 Illustration of Computation of GPA and CGPA and Format for Transcripts

i. Computation of GPA and CGPA
ii. Transcript: Based on the above criteria, the university may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

Suppose a student is registered in four courses 'W', 'X', 'Y' and 'Z' in a particular semester as mentioned below in the Column - I of the table 4. Column - II in the table below depicts the number of credits, which those courses carried. At the end of the semester, student was awarded with the grades as mentioned in Column – III in the table given below. Column – IV indicates the corresponding grade weight. Column – V and Column – VI indicate essentially the Credit value and Grade Points for every course completed by a student in that particular semester.

Table 4: Illustration for GPA

Courses in which student registered (Column – I)	**Credits (Column – II)**	**Letter Grade Column - III**	**Grade Value (Column – IV)**	**Credit Value (Column – V)**	**Grade Points (Column – VI)**
Course W	3	B	8	3 x 8	24
Course X	3	A	9	3 x 9	27
Course Y	3	C	7	3 x 7	21
Course Z	2	D	6	2 x 6	12
Total	**11**			**Total**	**84**

$$GPA = \frac{Total\ grade\ pts.}{Total\ no.\ of\ credits} = \frac{84}{11} = 7.636$$

Table 5: Illustration for CGPA

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Credit: 21 GPA:6.9	Credit: 22 GPA:7.8	Credit:25 GPA:5.6	Credit: 26 GPA:6.0	Credit: 26 GPA: 6.3	Credit 25 GPA 8.0
CGPA= **6.73** (21 x 6.9 + 22 x 7.8 + 25 x 5.6 + 26 x 6.0 + 26 x 6.3 + 25 x 8.0)/145					

The GPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

10. Promotion and Registration

Minimum marks for passing examination: Student shall not be declared to have passed examination unless he or she secures at least 50% marks in each of the subjects separately in the theory examinations, including sessional marks and at least 50% marks in each of the practical examinations including sessional marks. The students securing 60% marks or above in aggregate in all subjects in a single attempt at the Pharm.D. or as the case may be, Pharm. D. (Post Baccalaureate) course examination shall be declared to have passed in first class. Students securing 75% marks or above in any subject or subjects shall be declared to have passed with distinction in the subject or those subjects provided he or she passes in all the subjects in a single attempt.
The medium of examination is English.

Criteria to Pass Examination

Based on the marks obtained by the student in a particular course as described in tables above, the grade in that course is obtained, in accordance with the table 3

Eligibility for promotion to next year:

a) With the prior approval of the concerned Examining Authority, the institution can evaluate subjects of Remedial Mathematics/Biology either at its own level or the evaluation be conducted by the Examining Authority as prescribed under Pharm. D. regulations, 2008.

b) All students who have appeared for all the subjects and passed the first-year annual examination are eligible for promotion to the second year and, so on. However, failure in more than two subjects shall debar him or her from promotion to the next year classes.

c) Any one of the two subjects i.e. either Remedial Mathematics or Biology can be carried forward to Secondyear Pharm. D. as an additional failed subject along with 2 failed subjects of first-year under regulation 15 of the Pharm. D. Regulations, 2008

Provision of Grace-Marks

The University shall award grace-marks as per following:

"One percent of the total marks of theory examination of all the semesters may be given for improving the division of a candidate. Grace marks given to a candidate in semester examination may be deducted from total grace marks to be given for improvement of the division."

a) A maximum of One percent of the total marks of theory examination as grace marks at the end of the each semester/year, provided that a student secures a minimum of 15% marks in the respective subject/s of the End Semester/yearly Examination.
b) The remainder or part there of the 1% grace marks of first semester/year plus 1 percent grace-marks of second year, provided that a student secures a minimum of 15% marks in the respective subject/s of the End Semester Examination, similarly for next semesters/years.

For internal Examination:

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

11. Program Overview

The Program consists of subjects under the following categories:

Program Scheme: PharmD 2024

Table 6: Program Scheme

Year 1												
S. No.	Course Name	Course Code	Level	Category (Type of Course)*	Credits (Course wise)	Hours per Week			Marks Distribution			Total Credits (Semester wise)
						L	T	P	I	E	TL	
1.	HUMAN ANATOMY & PHYSIOLOGY	PDL 4101	100-199	DC	4	3	1	0	30	70	100	**34/36**
2.	PHARMACEUTICS	PDL 4102	100-199	DC	4	3	1	0	30	70	100	

3.	MEDICINAL BIOCHEMISTRY	PDL 4103	100-199	DC	4	3	1	0	30	70	100	
4.	PHARMACEUTICAL ORGANIC CHEMISTRY	PDL 4104	100-199	DC	4	3	1	0	30	70	100	
5.	PHARMACEUTICAL INORGANIC CHEMISTRY	PDL 4105	100-199	DC	4	3	1	0	30	70	100	
6.	REMEDIAL MATHEMATICS	PDL 4106	100-199	DC	4	3	1	0	30	70	100	
7.	REMEDIAL BIOLOGY	PDL 4107	100-199	DC	4	3	1	0	30	70	100	
8.	HUMAN ANATOMY AND PHYSIOLOGY	PDP 2101	100-199	DC	2	0	0	3	30	70	100	
9.	PHARMACEUTICS	PDP 2102	100-199	DC	2	0	0	3	30	70	100	
10.	MEDICINAL BIOCHEMISTRY	PDP 2103	100-199	DC	2	0	0	3	30	70	100	
11.	PHARMACEUTICAL ORGANIC CHEMISTRY	PDP 2104	100-199	DC	2	0	0	3	30	70	100	
12.	PHARMACEUTICAL INORGANIC CHEMISTRY	PDP 2105	100-199	DC	2	0	0	3	30	70	100	
13.	REMEDIAL BIOLOGY	PDP 2107	100-199	DC	2	0	0	3	30	70	100	
Year 2												
14.	PATHOPHYSIOLOGY	PDL 4201	200-299	DC	4	3	1	0	30	70	100	**32**
15.	PHARMACEUTICAL MICROBIOLOGY	PDL 4202	200-299	DC	4	3	1	0	30	70	100	

16.	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	PDL 4203	200-299	DC	4	3	1	0	30	70	100	
17.	PHARMACOLOGY – I	PDL 4204	200-299	DC	4	3	1	0	30	70	100	
18.	COMMUNITY PHARMACY	PDL 4205	200-299	DC	4	3	1	0	30	70	100	
19.	PHARMACOTHERAPEUTICS – I	PDL 4206	200-299	DC	4	3	1	0	30	70	100	
20.	PHARMACEUTICAL MICROBIOLOGY	PDP 2202	200-299	DC	2	0	0	3	30	70	100	
21.	PHARMACOGNOSY AND PHYTOPHARMACEUTICALS	PDP 2203	200-299	DC	2	0	0	3	30	70	100	
22.	PHARMACOLOGY – I	PDP 2204	200-299	DC	2	0	0	3	30	70	100	
23.	PHARMACOTHERAPEUTICS – I	PDP 2206	200-299	DC	2	0	0	3	30	70	100	
Year 3												
24.	PHARMACOLOGY – II	PDL 4301	300-399	DC	4	3	1	0	30	70	100	**35**
25.	PHARMACEUTICAL ANALYSIS	PDL 4302	300-399	DC	4	3	1	0	30	70	100	
26.	PHARMACOTHERAPEUTICS – II	PDL 4303	300-399	DC	4	3	1	0	30	70	100	
27.	PHARMACEUTICAL JURISPRUDENCE	PDL 4304	300-399	DC	4	3	1	0	30	70	100	
28.	MEDICINAL CHEMISTRY	PDL 4305	300-399	DC	4	3	1	0	30	70	100	

29.	PHARMACEUTICAL FORMULATIONS	PDL 4306	300-399	DC	4	3	1	0	30	70	100	
30.	PHARMACOLOGY – II	PDP 2301	300-399	DC	2	0	0	3	30	70	100	
31.	PHARMACEUTICAL ANALYSIS	PDP 2302	300-399	DC	2	0	0	3	30	70	100	
32.	PHARMACOTHERAPEUTICS – II	PDP 2303	300-399	DC	2	0	0	3	30	70	100	
33.	MEDICINAL CHEMISTRY	PDP 2305	300-399	DC	2	0	0	3	30	70	100	
34.	PHARMACEUTICAL FORMULATIONS	PDP 2306	300-399	DC	2	0	0	3	30	70	100	
35.	CLINICAL PSYCHOLOGY	CPY101	300-399	VA	1	1	0	0	15	35	50	
Year 4												
36.	PHARMACOTHERAPEUTICS – III	PDL 4401	400-499	DC	4	3	1	0	30	70	100	**37**
37.	HOSPITAL PHARMACY	PDL 4402	400-499	DC	4	3	1	0	30	70	100	
38.	CLINICAL PHARMACY	PDL 4403	400-499	DC	4	3	1	0	30	70	100	
39.	BIOSTATISTICS AND RESEARCH METHODOLOGY	PDL 4404	400-499	DC	4	3	1	0	30	70	100	
40.	BIOPHARMACEUTICS AND PHARMACOKINETICS	PDL 4405	400-499	DC	4	3	1	0	30	70	100	
41.	CLINICAL TOXICOLOGY	PDL 4406	400-499	DC	4	3	1	0	30	70	100	

42.	DISASTER MANAGEMENT	DM 101	400-499	VA	3	3	0	0	15	35	50	
43.	CLINICAL SKILLS- AND EMERGENCY INTERVENTIONS	NSW 1301	400-499	VA	2	2	0	0	15	35	50	
44.	PHARMACOTHERAPEUTICS – III	PDP 2401	400-499	DC	2	0	0	3	30	70	100	
45.	HOSPITAL PHARMACY	PDP 2402	400-499	DC	2	0	0	3	30	70	100	
46.	CLINICAL PHARMACY	PDP 2403	400-499	DC	2	0	0	3	30	70	100	
47.	BIOPHARMACEUTICS AND PHARMACOKINETICS	PDP 2405	400-499	DC	2	0	0	3	30	70	100	
Year 5												
48.	CLINICAL RESEARCH	PDL 4501	500-599	DC	4	3	1	0	30	70	100	**27**
49.	PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS	PDL 4502	500-599	DC	4	3	1	0	30	70	100	
50.	CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING	PDL 4503	500-599	DC	4	3	1	0	30	70	100	
51.	HUMAN VALUES AND	HR 101	500-599	VA	2	2	0	0	15	35	50	

	PROFESSIONAL ETHICS											
52.	AWARENESS ON ANTIMICROBIAL RESISTANCE	AMR 1201	500-599	VA	2	2	0	0	15	35	50	
53.	CLERKSHIP	PDP 4504	500-599	DC	1	0	1	0	30	70	100	
54.	PROJECT WORK (SIX MONTHS)	PDP 4505	500-599	DC	10	0	0	20	0	100	100	
Year 6												
55.	INTERNSHIP	PDP 6661	500-599	DC	36	0	0	36	0	100	100	**36**

FIRST YEAR

PDL 4101 - HUMAN ANATOMY AND PHYSIOLOGY (THEORY)

Theory: 3 Hrs /Week

Scope and Objectives: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since medicament, which is produced by pharmacist, isused to correct the deviations in human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

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

- Describe the structure (gross and histology) and functions of various organs of the human body;
- Describe the various homeostatic mechanisms and their imbalances of various systems;
- Identify the various tissues and organs of the different systems of the human body;
- Perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;
- Appreciate coordinated working pattern of different organs of each system; and
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis)

of human body

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the interlinked and physiological mechanisms of different organs of each system that occur within the body, including homeostasis, cell communication and the functioning of different organ system
- **CO02:** Connect and correlate distinct structural features of human cells, tissues, bones, organs, and systems of the human body with their normal functions
- **CO03:** Identify structural characteristics (gross anatomy) and comprehensive knowledge of the coordinated working pattern of different organs of each system.
- **CO04:** Develop critical thinking skills by analyzing and interpreting anatomical and physiological data, and solving problems related to human health.
- **CO05:** Understand the use of appropriate laboratory techniques to examine anatomical structures or physiological functions, blood group determination, Hb estimation, blood pressure measurement etc..

Course Material:

Text Books

1. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher HarperCollins College New York.
2. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference books

1. Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
2. Chatterjee, C.C. *Human physiology*. Volume 1 and11. Publisher: medical allied agency, Calcutta.
3. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H.
4. *Gray's anatomy.* Publisher: Churchill Livingstone, London.

Syllabus

1. Scope of anatomy and physiology, basic terminologies used in this subject (Description of the body as such planes and terminologies)
2. Structure of cell – its components and their functions.
3. Elementary tissues of the human body: epithelial, connective, Muscular and nervous tissues-their sub-types and characteristics
    a. Osseous system - structure, composition and functions of the Skeleton. (Done in practical classes - 6hrs)
    b. Classification of joints, Types of movements of joints and disorders of joints (Definitions only)
4. Haemopoetic System
    a. Composition and functions of blood
    b. Haemopoesis and disorders of blood components (definition of disorder)
    c. Blood groups
    d. Clotting factors and mechanism

e. Platelets and disorders of coagulation

5. Lymph

a. Lymph and lymphatic system, composition, formation and circulation.
b. Spleen: structure and functions, Disorders
c. Disorders of lymphatic system (definition only)

6. **Cardiovascular system**
    a. Anatomy and functions of heart
    b. Blood vessels and circulation (Pulmonary, coronary and systemic circulation)
    c. Electrocardiogram (ECG)
    d. Cardiac cycle and heart sounds
    e. Blood pressure – its maintenance and regulation
    f. Definition of the following disorders: Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias
7. **Respiratory system**
    a. Anatomy of respiratory organs and functions
    b. Mechanism / physiology of respiration and regulation of respiration
    c. Transport of respiratory gases
    d. Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.
8. **Digestive system**
    a. Anatomy and physiology of GIT
    b. Anatomy and functions of accessory glands of GIT
    c. Digestion and absorption
    d. Disorders of GIT (definitions only)
9. **Nervous system**
    a. Definition and classification of nervous system
    b. Anatomy, physiology and functional areas of cerebrum
    c. Anatomy and physiology of cerebellum
    d. Anatomy and physiology of mid brain
    e. Thalamus, hypothalamus and Basal Ganglia
    f. Spinal card: Structure and reflexes – mono-poly-planter
    g. Cranial nerves – names and functions
    h. ANS – Anatomy and functions of sympathetic and parasympathetic N.S.
10. **Urinary system**
    a. Anatomy and physiology of urinary system

b. Formation of urine
c. Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance
d. Clearance tests and micturition

12. Endocrine system

a. Pituitary gland
b. Adrenal gland
c. Thyroid and Parathyroid glands
d. Pancreas and gonads

13. Reproductive system

a. Male and female reproductive system
b. Their hormones – Physiology of menstruation
c. Spermatogenesis and Oogenesis
d. Sex determination (genetic basis)
e. Pregnancy and maintenance and parturition
f. Contraceptive devices

14. Sense organs

a. Eye
b. Ear
c. Skin
d. Tongue and Nose

15. Skeletal muscles

a. Histology
b. Physiology of Muscle contraction
c. Physiological properties of skeletal muscle and their disorders (definitions)

16. Sports physiology

a. Muscles in exercise, Effect of athletic training on muscles and muscle performance,
b. Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise
c. Drugs and athletic

PDP 2101 - HUMAN ANATOMY AND PHYSIOLOGY (PRACTICAL)

Practical: 3 Hrs. /Week

General Requirements: Dissection box, Laboratory Napkin, muslin cloth, record, Observation book (100 pages), Stationary items, Blood lancet.

Scope and Objectives: This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding both homeostasis mechanisms and homeostatic imbalances of various body systems. Since medicament, which is produced by pharmacist, isused to correct the deviations in human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

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

- Describe the structure (gross and histology) and functions of various organs of the human body;
- Describe the various homeostatic mechanisms and their imbalances of various systems;
- Identify the various tissues and organs of the different systems of the human body;
- Perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;
- Appreciate coordinated working pattern of different organs of each system; and
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

Course Outcomes: After completion of course students will be able to

- **CO01:** Acquire the knowledge about the interlinked mechanisms of different organs of each system in the maintenance of normal functioning (homeostasis) of the human body.
- **CO02:** Understand and identify the structure of human anatomy and organization of tissues, organs, and systems.
- **CO03:** Understand the structure (gross histology) and physiology of various organs and systems of the human body.
- **CO04:** Create the proficiency in the use of appropriate laboratory techniques to examine anatomical structures or physiological functions, blood group determination, Hb estimation, blood pressure measurement, etc. for human health
- **CO05:** Effectively communicate their findings and interpretations through written reports, and discussions, using appropriate terminology.

Course materials:

Text books

1. Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.

Reference books

1. Ranade VG, Text book of practical physiology, Latest edition, Publisher: PVG, Pune Anderson Experimental Physiology, Latest edition, Publisher: NA

List of Experiments:

1. Study of tissues of human body

a. Epithelial tissue.
b. Muscular tissue.

2. Study of tissues of human body
   a. Connective tissue.
   b. Nervous tissue.
3. Study of appliances used in hematological experiments.
4. Determination of W.B.C. count of blood.
5. Determination of R.B.C. count of blood.
6. Determination of differential count of blood.
7. Determination of
   a. Erythrocyte Sedimentation Rate.
   b. Hemoglobin content of Blood.
   c. Bleeding time and Clotting time.
8. Determination of
   a. Blood Pressure.
   b. Blood group.
9. Study of various systems with the help of charts, models and specimens
   a. Skeleton system part I-axial skeleton.
   b. Skeleton system part II- appendicular skeleton.
   c. Cardiovascular system.
   d. Respiratory system
   e. Digestive system.
   f. Urinary system.
   g. Nervous system.
   h. Special senses.
   i. Reproductive system
10. Study of different family planning appliances.
11. To perform pregnancy diagnosis test.
12. Study of appliances used in experimental physiology.
13. To record simple muscle curve using gastroenemius sciatic nerve preparation.
14. To record simple summation curve using gastroenemius sciatic nerve preparation.
15. To record simple effect of temperature using gastroenemius sciatic nerve preparation.
16. To record simple effect of load and after load using gastroenemius sciatic nerve preparation.
17. To record simple fatigue curve using gastroenemius sciatic nerve preparation.

Scheme of Practical Examination:

	Sessional	**Annual**
Identification	04	10
Synopsis	04	10

Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL4102 - PHARMACEUTICS (THEORY)

Theory: 2 Hrs/ Week

Scope and objectives: This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.

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

- know the formulation aspects of different dosage forms;
- do different pharmaceutical calculation involved in formulation;
- formulate different types of dosage forms; and
- Appreciate the importance of good formulation for effectiveness.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the art of formulating pharmaceutical monophasic formulations as per industry requirement
- **CO02:** Critically understand the formulation of biphasic formulations.
- **CO03:** Analyse the evaluation parameters used for the quality of the various formulatuion.
- **CO04: I**dentify the use of various exciepienct on various poperties of formulations.
- **CO05:** Understand the accurate pharmaceutical calculations for medication preparation and dispensing.

Course materials:

Text books

1. Cooper and Gunn's Dispensing for pharmacy students.
2. A text book Professional Pharmacy by N.K. Jain and S.N. Sharma.

Reference books

1. Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
2. Remington's Pharmaceutical Sciences.
3. Register of General Pharmacy by Cooper and Gunn.
4. General Pharmacy by M.L.Schroff.

Syllabus

1. a. Introduction to dosage forms - classification and definitions
   b. Prescription: definition, parts and handling
   c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.
2. Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.
3. Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary, structure of Monograph and details of pharmaceutical testing.
4. Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.
5. 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.
6. 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.
7. Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.
8. Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.
9. Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.
10. Pharmaceutical calculations related to dosages forms mentioned above (CI, angle of repose, displacement value etc.)
11. Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.
12. Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.

PDP 2102 - PHARMACEUTICS (PRACTICAL)

Practical: 3 Hrs./Week

Scope and objectives: This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.

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

- know the formulation aspects of different dosage forms;
- do different pharmaceutical calculation involved in formulation;
- formulate different types of dosage forms; and
- Appreciate the importance of good formulation for effectiveness.

Course Outcomes: After completion of course students will be able to

- **CO01:** Demonstrate about pharmacy history and pharmacy profession.
- **CO02:** Read different parts of prescription and analysing dose adjustments.
- **CO03:** Understand various pharmaceutical monodisperse dosage forms.
- **CO04:** Understand various pharmaceutical biphasic dosage forms.
- **CO05:** Understand pharmaceutical mathematical calculations
- **CO06:** Understand the need and formulation of suppositories, galenicals and surgical dressings as per industry requirements.

List of Experiments:

1. **Syrups**
   a. Simple Syrup I.P
   b. Syrup of Ephedrine HCl NF
   c. Syrup vasaka IP
   d. Syrup of ferrous Phosphate IP
   e. Orange Syrup
2. **Elixir**
   a. Piperizine citrate elixir BP
   b. Cascara elixir BPC
   c. Paracetamol elixir BPC
3. **Linctus**
   a. Simple Linctus BPC
   b. Pediatric simple Linctus BPC
4. **Solutions**
   a. Solution of cresol with soap IP
   b. Strong solution of ferric chloride BPC
   c. Aqueous Iodine Solution IP
   d. Strong solution of Iodine IP
   e. Strong solution of ammonium acetate IP
5. **Liniments**
   a. Liniment of turpentine IP*
   b. Liniment of camphor IP
6. **Suspensions***
   a. Calamine lotion
   b. Magnesium Hydroxide mixture BP
7. **Emulsions***
   a. Cod liver oil emulsion
   b. Liquid paraffin emulsion
8. **Powders**
   a. Eutectic powder
   b. Explosive powder
   c. Dusting powder
   d. Insufflations

9. **Suppositories**
    a. Boric acid suppositories
    b. Chloral suppositories
10. **Incompatibilities**
    a. Mixtures with Physical
    b. Chemical and Therapeutic incompatibilities

* Colourless bottles required for dispensing Paper envelope (white), butter paper and white paper required for dispensing.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4103 - MEDICINAL BIOCHEMISTRY (THEORY)

Theory: 3 Hrs/Week

Scope of the Subject: Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.

Objectives of the Subject (Know, do, appreciate):

The objective of the present course is providing biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –

- understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases;
- know the metabolic process of biomolecules in health and illness (metabolic disorders);
- understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism;
- know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
- Do the qualitative analysis and determination of biomolecules in the body fluids.

Course Outcomes: After completion of course students will be able to

- **CO01:** Develop a solid understanding of the fundamental concepts of biochemistry within pharmaceutical sciences, enhancing their ability to understand the biochemical basis of drug action, metabolism, and the physiological effects of drugs on the human body, with an emphasis on promoting good health and well-being.
- **CO02:** Acquire a comprehensive understanding of the metabolic pathways involved in the metabolism of carbohydrates, lipids, proteins, amino acids, and nucleic acids, and learn to relate these pathways to various metabolic disorders, thereby contributing to the prevention and management of non-communicable diseases in support of healthy lives.
- **CO03:** Develop the skills to apply biochemical knowledge in clinical settings, enabling them to interpret laboratory results, understand metabolic disorders, and make informed decisions regarding patient care and therapeutic interventions, fostering quality healthcare and responsible consumption and production.
- **CO04:** Apply biochemical principles to clinical scenarios by performing and interpreting various eco-friendly diagnostic tests related to kidney and liver function, lipid profiles, and electrolyte balance, thereby linking biochemical knowledge to clinical practice in a manner that supports sustainable healthcare practices.
- **CO05:** Apply their biochemical knowledge ethically and professionally in the practice of pharmacy, ensuring they consider the biochemical implications of drug therapies on individual patients, particularly in the context of personalized medicine and innovation within the pharmaceutical industry.

Text books (Theory)

1. Harpers review of biochemistry - Martin
2. Text book of biochemistry – D. Satyanarayana
3. Text book of clinical chemistry- Alex kaplan and Laverve L. Szabo

Reference books (Theory)

1. Principles of biochemistry -- Lehninger
2. Text book of biochemistry -- Ramarao
3. Practical Biochemistry-David T.Plummer.
4. Practical Biochemistry-Pattabhiraman.

Syllabus

Topics

1. **Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.
2. **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.
3. **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.

4. **Lipid metabolism:** Oxidation of saturated (-oxidation); Ketogenesis and ketolysis; biosynthesisof fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).
5. **Biological oxidation:** Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;
6. **Protein and amino acid metabolism:** protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination and decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.
7. **Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.
8. **Introduction to clinical chemistry: Cell**; composition; malfunction; Role of the clinical chemistry laboratory.
9. **The kidney function tests:** Role of kidney; Laboratory tests for normal function includes-
    a) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative 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)
10. **Liver function tests:** Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation.
    a) Test for hepatic dysfunction-Bile pigments metabolism.
    b) Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen.
    c) Dye tests of excretory function.
    d) Tests based upon abnormalities of serum proteins.

Selected enzyme tests:

11. **Lipid profile tests:** Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.
12. **Immunochemical techniques:** for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)
13. **Electrolytes:** Body water, compartments, water balance, and electrolyte distrubution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.

PDP 2103 - MEDICINAL BIOCHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Scope of the Subject: Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.

Objectives of the Subject (Know, do, appreciate):

The objective of the present course is providing biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –

- understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases;
- know the metabolic process of biomolecules in health and illness (metabolic disorders);
- understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism;
- know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
- Do the qualitative analysis and determination of biomolecules in the body fluids.

Course Outcomes: After completion of course students will be able to

- **CO01:** Be proficient in basic laboratory techniques relevant to medicinal biochemistry, including pipetting, solution preparation, and laboratory safety protocols
- **CO02:** Acquire knowledge on biochemical assays to analyze the activity of enzymes and other biomolecules relevant to understand the pathological conditions and diseases.
- **CO03:** Apply knowledge of qualitative and quantitative estimation of the biological macromolecules.
- **CO04:** Understand data interpretation emanating from a Clinical Test Lab.
- **CO05:** Understand the physiological conditions that influence the structures and reactivity's of biomolecules.

List of Experiments:

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. Quantitative estimation of serum cholesterol by Libermann Burchard's method.**
8. Preparation of Folin Wu filtrate from blood.*
9. Quantitative estimation of blood creatinine.**
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**
16. Determination of Glucose by means of Glucoseoxidase.**
17. Enzymatic hydrolysis of Glycogen/Starch by Amylases.**
18. Study of factors affecting Enzyme activity. (pH and Temp.)**
19. Preparation of standard buffer solutions and its pH measurements (any two)*
20. Experiment on lipid profile tests**
21. Determination of sodium,calcium and potassium in serum.**
22. Determination of effect of pH, temperature and electrolyte on salivary amylase. **

** indicate major experiments and * indicate minor experiments

Assignments:

Format of the assignment

1. Minimum and Maximum number of pages.
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-

voce and record maintenance).

PDL 4104 - PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)

Theory: 3 Hrs. /Week

Scope and objectives: This course is designed to impart a very good 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 Outcomes: After completion of course students will be able to

- **CO01:** Detect and analyse the structures, physical properties, acid-base theories and isomerism of organic compounds
- **CO02:** Interpret the IUPAC system of nomenclature of simple organic compounds belonging to different classes of organic compounds.
- **CO03:** Conclude nucleophilic substitution reactions, electrophilic substitution reactions and free radical chain reactions with mechanism, stereochemistry and orientation of the reaction, reactions of carbon carbon double bond, order of reactivity and stability of compounds.
- **CO04:** Deduce electrophilic addition, free radical addition, elimination reactions, oxidation and reduction reactions with mechanism, stereochemistry and orientation of the reaction, order of reactivity, stability of compounds.
- **CO05:** Demonstrate the mechanisms involved in various named reactions and methods of preparation, test for purity, principle involved in the assay, medicinal uses of some important organic compounds.

Course materials:

Text books

1. T.R.Morrison and R. Boyd - Organic chemistry,
2. Bentley and Driver-Text book of Pharmaceutical chemistry
3. I.L.Finer- Organic chemistry, the fundamentals of chemistry

Reference books

1. Organic chemistry – J.M. Cram and D.J. Cram
2. Organic chemistry- Brown
3. Advanced organic chemistry- Jerry March, Wiley
4. Organic chemistry- Cram and Hammered, Pine Hendrickson

Syllabus

1. 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

2. 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.
3. Free radicals chain reactions of alkane : Mechanism, relative reactivity and stability
4. Alicyclic compounds : Preparations of cycloalkanes, Bayer strain theory and orbital picture of angle strain.
5. Nucleophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN_2 reactions. Stereochemistry and steric 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 solvolyses, nucleophilic assistance by the solvents.
6. Dehydrohalogenation 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.
7. Electrophillic and free radicals addition: Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radicals additon, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.
8. Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.
9. Theory of resonance: Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophyllic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyper conjugation, nucleophilic substitution in allylic substrate, SN2 nucleophilic substituion in vinylic substrate, vinylic cation, 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.
10. Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration,

sulphonation, halogenation, friedel craft alkylation, friedel 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 halogination of alkyl benzene, resonance stabilization of benzyl radical.

11. Nucleophilic substitution 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 caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.
12. 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.
13. 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.
14. Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.
15. Oxidation reduction reaction.
16. Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, 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.

PDP 2104 - PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs/Week

Scope and objectives: This course is designed to impart a very good 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/ nucleophilic [alkyl/ acyl/ aryl] /electrophilic substitution, free radical/ Nucleophilic / electrophilic 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 Outcomes: After completion of course students will be able to

- **CO01:** Apply various laboratory techniques such as distillation, recrystallization, melting and boiling point.
- **CO02:** Practice the use of stereo models in studying isomerism and assigning configuration to various organic compounds.

•**CO03:** Propose the methods for the synthesis, purity, and analysis for identification and confirmation of hydrocarbons and organic compounds.

List of Experiments:

I. Introduction to the various laboratory techniques through demonstration involving synthesisof the following compounds (at least 8 compounds to be synthesized):

1. Acetanilde / aspirin (Acetylation)
2. Benzanilide / Phenyl benzoate (Benzoylation)
3. P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination)
4. Dibenzylidene acetone (Condensation)
5. 1-Phenylazo-2-napthol (Diazotisation and coupling)
6. Benzoic acid / salicylic acid (Hydrolysis of ester)
7. M-dinitro benzene (Nitration)
8. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde
9. M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene
10. Benzophenone oxime
11. Nitration of salicylic acid
12. Preparation of picric acid
13. Preparation of O-chlorobenzoic acid from O-chlorotolune
14. Preparation of cyclohexanone from cyclohexanol

II. Identification of organic compounds belonging to the following classes by :

Systematic qualitative organic analysis including preparation of derivatives Phenols, amides, carbohydrates, amines, carboxylic acids, aldehyde and ketones, Alcohols, esters, hydrocarbons, anilides, nitrocompounds.

III. Introduction to the use of stereo models:

Methane, Ethane, Ethylene, Acetylene, Cis-alkene, Trans-alkene, inversion of configuration.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4105 - PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)

Theory: 2 Hrs. /Week

Scope and objectives: This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.

Upon completion of the course student shall be able to:

- understand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals;
- know the analysis of the inorganic pharmaceuticals their applications; and
- Appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand and apply the principles of analytical chemistry and procedures of analysis of drugs as per industry requirement.
- **CO02:** Apply and understand the applications of various techniques i.e. volumetric and gravimetric analysis.
- **CO03:** Analyze the sources of errors, limit tests and methods to determine the impurities in inorganic drugs and pharmaceuticals.
- **CO04:** Understand about radiopharmaceuticals, their applications and certain miscellaneous agents such as sclerosing agents, expectorants, sedative, antidotes and respiratory stimulants.

- **CO05:** Understand the medicinal and pharmaceutical importance of inorganic compounds and appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease

Course materials:

Text books

1. A text book Inorganic medicinal chemistry by Surendra N. Pandeya
2. A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical chemistry Vol -I and Vol-II
3. Inorganic Pharmaceutical Chemistry III-Edition P.Gundu Rao

Reference books

1. Inorganic Pharmaceutical Chemistry by Anand and Chetwal
2. Pharmaceutical Inorganic chemistry by Dr.B.G.Nagavi
3. Analytical chemistry principles by John H. Kennedy
4. I.P.1985 and 1996, Govt. of India, Ministry of health

Syllabus

1. Errors

Errors in quantitative analysis, classification of errors, concept of accuracy and precision, treatment of analytical results.

2. Volumetric analysis

Principle of volumetric analysis, different methods of analysis, different methods for expressing concentrations of solutions, primary and secondary standards.

3. 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.

4. Redox titrations

Concepts of oxidation–reduction reactions, redox reactions, theory of redox titrations, redox indicators, iodometry and iodimetry, titrations involving cerric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride.

5. Non aqueous titration

Theoretical basis, types of solvents, preparations and standardization of titrant solutions, titration of weak acid, weak bases and indicators. standardization of perchloric acid, lithium and sodium methoxide, tetra butyl ammonium hydroxide.

6. Precipitation titrations

Introduction, types of precipitation titrations, end point detection.

7. Complexometric titrations

Introduction, principle, types of titrations, endpoint detection.

8. Theory of Indicators

9. Gravimetry

Basic concepts, Precipitation techniques, co- precipitation, post–precipitation, various steps involved in gravimetric analysis, pharmaceutical applications.

10. Limit tests

Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, lead and heavy metals.

11. Medicinal Gases

Preparation and uses of the following Oxygen, Carbon dioxide, Helium, Nitrogen and Nitrous Oxide.

Method of preparation, assay, storage conditions and uses of inorganic compounds listed in I.P belonging to the following categories.

12. Acidifiers

Dilute hydrochloric acid, Sodium phosphate, Ammonium chloride.

13. Antacids

Classification, Qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity, Sodium bicarbonate, Potassium citrate, 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.

14. Cathartics

Magnesium hydroxide, Magnesium sulphate, Magnesium carbonate and Sodium phosphate.

15. Electrolyte replenisher

Electrolytes used for replacement therapy : Sodium chloride, Potassiu m 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.

16. Essential Trace elements

Definition, Physiological role of Iron, Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine.

17. Antimicrobials

Hydrogen Peroxide, Potassium Permanganate, Chlorinated Lime, Iodine, Boric Acid, Silver Nitrate, Selenium Sulphide.

18. 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.

19. Dental products

Anti-caries agents: Role of Fluorides as anti - caries agents, Sodium fluoride.

Dentifrices: Calcium carbonate, dibasic calcium phosphate, Zinc chloride.

20. 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.

21. Radiopharmaceuticals.

Introduction, measurement of radioactivity, clinical applications and dosage, hazards and Precautions

PDP 2105 - PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./ Week

Scope and objectives: This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.

Upon completion of the course student shall be able to:

- understand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals;
- know the analysis of the inorganic pharmaceuticals their applications; and
- Appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

Course Outcomes: After completion of course students will be able to

- **CO01:** Create and apply the limit test experimentation for various inorganic compounds.
- **CO02:** Expertise in preparation of different strengths of solutions.
- **CO03:** Evaluate identification, analysis and purity determination of various drugs and inorganic pharmaceuticals as per industry needs.
- **CO04:** Understand the volumetric analysis and estimation of mixtures such as Sodium hydroxide and sodium carbonate; Boric acid and Borax and Oxalic acid and sodium oxalate

List of Experiments:

1. **Limit test (6 exercises)**
    a. Limit test for chlorides
    b. Limit test for sulphates
    c. Limit test for iron
    d. Limit test for heavy metals
    e. Limit test for arsenic
    f. Modified limit tests for chlorides and sulphates
2. **Assays (10 exercises)**
    a. Ammonium chloride- Acid-base titration
    b. Ferrous sulphate- Cerimetry
    c. Copper sulpahte- Iodometry
    d. Calcilugluconate- Complexometry
    e. Hydrogen peroxide – Permanganometry
    f. Sodium benzoate – Nonaqueous titration
    g. Sodium chloride – Modified volhard's method
    h. Assay of KI – KIO_3 titration
    i. Gravimetric estimation of barium as barium sulphate

j. Sodium antimony gluconate or antimony potassium tartarate

3. **Estimation of mixture (Any two exercises)**
   a. Sodium hydroxide and sodium carbonate
   b. Boric acid and Borax
   c. Oxalic acid and sodium oxalate
4. **Test for identity (Any three exercises)**
   a. Sodium bicorbonate
   b. Barium sulphate
   c. Ferrous sulphate
   d. Potassium chloride
5. **Test for purity (Any two exercises)**
   a. Swelling power in Bentonite
   b. Acid neutralising capacity in aluminium hydroxide gel
   c. Ammonium salts in potash alum
   d. Adsorption power heavy Kaolin
   e. Presence of Iodates in KI
6. **Preparations (Any two exercises)**
   a. Boric acids
   b. Potash alum
   c. Calcium lactate
   d. Magnesium suphate

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment1and 2	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4106 - REMEDIAL MATHEMATICS (THEORY)

Theory: 3 Hrs. /Week

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

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

- Know Trigonometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
- solve the problems of different types by applying theory; and
- appreciate the important applications of mathematics in pharmacy.

Course Outcomes: After completion of course students will be able to:

- **CO01**: Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.
- **CO02**: Create, use and analyze mathematical representations and mathematical relationships
- **CO03**: Communicate mathematical knowledge and understanding to help in the field of Clinical Pharmacy
- **CO04**: Perform abstract mathematical reasoning

Course materials:

Text books

1. Differential calculus By Shantinarayan
2. Text book of Mathematics for second year pre-university by Prof.B.M.Sreenivas

Reference books

1. Integral calculus By Shanthinarayan
2. Engineering mathematics By B.S.Grewal
3. Trigonometry Part-I By S.L.Loney

Syllabus

Topics

1. **Algebra :** Determinants, Matrices
2. **Trigonometry :** Sides and angles of a triangle, solution of triangles
3. **Analytical Geometry :**Points, Straight line, circle, parabola
4. **Differential calculus:** Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables
5. **Integral Calculus:** Definite integrals, integration by substitution and by parts, Properties of definite integrals.
6. **Differential equations:** Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneouslinear equation of second order.

7. **Laplace transform:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting.

PDL 4107 - BIOLOGY (THEORY)

Theory: 3 Hrs. /Week

Scope and objectives: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the cell biology (Basic Nature of Plant cell and Animal cell)
- **CO02:** Classify the both Plants & Animals system
- **CO03:** Demonstrate tissue system and organ system in plant and animals
- **CO04:** Analyze the theory of evolution and various types of poisonous animals and their pathogenic effects.
- **CO05:** Understand the physiology of plants and animals with the medicinal uses of plants.

Course materials:

Text books

1. Text book of Biology by S.B. Gokhale
2. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C. Dutta.
4. Outlines of Zoology by M. Ekambaranatha ayyer and T.N. Ananthakrishnan.
5. A manual for pharmaceutical biology practical by S.B.Gokhale and C.K. Kokate.

Syllabus

PART – A

01 Introduction
02 General organization of plants and its inclusions
03 Plant tissues
04 Plant kingdom and its classification
05 Morphology of plants
06 Root, Stem, Leaf and Its modifications
07 Inflorescence and Pollination of flowers
i. Morphology of fruits and seeds
ii. Plant physiology
10 Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae

11 Studies of Fungi, Yeast, Penicillin and Bacteria

PART-B

01 Study of Animal cell
02 Study animal tissues
03 Detailed study of frog
04 Study of Pisces, Raptiles, Aves
05 Genearal organization of mammals
06 Study of poisonous animals

PDP 2107 - BIOLOGY (PRACTICAL)

Practical: 3 Hrs/Week

Scope and objectives: This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the cell biology (Basic Nature of Plant cell)
- **CO02:** Knowledge of plants physiological experiments
- **CO03:** Understand the various tissue, system and organ system in plant and animals
- **CO04:** Proficient in transverse section of various natural drugs
- **CO05:** Identify various plant parts along with its modifications

List of Experiments:

1. Introduction of biology experiments
2. Study of cell wall constituents and cell inclusions
3. Study of Stem modifications
4. Study of Root modifications
5. Study of Leaf modifications
6. Identification of Fruits and seeds
7. Preparation of Permanent slides
8. T.S. of Senna, Cassia, Ephedra, Podophyllum.
9. Simple plant physiological experiments
10. Identification of animals
11. Detailed study of Frog
12. Computer based tutorials

Scheme of Practical Examination:

	Sessional	**Annual**
Identification	04	10

Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance.

SECOND YEAR

PDL 4201 - PATHOPHYSIOLOGY (THEORY)

Theory: 3 Hrs. /Week

Scope of the Subject: This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subject of pharmacy.

Objectives of the Subject: Upon completion of the subject student shall be able to –

- describe the etiology and pathogenesis of the selected disease states;
- name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply the basic pathogenesis of different disorders, signs and symptoms of the diseases, complications of the diseases.
- **CO02:** Apply the concepts of disease etiology, risk factors, causative agents, micro-organisms of infectious disorders, life cycle of important pathogens
- **CO03:** Understand various laboratory tests, diagnostic procedures, normal and pathological values of different biomarkers, significance and interpretation
- **CO04:** Correlate between the pathogenesis of diseases and clinical applications to inhibit mortality and morbidity

Course Material:

Text books

1. Pathologic basis of disease by- Cotran, Kumar, Robbins
2. Text book of Pathology- Harsh Mohan
3. Text book of Pathology- Y.M. Bhinde

Reference books

1. Clinical Pharmacy and Therapeutics; Second edition; Roger Walker; Churchill Livingstone publication

Syllabus

1. Basic principle of cell injury and Adaptation

a. Causes, Pathogenesis and morphology of cell injury
b. Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen infiltration and glycogen infiltration and glycogen storage diseases

2. Inflammation

a. Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of

chronic inflammation

b. Repairs of wounds in the skin, factors influencing healing of wounds

3. Diseases of Immunity

a. Introduction to Tand B cells
b. MHC proteins or transplantation antigens
c. Immune tolerance
    a. Hypersensitivity: Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs
    b. Autoimmunity: Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft.
    c. Acquired immune deficiency syndrome (AIDS)
    d. Amylodosis

4.**Cancer:** 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, etiology and pathogenesis of cancer.

5. Types of shock, mechanisms, stages and management
6. Biological effects of radiation
7. Environmental and nutritional diseases
    a. Air pollution and smoking- SO2,NO, NO2, and CO
    b. Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.
8. Pathophysiology of common diseases
    a. Parkinsonism
    b. Schizophrenia
    c. Depression and mania

d. Hypertension,
e. Stroke (ischaemic and hemorrhage)
f. Angina, CCF, Atherosclerosis, Myocardial infarction
g. Metabolic disorders: Diabetes Mellitus & Thyroid disorders
h. Peptic ulcer and inflammatory bowel diseases
i. Cirrhosis and Alcoholic liver diseases
j. Acute and chronic renal failure
k. Asthma and chronic obstructive airway diseases
l. Disorders of joints: arthritis

9. Infectious diseases: Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis.

Assignments:

List of Experiments:

1. Chemical Mediators of inflammation
2. Drug Hypersensitivity
3. Cigarette smoking & its ill effects
4. Biological Effects of Radiation
5. Etiology and hazards of obesity
6. Complications of diabetes
7. Diagnosis of cancer
8. Disorders of vitamins
9. Methods in Pathology-Laboratory values of clinical significance
10. Pathophysiology of Dengue Hemorrhagic Fever (DHF)

Format of the assignment

1 Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year
4. It shall be computer draft copy.
5. Name and signature of the student

Time allocated for presentation may be 8+2 Min.

PDL 4202 - PHARMACEUTICAL MICROBIOLOGY (THEORY)

Theory: 3 Hrs /Week

Scope of the Subject: Microbiology has always been an essential component of pharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology, which is expected to change the complete drug product scenario in the future.

This course deals with the various aspects of microorganisms, its classification, morphology, laboratory cultivation identification and maintenance. Its 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.

Objectives of the Subject:

Upon completion of the subject student shall be able to –

- know the anatomy, identification, growth factors and sterilization of microorganisms;
- know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect;
- do estimation of RNA and DNA and there by identifying the source;
- do cultivation and identification of the microorganisms in the laboratory;
- do identification of diseases by performing the diagnostic tests; and
- Appreciate the behavior of motility and behavioral characteristics of microorganisms.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply the knowledge to understand, identify and study the comparative characteristics of prokaryotes and eukaryotes, with special emphasis on structural similarities and differences among various physiological groups of bacteria/archaea, fungi and virus.
- **CO02:** Know microbial techniques for cultivation, isolation and identification of pure cultures of bacteria and know the various physical and chemical growth requirements.
- **CO03:** Explain different methods of sterilization their and applications in pharmaceutical microbiology.
- **CO04:** Apply the basic knowledge of immunological processes and contrast the key mechanisms of innate and adaptive immunity, concepts of antibody and antigen - antibody reactions. Define the terms bacterial vaccines, toxoids, immunization programme, importance of booster dose.
- **CO05:** Estimate potency of antibiotic by various microbial assay.
- **CO06:** Apply the knowledge related to pathogenesis, modes of transmission for the treatment and control of infectious diseases, along with understanding principles and procedure of various diagnostic tests for diseases.

Course material:

Text books

1. Vanitha Kale and Kishor Bhusari — Applied Microbiology ‖ Himalaya Publishing house Mumbai.
2. Mary Louis Turgeon — Immunology and Serology in Laboratory Medicines‖ 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.
3. Harsh Mohan, — Text book of Pathology‖ 3rd edition, 1998, B-3 Ansari road Darya ganj N. Delhi.

Reference books

1. Prescot L.M., Jarley G.P Klein D.A —Microbiology‖ 2nd- edition Mc Graw Hill Company Inc
2. Rawlins E.A.‖Bentley's Text Book of Pharmaceutics‖ B ailliere Tindals 24-28 London 1988
3. Forbisher — Fundamentals of Microbiology‖ Philidelphia W.B. Saunders.
4. Prescott L.M. Jarley G.P., Klein.D.A. — Microbiology.‖2nd edition WMC Brown Publishers, Oxford. 1993
5. War Roitt, Jonathan Brostoff, David male, — Immunology‖3rd edition 1996, Mosby-year book Europe Ltd, London.
6. Pharmacopoeia of India, Govt of India, 1996

Syllabus

1. Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them.
2. Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae, Spirochetes.
3. Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures.
4. Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria -Total and Viable counting techniques.
5. Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations. Brief information on Validation. Sterilization of products, process and facilities.
6. Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations.
7. Immunology- Immunity, Definition, Classification, General principles of natural immunity, Phagocytosis, acquired immunity (active and passive) . Antigens, chemical nature of antigens structure and formation of Antibodies, Antigen-Antibody reactions. Bacterial exotoxins and endotoxins. Significance of toxoids in active immunity, Immunization programme, and importance of booster dose.
8. Diagnostic tests: Schick's Test, Elisa test, Western Blot test, Southern Blot PCRWidal, QBC, Mantaux Peripheral smear. Study of malaria parasite.
9. Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and

vitamin B_2 and B_{12}. Standardisation of vaccines and sera.

10. Study of infectious diseases: Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV.

PDP 2202 - PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)

Practical: 3 Hrs/ Week

Scope of the Subject: Microbiology has always been an essential component of pharmacy curriculum. This is because of the relevance of microbiology to pharmaceutical sciences and more specifically to pharmaceutical industry. Pharmaceutical biotechnology is the logical extension of pharmaceutical microbiology, which is expected to change the complete drug product scenario in the future.

This 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.

Objectives of the Subject:

Upon completion of the subject student shall be able to –

- know the anatomy, identification, growth factors and sterilization of microorganisms;
- know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect;
- do estimation of RNA and DNA and there by identifying the source;
- do cultivation and identification of the microorganisms in the laboratory;
- do identification of diseases by performing the diagnostic tests; and
- Appreciate the behavior of motility and behavioral characteristics of microorganisms.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply techniques for the growth and control of microbes as well as different bacteriological techniques involved in microbiology.
- **CO02:** Identify of unknown bacteria and microbes responsible for different diseases through various staining techniques and biochemical tests
- **CO03:** Isolate specific stains of bacteria from mixed cultures and preserve them for long durations
- **CO04:** Apply and perform various sterilization techniques to maintain aseptic conditions and adhere to GLP.

List of Experiments:

1. Study of apparatus used in experimental microbiology*.
2. Sterilization of glass ware's. Preparation of media and sterilisation.*

3. Staining techniques – Simple staining ; Gram's staining ; Negative staining**
4. Study of motility characters*.
5. Enumeration of micro-organisms (Total and Viable)*
6. Study of the methods of isolation of pure culture.*
7. Bio chemical testing for the identification of micro-organisms.
8. Cultural sensitivity testing for some micro-organisms.*
9. Sterility testing for powders and liquids.*
10. Determination of minimum inhibitory concentration.*
11. Microbiological assay of antibiotics by cup plate method.*
12. Microbiological assay of vitamins by Turbidometric method**
13. Determination of RWC.**
14. Diagnostic tests for some common diseases, Widal, malarial parasite.**

* Indicate minor experiment & ** indicate major experiment

Assignments:

1 Visit to some pathological laboratories & study the activities and equipment/instruments used and reporting the same
2. Visit to milk dairies (Pasteurization) and microbial laboratories (other sterilization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments
   a. Report of recent microbial techniques developed in diagnosing some commondiseases.
   b. Latest advancement developed in identifying, cultivating & handling of microorganisms.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. It shall be computer draft copy.
3. Reference(s) shall be included at the end.
4. Name and signature of the student.
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4203 - PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)

Theory: 3 Hrs /Week

Scope and objectives: This subject has been introduced for the pharmacy course in order to make 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.

Upon completion of the course student shall be able to:

- understand the basic principles of cultivation, collection and storage of crude drugs;
- know the source, active constituents and uses of crude drugs; and
- Appreciate the applications of primary and secondary metabolites of the plant.

Course Outcomes: After completion of course students will be able to

CO01: Apply the knowledge about the basic concepts related to the history, applications of pharmacognosy, classification, sources, macroscopy and microscopy of crude plant drugs in their aukthentication and quality assurance

CO02: Describe the fundamental principles on cultivation, collection, processing and evaluation of medicinal plants.

CO03: Recognize basic features of plant cell, different cell inclusion and cell wall components.

CO04: Describe and detect adulteration of crude drugs using morphological, microscopical, chemical and physical methods of evaluation.

CO05: Discuss regarding natural pesticides and their sources; describe the various plant fibers used in surgical dressings and related products.

CO06: Apply knowledge related to primary and secondary plant metabolites (lipids, proteins, carbohydrates, alkaloids, flavonoids, terpenes, volatile oils, tannins, resins) with emphasis on their classification, detection and extraction.

Course materials:

Text books

1. Pharmacognosy by G.E. Trease & W.C.Evans.
2. Pharmacognosy by C.K.Kokate,Gokhale & A.C.Purohit.

Reference books

1. Pharmacognosy by Brady &Tyler.E.
2. Pharmacognosy by T.E.Wallis.
3. Pharmacognosy by C.S. Shah & Qadery.
4. Pharmacognosy by M.A. Iyengar.

Syllabus

Topics

1. Introduction.
2. Definition, history and scope of Pharmacognosy.
3. Classification of crude drugs.
4. Cultivation, collection, processing and storage of crude drugs.
5. Detailed method of cultivation of crude drugs.
6. Study of cell wall constituents and cell inclusions.
7. Microscopical and powder Microscopical study of crude drugs.
8. Study of natural pesticides.
9. Detailed study of various cell constituents, Ergastic cell contents.
10. Carbohydrates and related products.
11. Detailed study carbohydrates containing drugs.(11 drugs)
12. Definition sources, method extraction, chemistry and method of analysis of lipids, polyphenols & flavonoids.
13. Definition, source, classification, chemistry and method of extraction of oils.
14. Definition, classification, chemistry and method of analysis of protein.
15. Study of plants fibers used in surgical dressings and related products.
16. Different methods of adulteration of crude drugs.
17. Definition, source, classification, chemistry and method of extraction of alkaloid

PDP 2203 - PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)

Practical: 3 Hrs/ Week

General Requirements: Laboratory Napkin, Observation Book 150 pages Zero brush, Needle, Blade, Match box.

Scope and objectives: This subject has been introduced for the pharmacy course in order to make 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.

Upon completion of the course student shall be able to:

- understand the basic principles of cultivation, collection and storage of crude drugs;
- know the source, active constituents and uses of crude drugs; and
- Appreciate the applications of primary and secondary metabolites of the plant.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply macroscopic , microscopic and physical techniques for quality assessment of crude plant drugs

- **CO02:** Perform chemical analysis and quality control of crude organized and unorganized drugs
- **CO03:** Perform identification tests for detection of phytoconstituents present in plant drugs
- **CO04:** Identify and know various crude plant drugs used for the treatment of various diseases

List of Experiments:

1. Introduction of 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 Cassia.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 Isapgol.
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. Determination of Iodine value.
19. Determination of Saponification value and unsaponifiable matter.
20. Determination of ester value.
21. Determination of Acid value.
22. Chemical tests for Acacia.
23. Chemical tests for Tragacanth.
24. Chemical tests for Agar.
25. Chemical tests for Starch.
26. Chemical tests for Lipids.(castor oil,sesame oil, shark liver oil,bees wax)
27. Chemical tests for Gelatin.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	04	10

Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance.

PDL4204 - PHARMACOLOGY – I (THEORY)

Theory: 3 Hrs /Week

Scope of the Subject: 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, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basicpractical knowledge relevant to therapeutics will be imparted.

Objectives of the Subject : Upon completion of the subject student shall be able to (Know, do, appreciate) –

- understand the pharmacological aspects of drugs falling under the above mentioned chapters;
- handle and carry out the animal experiments;
- appreciate the importance of pharmacology subject as a basis of therapeutics; and
- Correlate and apply the knowledge therapeutically.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply basic concepts in pharmacology in clinical settings, application of pharmacokinetic parameters in patients, classification systems, and therapeutic uses
- **CO02:** Correlate the principles of biochemistry and the pathological basis of diseases with pharmacological concepts to promote health education
- **CO03:** Apply the knowledge of mechanisms of drug action, ADR, toxicology, and drug interactions in prescription analysis and therapeutic monitoring to foster affordability
- **CO04:** Apply the pharmacological principles in therapeutics to promote public healthcare and education for sustainable development
- **CO05:** Appraise the role of pharmacologists in drug development, drug discovery, and

drug use to decrease mortality and morbidity

Course Materials:

Text books

1. Tripathi, K. D. Essentials of medical pharmacology. 4th Ed, 1999. Publisher: Jaypee, Delhi.
2. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
3. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books

1. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th Ed, 1996. Publisher Mc Graw Hill, Pergamon press.
2. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co
3. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.
4. Shargel and Leon. Applied Biopharmaceutics and pharmacokinetics. Latest edition. Publisher: Prentice Hall, London.

Syllabus

Title of the topic

1. General Pharmacology

a. Introduction, definitions and scope of pharmacology
b. Routes of administration of drugs
c. Pharmacokinetics (absorption, distribution, metabolism and excretion)
d. Pharmacodynamics
e. Factors modifying drug effects
f. Drug toxicity - Acute, sub- acute and chronic toxicity.
g. Pre-clinical evaluations
h. Drug interactions

Note: The term Pharmacology used here refers to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions and dose and route of administration.

2. Pharmacology of drugs acting on ANS

a. Adrenergic and antiadrenergic drugs
b. Cholinergic and anticholinergic drugs
c. Neuromuscular blockers
d. Mydriactics and miotics
e. Drugs used in myasthenia gravis
f. Drugs used in Parkinsonism

3. Pharmacology of drugs acting on cardiovascular system

a. Antihypertensive
b. Anti-anginal drugs
c. Anti-arrhythmic drugs
d. Drugs used for therapy of Congestive Heart Failure
e. Drugs used for hyperlipidaemias

4. Pharmacology of drugs acting on Central Nervous System

a. General anesthetics
b. Sedatives and hypnotics
c. Anticonvulsants
d. Analgesic and anti-inflammatory agents
e. Psychotropic drugs
f. Alcohol and methyl alcohol
g. CNS stimulants and cognition enhancers
h. Pharmacology of local anaesthetics

5. Pharmacology of Drugs acting on Respiratory tract

a. Bronchodilators
b. Mucolytics
c. Expectorants
d. Antitussives
e. Nasal Decongestants

6. Pharmacology of Hormones and Hormone antagonists

a. Thyroid and Antithyroid drugs
b. Insulin, Insulin analogues and oral hypoglycemic agents
c. Sex hormones and oral contraceptives
d. Oxytocin and other stimulants and relaxants

7. Pharmacology of autocoids and their antagonists

a. Histamines and Antihistaminics
b. 5-Hydroxytryptamine and its antagonists
c. Lipid derived autocoids and platelet activating factor

PDP 2204 - PHARMACOLOGY I (PRACTICAL)

Scope of the Subject: 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, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, blood and blood forming agents and renal system will be taught. In addition to theoretical knowledge, the basicpractical knowledge relevant to therapeutics will be imparted.

Objectives of the Subject : Upon completion of the subject student shall be able to (Know, do,

appreciate) –

- understand the pharmacological aspects of drugs falling under the above mentioned chapters;
- handle and carry out the animal experiments;
- appreciate the importance of pharmacology subject as a basis of therapeutics; and
- Correlate and apply the knowledge therapeutically.

Course Outcomes: After completion of course students will be able to

- **CO01:** Apply pharmacodynamic and pharmacokinetic aspects, adverse effects, and therapeutic uses to promote public healthcare
- **CO02:** Apply the knowledge of dose, route of administration, precautions, and contraindications of various drugs in clinical therapeutics
- **CO03:** Analyse pharmacological aspects of drugs used to treat diseases of different organ systems of the body to decrease mortality and morbidity
- **CO04:** Apply the principles of experimental pharmacology in drug discovery by preclinical and clinical trials
- **CO05:** Correlate the basics of pharmacology and toxicology with clinical application of pharmacotherapeutics in health education

List of Experiments:

1. Study of agonistic and antagonistic effects of drugs using Guinea -pig ileum preparation.**
2. To study the effects of drugs on intestinal motility using frog's esophagus model*
3. To study the effects of drugs using rat uterus preparation.**
4. To study the anticonvulsant property of drugs (any one model).*
5. To study antihistaminic property of drug using histamine induced anaphylactic reaction in guinea pigs.
6. To study the apomorphine-induced compulsive behaviour (stereotypy) in mice.*
7. To study the muscle relaxant property of diazepam in mice using rotarod apparatus.*
8. To study the antiinflammatory property of indomethacin against carrageenan-induced paw oedema.**
9. To study the anxiolytic effect of diazepam in mice using mirrored-chamber apparatus.**
10. To demonstrate the effect of various drugs on the blood pressure and respiration of anaesthetized dog.
11. To study the effect of anthelmintics on earthworms.
12. To study the taming effect of chlorpromazine.*
13. To study the effects of drugs on vas deferense of the male rat.**
14. To study the effect of drugs on pesticide toxicity using rats as model.
15. To study the effect of drugs on heavy metal toxicity.

** indicate major experiment & * indicate minor experiment

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4205 - COMMUNITY PHARMACY (THEORY)

Theory: 2 Hrs. /Week

Scope: In the changing scenario of pharmacy practice in India, 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 counselling, health screening services for improved patient care in the community set up.

Objectives: Upon completion of the course, the student shall be able to –

- know pharmaceutical care services;
- know the business and professional practice management skills in community pharmacies;
- do patient counselling & provide health screening services to public in community pharmacy;
- respond to minor ailments and provide appropriate medication;
- show empathy and sympathy to patients; and
- appreciate the concept of Rational drug therapy.

Course Outcomes: After completion of course students will be able to

- **CO01:** Demonstrate the ability to provide patient-centered care to diverse patients by devising, modifying, implementing, documenting, and monitoring evidence-based pharmacotherapy care plans, independently or in collaboration with healthcare teams, while considering patient circumstances.
- **CO02:** Apply knowledge of business management, professional practice skills, and digital pharmacy tools (e.g., telepharmacy, inventory management software) to effectively operate community pharmacies.

- **CO03:** Exhibit proficiency in writing prescriptions, identifying and preventing medication errors, promoting medication adherence, dispensing over-the-counter (OTC) drugs, providing patient counseling, and conducting health screening services (e.g., blood pressure, glucose monitoring).
- **CO04:** Evaluate symptoms of common minor ailments and recommend appropriate over-the-counter medications, ensuring safe and effective patient care.
- **CO05:** Actively participate in public health initiatives, including prevention programs for communicable and non-communicable diseases (e.g., diabetes, hypertension awareness), to promote community health.

Course materials:

Text Books:

1. Health Education and Community Pharmacy by N.S.Parmar.
2. WHO consultative group report.
3. Drug store & Business management by Mohammed Ali & Jyoti.

Reference books:

1. Handbook of pharmacy – health care.Edt. Robin J Harman. The Pharmaceutical press.
2. Comprehensive Pharmacy Review – Edt. Leon Shargel. Lippincott Williams & Wilkins.

Special requirements:

1. Either the college is having model community pharmacy (meeting the schedule N requirement) or sign MoU with at least 4-5 community pharmacies nearby to the college for training the students on dispensing and counselling activities.
2. Special equipments like B.P apparatus, Glucometer, Peak flow meter, and apparatus for cholesterol estimation.

Scheme of evaluation (80 Marks)

1.	Synopsis	10
2.	Major Experiment	30
	(Counselling of patients with specific diseases – emphasis should be given on	
	Counselling introduction, content, process and conclusion)	
3.	Minor Experiment(Ability to measure B.P/ CBG / Lung function)	15
4.	Prescription Analysis (Analyzing the prescriptions for probable drug interaction and	
	ability to tell the management)	15
5.	Viva – Voce	10

Syllabus

Topics

1 **Definition, scope, of community pharmacy**
Roles and responsibilities of Community pharmacist

2 **Community Pharmacy Management**

a) Selection of site, Space layout, and design
b) Staff, Materials- coding, stocking
c) Legal requirements
d) Maintenance of various registers
e) Use of Computers: Business and health care soft wares

3 **Prescriptions** – parts of prescription, legality & identification of medication related problems like drug interactions.

4 **Inventory control in community pharmacy**
Definition, various methods of Inventory Control
ABC, VED, EOQ, Lead time, safety stock

5 **Pharmaceutical care**
Definition and Principles of Pharmaceutical care.

6 **Patient counselling**
Definition, outcomes, various stages, barriers, Strategies to overcome barriers
Patient information leaflets- content, design, & layouts, advisory labels

7 **Patient medication adherence**
Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence.

8 **Health screening services**
Definition, importance, methods for screening
Blood pressure/ blood sugar/ lung function and
Cholesterol testing

9 **OTC Medication- Definition, OTC medication list & Counselling**

10 **Health Education**
- WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients.
- Commonly occurring Communicable Diseases, causative agents,
- Clinical presentations and prevention of communicable diseases –Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy,
- Syphilis, Gonorrhea and AIDS
- Balance diet, and treatment & prevention of deficiency disorders Family planning – role of pharmacist

11 **Responding to symptoms of minor ailments**
- Relevant pathophysiology, common drug therapy to,
- Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.

12 **Essential Drugs concept and Rational Drug Therapy**
Role of community pharmacist
13 **Code of ethics for community pharmacist.**
14. Drug information centre.

PDL 4206 - PHARMACOTHERAPEUTICS - I (THEORY)
Theory: 3 Hrs /Week
Scope of the Subject: 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.
Objectives: At completion of this subject it is expected that students will be able to understand –

- the pathophysiology of selected disease states and the rationale for drug therapy;
- the therapeutic approach to management of these diseases;
- the controversies in drug therapy;
- the importance of preparation of individualised therapeutic plans based on diagnosis;
- 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);
- describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
- summarise the therapeutic approach to management of these diseases including reference to the latest available evidence;
- discuss the controversies in drug therapy;
- discuss the preparation of individualised therapeutic plans based on diagnosis; and
- 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).

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the pathophysiology and management of cardiovascular, respiratory, and endocrine diseases.
- **CO02:** Cultivate patient case-based assessment skills.
- **CO03:** Evaluate quality use of medicines issues concerning therapeutic agents in treating these diseases.
- **CO04:** Apply clinical skills in therapeutic management of these conditions.

Course materials:

Text Books

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication.
b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange.

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication.
b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.
d. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA
e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
f. Relevant review articles from recent medical and pharmaceutical literature

Syllabus

Etiopathogenesis and pharmacotherapy of diseases associated with followingsystems/ diseases

Title of the topic

1 **Cardiovascular system:** Hypertension, Congestive cardiac failure, Angina Pectoris, Myocardial infarction, Hyperlipidaemias, Electrophysiology of heart and Arrhythmias

2 **Respiratory system :** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases
Endocrine system : Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis

3 **General prescribing guidelines for**
a. Paediatric patients
b. Geriatric patients
c. Pregnancy and breast feeding

4 **Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial

5 **Introduction to rational drug use**
Definition, Role of pharmacist Essential drug concept Rational drug formulations

PDP 2206 - PHARMACOTHERAPEUTICS - I (PRACTICAL)

Practical : 3 Hrs./Week

Scope of the Subject: 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.

Objectives: At completion of this subject it is expected that students will be able to understand

–

- the pathophysiology of selected disease states and the rationale for drug therapy;
- the therapeutic approach to management of these diseases;
- the controversies in drug therapy;
- the importance of preparation of individualised therapeutic plans based on diagnosis;
- 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);
- describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
- summaries the therapeutic approach to management of these diseases including reference to the latest available evidence;
- discuss the controversies in drug therapy;
- discuss the preparation of individualized therapeutic plans based on diagnosis; and
- 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).

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the proficiency in medication selection tailored to diverse patient needs.
- **CO02:** Evaluate drug interactions and adverse effects for safe prescribing.
- **CO03:** Analyse the therapeutic planning to optimise treatment outcomes.
- **CO04:** Apply pharmacotherapeutic principles to real-world clinical scenarios.
- **CO05:** Evaluate drug efficacy and adjust treatment plans accordingly.

Practicals :

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation. A minimum of 20 cases should be presented and recorded covering most common diseases.

Assignments :

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.

4. It shall be computer draft copy.

5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

THIRD YEAR

PDL 4301 PHARMACOLOGY – II (THEORY)

Theory: 3 Hrs. /Week

Scope of the Subject: 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 autacoids, respiratory system, GIT, immune system and hormones, and pharmacology of autocoids and hormones will be concentrated. In addition, pharmacology of chemotherapeutic agents, vitamins, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, thebasic practical knowledge relevant to therapeutics will be imparted.

Objectives of the Subject Upon completion of the subject student shall be able to:

- understand the pharmacological aspects of drugs falling under the above mentioned chapters,
- carry out the animal experiments confidently,
- appreciate the importance of pharmacology subject as a basis of therapeutics, and
- Correlate and apply the knowledge therapeutically.

Course Outcomes: After completion of course students will be able to

- **CO01:** Know about the different drugs used for treatment of diseases.
- **CO02:** Know of mode of action, uses, and adverse effects of drugs used in cancer, inflammation, respiratory system, urinay system, and immune system.
- **CO03:** Understand the principles of animal toxicology and bioassay procedures.
- **CO04:** Understand the cell, macromolecules, cell signaling, DNA replication and cell cycle.
- **CO05:** Know the importance of gene and its structure, genome, gene expression, recombinant DNA technology and other associated aspects.

Course materilas:

Text books

a. Tripathi, K. D. Essentials of medical pharmacology. 4th edition, 1999. Publisher: Jaypee, Delhi.
b. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.
c. Rang, H.P. and Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books

a. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th edition, 1996. Publisher: Mc Graw Hill, Pergamon press.
b. Craig, C.R. and Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown and company.
c. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, International.
d. Gupta, P.K. and Salunkhe, D.K. Modern Toxicology. Volume I, II and III. Latest edition. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.

Text books (Practical)

Kulkarni, S. K. and Dandia, P.C. Hand book of experimental pharmacology. Latest edition, Publisher: Vallab, Delhi

Reference books (Practical) :

a. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
b. Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.
c. Ghosh, M.N. Fundamentals of experimental pharmacology. Latest edition, Publisher: Scientific book agency, Kolkata.
d. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.

Syllabus

1. Pharmacology of Drugs acting on Blood and blood forming agents

a) Anticoagulants
b) Thrombolytics and antiplatelet agents
c) Haemopoietics and plasma expanders

2. Pharmacology of drugs acting on Renal System

d) Diuretics
e) Antidiuretics

3. Chemotherapy

f) Introduction
g) Sulfonamides and co-trimoxazole
h) Penicillins and Cephalosporins
i) Tetracyclins and Chloramphenicol
j) Macrolides, Aminoglycosides, Polyene & Polypeptide antibiotics
k) Quinolines and Fluroquinolines
l) Antifungal antibiotics
m) Antiviral agents
n) Chemotherapy of tuberculosis and leprosy

o) Chemotherapy of Malaria
p) Chemotherapy of protozoal infections (amoebiasis, Giardiasis)
q) Pharmacology of Anthelmintic drugs
r) Chemotherapy of cancer (Neoplasms)

4. Immunopharmacology

Pharmacology of immunosuppressants and stimulants

5. Principles of Animal toxicology

Acute, sub acute and chronic toxicity.

6. The dynamic cell: The structures and functions of the components of the cell

a) Cell and macromolecules: Cellular classification, sub-cellular organelles, macromolecules, large macromolecular assemblies
b) Chromosome structure: Pro and eukaryotic chromosome structures, chromatin structure, genome complexity, the flow of genetic information.
c) DNA replication: General, bacterial and eukaryotic DNA replication.
d) The cell cycle: Restriction point, cell cycle regulators and modifiers.
e) Cell signaling: Communication between cells and their environment, ion-channels, signal transduction pathways (MAP kinase, P38 kinase, JNK, Ras and PI3-kinase pathways, biosensors.

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, histones, acetylation, HDACS, DNA binding protein families.
c. Transcription and Transcription factors: Basic principles of
d. transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes.
e. RNA processing: rRNA, tRNA and mRNA processing.
f. Protein synthesis: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events
g. Altered gene functions: Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes.
h. The gene sequencing, mapping and cloning of human disease genes. Introduction to gene therapy and targeting.
i. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications

Books:

1 Molecular Biology of the Cell by Alberts B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson, JD, 3rd edition.

2 Molecular Cell Biology By Lodish, H., Baltimore, D., Berk, A et al., 5th edition.
3 Molecular Biology by Turner, PC., McLennan, AG., Bates, AD and White MRH 2nd edition.
4 Genes VIII by Lewin, B., (2004)
5 Pharmaceutical Biotechnology, by Crommelin, DJA and Sindelar RD (1997)
6 Recombinant DNA by Watson, JD., Gilman, M., et al., (1996)
7 Biopharmaceutical: Biochemistry and Biotechnology by Walsh, G., (1998)

PDP 2301 PHARMACOLOGY – II (PRACTICAL)

Practical: 3 Hrs/Week

Scope of the Subject: 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 autacoids, respiratory system, GIT, immune system and hormones, and pharmacology of autocoids and hormones will be concentrated. In addition, pharmacology of chemotherapeutic agents, vitamines, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, thebasic practical knowledge relevant to therapeutics will be imparted.

Objectives of the Subject Upon completion of the subject student shall be able to:

- understand the pharmacological aspects of drugs falling under the above mentioned chapters,
- carry out the animal experiments confidently,
- appreciate the importance of pharmacology subject as a basis of therapeutics, and
- Correlate and apply the knowledge therapeutically.

Course Outcomes: After completion of course students will be able to

- **CO01:** Describe about the laboratory animals, handling and its restrain, appliances used and physiological salt solution
- **CO02:** Record Drug Response Curve of various drugs
- **CO03:** Know about the anesthetic and euthanasia techniques
- **CO04:** Understand the basic principles of bioassay and perform the biossasy of various drugs
- **CO05:** Know the importance of various equipments in animal studies.

List of Experiments:

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 record the dose response curve of Histamine using isolated guinea -pig ileum preparation.
9. Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.
10. To carry out bioassay of Histamine using isolated guinea -pig ileum preparation by interpolation method.
11. To carry out bioassay of Histamine using guinea-pig ileum preparation by three point method.
12. To study the routes of administration of drugs in animals (Rats, Mice, Rabbits).
13. Study of theory, principle, procedure involved and interpretation of given results for the following experiments:
    a) Analgesic property of drug using analgesiometer.
    b) Antiinflammatory effect of drugs using rat-paw edema method.
    c) Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.
    d) Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.
    e) Locomotor activity evaluation of drugs using actophotometer and rotarod.

f) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

Scheme of Practical Examination:

	Sessionals	**Annual**
Identification	02	10
Synopsis	04	10
Major Experiment (Bioassay)	08	30
Minor Experiment (Interpretation of given Graph or simulated experiment)	04	10
Viva	02	10
Max Marks	**20**	**70**
Duration	**3hrs**	**4hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4302- PHARMACEUTICAL ANALYSIS (THEORY)

Theory: 3 Hrs /Week

Objectives: To develop ability to work in pharmaceutical industries on modern analytical methods, instruments, analytical method development, validation, analytical research and achieving global standards.

Scope: Pharmaceutical analysis is a branch of practical chemistry that involves a series of process for identification, determination, quantification and purification of a substance, separation of the components of a solution or mixture, or determination of structure of chemical compounds.

Course Outcomes: After completion of course students will be able to

- **CO01:** Analyze the importance of quality assurance processes including validation methods, Good Laboratory Practice (GLP), and ISO practices, in alignment with industry requirements and their role in promoting sustainable practices and public health.
- **CO02:** Understand the fundamentals of various chromatographic techniques such as TLC, HPLC, HPTLC, and GC, with a focus on their applications in sustainable pharmaceutical development and environmental safety.
- **CO03:** Develop knowledge on the theoretical aspects, instrumentation, and interpretation of data/spectra related to electrometric methods, emphasizing their contribution to innovative solutions in analytical chemistry and sustainability.
- **CO04:** Learn theoretical knowledge on instrumentation, elements of interpretation of data/spectra, and the application of different spectroscopic techniques, highlighting their role in enhancing efficiency and reducing waste in pharmaceutical processes.
- **CO05:** Apply skills and knowledge of instrumentation, applications, and study of pharmaceutically important compounds estimated by fluorimetry, flame photometry, UV-Spectrophotometry, and electrometric methods, focusing on their impact on health outcomes and environmental sustainability.

Course materials:

Text Books

1. Text Book of Pharm. Analysis by Higuchi. T and Hasen. E. B., New York Inter Science Publishers.
2. Text Book of Chemical Analysis, by A.I.Vogel, ELBS with Macmillan press, Hampshire.
3. Textbook of Pharm. Analysis by K.A.Connors, John Wiley & Sons, New York,

Brisbane, Singapore.
4. Textbook of Pharm. Analysis (Practical) by Beckett & Stenlake, CBS Publishers, Delhi.
5. Textbook of Drug Analysis by P.D. Sethi., CBS Publishers, Delhi.

Reference Books

6. Quantitative Pharma. Analysis by Jenkins, The Blakiston division, New York.
7. Quantitative Drug Analysis, by Garrot. D, Chapman & Hall Ltd., London.
8. Undergraduate Instrumental Analysis by James. E., CBS Publishers.
9. Instrumental Analysis by Willard and Merritt, EWP, East West Press Ltd., Delhi/Madras.
10. Pharm Analysis by Skoog and West, Sounders Manipal College Publishing.
11. Spectroscopy by Silverstein, John & Wiley & Sons. Inc., Canada & Singapore.
12. How to practise GMP-A Plan for total quality control by P.P. Sharma, Vandana Publications, Agra.
13. The Science & Practice of Pharmacy by Remington Vol-I & II, Mack Publishing Co. Pennsylvania.
14. TLC by Stahl, Spring Verlay.
15. Text Book of Pharm. Chemistry by Chatten, CBS Publications.
16. Spectroscopy by William Kemp, ELBS with Macmillan Press, Hampshire.
17. I.P.-1996, The Controller of Publications, New Delhi.

18. BPC- Dept. of Health, U.K. for HMSO.
19. USP - Mack Publishing Co., Easton, PA.
20. The Extra Pharmacopoeia – The Pharm. Press, London.

Syllabus

1. **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.

2. 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.
c. **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.
g. **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.

3. 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.

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 applications.

4. 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.

- **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.

Fluorimetric Analysis: Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation, Applications, fluorescent indicators, study of pharmaceutically important compounds estimated by fluorimetry.

a. **Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.
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.
e. **NMR & ESR (introduction only):** Introduction, theoretical aspects and applications.
f. **Mass Spectroscopy**: (**Introduction only**) – Fragmentation, types of ions produced mass spectrum and applications.
g. **Polarimetry: (Introduction only**) – Introduction to optical rotatory dispersion, circular dichroism, polarimeter.
h. **X-RAY Diffraction: (Introduction only**) – Theory, reciprocal lattice concept, diffraction patterns and applications.
i. **Thermal Analysis**: Introduction, instrumentation, applications, and DSC and DTA.

PDP 2302 PHARMACEUTICAL ANALYSIS (PRACTICAL)
Practical: 3 Hrs./Week
Objectives: To develop ability to work in pharmaceutical industries on modern analytical methods, instruments, analytical method development, validation, analytical research and achieving global standards.
Scope: Pharmaceutical analysis is a branch of practical chemistry that involves a series of process for identification, determination, quantification and purification of a substance, separation of the components of a solution or mixture, or determination of

structure of chemical compounds.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the importance of analysis in the pharmaceutical industry, emphasizing ethical practices and sustainability in drug development.
- **CO02:** Gain knowledge about the assay of pharmaceutical substances and products, focusing on quality assurance and environmental impact assessments.
- **CO03:** Develop basic practical skills using instrumental techniques, integrating sustainable methodologies and responsible resource management.
- **CO04:** Inculcate theoretical knowledge on various instrumental techniques adopted for the analysis of pharmaceuticals, highlighting innovation and sustainable practices in analytical chemistry.
- **CO05:** Develop various methodologies for the assay of drugs and pharmaceuticals, incorporating skills and knowledge gained to promote sustainability and social responsibility in pharmaceutical practices.

List of Experiments:

1. Separation and identification of Amino Acids by Paper Chromatography.
2. Separation and identification of Sulpha drugs by TLC technique.
3. Effect of pH and solvent on the UV spectrum of given compound.
4. Comparison of the UV spectrum of a compound with that of its derivatives.
5. Determination of dissociation constant of indicators using UV-Visiblespectroscopy.
6. Conductometric titration of mixture of acids with a strong base.
7. Potentiometric titration of a acid with a strong base.
8. Estimation of drugs by Fluorimetric technique.
9. Study of quenching effect in fluorimetry.
10. Colourimetric estimation of Supha drugs using BMR reagent.
11. Simultaneous estimation of two drugs present in given formulation.
11. Assay of Salicylic Acid by colourimetry.
12. Determination of Chlorides and Sulphates in Calcium gluconate byNepheloturbidimetric Method.
13. Determination of Na/K by Flame Photometry.
14. Determination of pKa using pH meter.
15. Determination of specific rotation.
16. Comparison of the IR spectrum of a compound with that of its derivatives.

17. Demonstration of HPLC.
18. Demonstration of HPTLC.
19. Demonstration of GC-MS.
20. Demonstration of DSC.
21. Interpretation of NMR spectra of any one compound.

PDL4303 PHARMACOTHERAPEUTICS – II (THEORY)

Theory: 3 Hrs. /Week

Scope of the Subject: 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 studentto understand the pathophysiology of common diseases and their management.

Objectives of the Subject Upon completion of the subject student shall be able to –

- To know the pathophysiology of selected disease states and the rationale for drug therapy
- To know the therapeutic approach to management of these diseases;
- To know the controversies in drug therapy;
- To know the importance of preparation of individualized therapeutic plans based on diagnosis; and to Appreciate the 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 responseand adverse effects).

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand pharmacotherapeutic principles tailored to address a spectrum of health conditions including Infectious Diseases, Musculoskeletal Disorders, Renal System Dysfunctions, Oncological Maladies, and Dermatological Concerns.
- **CO02:** Develop proficiency in selecting optimal pharmaceutical interventions by integrating patient-specific variables including medical history, concurrent illnesses, and potential drug interactions, fostering judicious prescribing practices aimed at maximizing therapeutic efficacy while mitigating adverse outcomes.
- **CO03:** Acquire knowledge in pharmacotherapy tailored to diverse health conditions, focusing on patient-specific factors for optimal prescribing and treatment outcomes.
- **CO04:** Evaluate medical literature and apply evidence-based practices in pharmacotherapy decision-making.

Course materials:

Text books

Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication

Reference books

a. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange
b. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication
c. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA]

Syllabus

Etiopathogenesis and pharmacotherapy of diseases associated with following systems / diseases –

Title of the topic

1. **Infectious disease:** Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningitis, Respiratory tract infections, Gastroenteritis, Endocarditis, Septicemia, Urinary tract infections, Protozoal infection- Malaria, HIV & Opportunistic infections, Fungal infections, Viral infections, Gonarrhoea and Syphillis
2. **Musculoskeletal disorders**
   Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic lupus erythematosus.
3. **Renal system**
   Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders
4. **Oncology:** Basic principles of Cancer therapy, General introduction to cancer chemotherapeutic agents, Chemotherapy of breast cancer, leukemia.

Management of chemotherapy nausea and emesis

5. **Dermatology:** Psoriasis, Scabies, Eczema, Impetigo

PDP 2303- PHARMACOTHERAPEUTICS – II (PRACTICAL)

Practical: 3 Hrs./Week

Scope of the Subject: 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 studentto understand the pathophysiology of common diseases and their management.

Objectives of the Subject Upon completion of the subject student shall be able to –

- know the pathophysiology of selected disease states and the rationale for drug therapy
- know the therapeutic approach to management of these diseases;
- know the controversies in drug therapy;
- know the importance of preparation of individualised therapeutic plans based on diagnosis; and
- appreciate the 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).

Course Outcomes: After completion of course students will be able to

- **CO01:** Remember the medication selection tailored to diverse patient needs.
- **CO02:** Assess drug interactions and adverse effects for safe prescribing.
- **CO03:** Create a therapeutic plan to optimise treatment outcomes.
- **CO04:** Apply pharmacotherapeutic principles to real-world clinical scenarios.
- **CO05:** Evaluate drug efficacy and adjusts treatment plans accordingly.

Practicals

Hospital postings in various departments designed to complement the lectures by providing practical clinical discussion; attending ward rounds; follow up the progress and changes made in drug therapy in allotted patients; case presentation upon discharge. Students are required to maintain a record of cases presented and the same should be submitted at the end of the course for evaluation.

The student shall be trained to understand the principle and practice involved in selection

of drug therapy including clinical discussion.

A minimum of 20 cases should be presented and recorded covering most common diseases.

Assignments:

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4304 PHARMACEUTICAL JURISPRUDENCE (THEORY)

Theory: 2 Hrs. /Week

Scope of the Subject: (4-6 lines): 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.

Objectives of the Subject: Upon completion of the subject student shall be able to (Know, do, and appreciate) –

- practice the Professional ethics;
- understand the various concepts of the pharmaceutical legislation in India;
- know the various parameters in the Drug and Cosmetic Act and rules;
- know the Drug policy, DPCO, Patent and design act;
- understand the labeling requirements and packaging guidelines for drugs and cosmetics;
- be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act; and
- other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.

Course Outcomes: After completion of course students will be able to

- **CO01:** Assess the principles of pharmaceutical legislation and professional ethics as they apply to the pharmaceutical industry and pharmacy practice
- **CO02:** Summarize objectives, legal definitions, constitution and functions of drugs and cosmetics act, 1940, Pharmacy Act –1948, Medicinal and Toilet Preparation Act – 1955, Narcotic Drugs and Psychotropic substances Act-1985
- **CO03:** Outline the concepts of drugs and magic remedies act, essential commodities act relevant to drugs price control order
- **CO04:** Analyse various parameters in prevention of cruelty to animals act-1960, patents & design act-1970
- **CO05:** Assess prescription and non-prescription products and drug price control order & national drug policy to foster equality and affordability

Course materials:

Text books

a. Mithal , B M. Textbook of Forensic Pharmacy. Calcutta :National; 1988.

Reference books

a. Singh, KK, editor. Beotra's the Laws of Drugs, Medicines & cosmetics. Allahabad: Law Book House; 1984.
b. Jain, NK. A Textbook of forensic pharmacy. Delhi: Vallabh prakashan ; 1995.
c. Reports of the Pharmaceutical enquiry Committee
d. I.D.M.A., Mumbai. DPCO 1995
e. Various reports of Amendments.
f. Deshapande, S.W. The drugs and magic remedies act 1954 and rules 1955. Mumbai: Susmit Publications; 1998.
g. Eastern Book Company .The narcotic and psychotropic substances act 1985, Lucknow: Eastern; 1987.

Syllabus

1. **Pharmaceutical Legislations –** A brief review.
2. Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI.
3. **Drugs and Cosmetics Act, 1940,and its rules 1945.**
    a. Objectives, Legal definition, Study of Schedule's with reference to Schedule B,
    b. C&C1, D, E1, F&F1, F2, F3, FF, G, H, J, K, M, N, P, R, V, W, X, Y.
    c. Sales, Import, labeling and packaging of Drugs And Cosmetics Provisions Relating to Indigenous Systems.
    d. Constitution and Functions of DTAB,DCC,CDL. Qualification and duties –Govt. analyst and Drugs Inspector
4. **Pharmacy Act –1948**.
    a. Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER.
5. **Medicinal and Toilet Preparation Act –1955**.
    a. Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic,

Patent & Proprietory Preparations.

6. **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, Schedules to the Act.
7. **Study of Salient Features of Drugs and magic remedies Act and its rules.**
8. **Study of essential Commodities Act Relevant to drugs price control Order.**
9. **Drug Price control Order & National Drug Policy (Current).**
10. **Prevention Of Cruelty to animals Act-1960.**
11. **Patents & design Act-1970.**
12. **Brief study of prescription and Non-prescription Products.**

Assignments:

Format of the assignment

1. Minimum & Maximum number of pages
2. It shall be a computer draft copy
3. Reference(s) shall be included at the end.
4. Name and signature of the student
5. Assignment can be a combined presentation at the end of the academic year.
6. Time allocated for presentation may be 8+2 Min

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.

PDL 4305 MEDICINAL CHEMISTRY (THEORY)

Theory: 3 Hrs. /Week

Objectives: The objective of medicinal chemistry is the design and discovery of new compounds that are suitable for use as drugs. This process involves a team of workers

from a wide range of disciplines such as chemistry, biology, biochemistry, pharmacology mathematics, medicine and computing, amongst others.

Scope: Medicinal chemistry offers a wide variety of lab opportunities in pharmaceutical, biotechnology, and medical device companies. Most chemists use their research skills to formulate, produce, characterize, and analyze new compounds for specific applications.

Course Outcomes: After completion of course students will be able to

- **CO01:** Demonstrate the importance of modern concept of rational drug design including energy minimisation.
- **CO02:** Assess the chemistry of drugs with respect to their pharmacological activity
- **CO03:** Conclude the drug metabolic pathways, adverse effects and therapeutic value of drugs
- **CO04:** Analyse the Structural Activity Relationship (SAR) of different class of drugs
- **CO05:** Outline the chemical synthesis of some drugs

Course materials:

Text Books

a. A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.

Reference Books

b. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott-Raven Publishers-New York, Philadelphia.
c. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.
d. Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wiley-interscience Publication, New York, Toranto.
e. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.
f. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.
g. Organic Drug Synthesis-Ledniser Mitzsher Vol. I and II.
h. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.
i. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania.

Syllabus

1. Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationaship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD) and concept of antisense molecules.

A study of the development of the following classes of drugs including SAR, mechanism

of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.

2. Anti-infective agents
    a) Local anti-infective agents
    b) Preservatives
    c) Antifungal agents
    d) Urinary tract anti-infectives
    e) Antitubercular agents
    f) Antiviral agents and Anti AIDS agents

g) Antiprotozoal agents
h) Anthelmentics
i) Antiscabies and Antipedicular agents

3. Sulphonamides and sulphones
4. Antimalarials
5. Antibiotics
6. Antineoplastic agents
7. Cardiovascular agents
   j) Antihypertensive agents
   k) Antianginal agents and vasodilators
   l) Antiarrhythmic agents
   m) Antihyperlipidemic agents
   n) Coagulants and Anticoagulants
   o) Endocrine
8. Hypoglycemic agents
9. Thyroid and Antithyroid agents
10. Diureties
11. Diagnostic agents
12. Steroidal Hormones and Adrenocorticoids

PDP 2305- MEDICINAL CHEMISTRY (PRACTICAL)

Practical: 3 Hrs./Week

Objectives: The objective of medicinal chemistry is the design and discovery of new compounds that are suitable for use as drugs. This process involves a team of workers from a wide range of disciplines such as chemistry, biology, biochemistry, pharmacology mathematics, medicine and computing, amongst others.

Scope: Medicinal chemistry offers a wide variety of lab opportunities in pharmaceutical, biotechnology, and medical device companies. Most chemists use their research skills to formulate, produce, characterize, and analyze new compounds for specific applications.

Course Outcomes: After completion of course students will be able to

- **CO01:** Predict partition coefficients, and dissociation constants of compounds for QSAR analysis.
- **CO02:** Synthesize various medicinally important compounds in research.
- **CO03:** Assess the purity (assay) of important drugs from the course content.
- **CO04:** Interpret the monograph of important drugs.

List of Experiments:

2. Assays of important drugs from the course content.
3. Preparation of medicinally important compounds or intermediates required for

synthesis of drugs.

4. Monograph analysis of important drugs.
5. Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis.

PDL 4306- PHARMACEUTICAL FORMULATIONS (THEORY)

Theory: 2 Hrs. /Week

Scope of the Subject: Scope and objectives of the course: Subject deals with the formulation and evaluation of various pharmaceutical dosage forms.

Objectives of the Subject: Upon completion of the subject student shall be able to (Know, do, appreciate) –

- understand the principle involved in formulation of various pharmaceutical dosage forms;
- prepare various pharmaceutical formulation;
- perform evaluation of pharmaceutical dosage forms; and
- Understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand various pharmaceutical dosage forms.
- **CO02:** Describe various types of tablets, granulation techniques and formulation methods.
- **CO03:** Demonstrate different techniques for the formulation and evaluation of capsules and liquid dosage forms.
- **CO04:** Apply different in-process and finished product quality control tests for various formulations.
- **CO05:** Understand parenteral and semisolid dosage forms along with their evaluation as per industry requirement
- **CO06:** Assess importance of controlled and novel drug delivery systems.

Course materials:

Text books

a. Pharmaceutical dosage forms, Vol, I,II and III by lachman
b. Rowlings Text book of Pharmaceutics
c. Tutorial Pharmacy – Cooper &Gun

Reference books

a. Remington's Pharmaceutical Sciences
b. USP/BP/IP

Syllabus

1. Pharmaceutical dosage form- concept and classification
2. **Tablets**: Formulation of different types of tablets, tablet excipients,granulation techniques quality control and evaluation of tablets. Tablet coating, Type of coating, quality control tests for coated tablet.

3. **Capsules**; Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatin capsules, quality control tests for soft gelatin capsules.
4. **Liquid orals**: Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations
5. **Parenterals** Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization
6. **Ophthalmic preparations (Semi – Solids)**: Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labeling, Ointments Types of Ointment Base Preparation of ointment, Jellies Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging
7. Definition and concept of **Controlled and novel Drug delivery systems** with available examples, viz. parentral, trans dermal, buccal, rectal, nasal, implants, ocular

PDP 2306- PHARMACEUTICAL FORMULATIONS (PRACTICAL)
Practical: 3 Hrs./Week
Scope of the Subject: Scope and objectives of the course: Subject deals with the formulation and evaluation of various pharmaceutical dosage forms.
Objectives of the Subject: Upon completion of the subject student shall be able to (Know, do, appreciate) –

- understand the principle involved in formulation of various pharmaceutical dosage forms;
- prepare various pharmaceutical formulation;
- perform evaluation of pharmaceutical dosage forms; and
- Understand and appreciate the concept of bioavailability and bioequivalence, their role in clinical situations.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the principles involved in formulation and evaluation of various pharmaceutical dosage forms as per industry needs.
- **CO02:** Demonstrate the preparation of various formulations with lucid understanding of new drug delivery technologies
- **CO03:** Assess the formulation release through dissolution studies and understand the concept of bioavailability and bioequivalence.

List of Experiments:

1. **Manufacture of Tablets**
   a. Ordinary compressed tablet-wet granulation
   b. Tablets prepared by direct compression.
   c. Soluble tablet.

d. Chewable tablet.

2. **Formulation and filling of hard gelatin capsules**
3. **Manufacture of parenterals**
   a. Ascorbic acid injection
   b. Calcium gluconate injection
   c. Sodium chloride infusion.
   d. Dextrose and Sodium chloride injection/ infusion.
4. **Evaluation of Pharmaceutical formulations (QC tests)**
   a. Tablets
   b. Capsules
   c. Injections
5. **Formulation of two liquid oral preparations and evaluation by assay**
   a. Solution: Paracetamol Syrup
   b. Antacid suspensions- Aluminum hydroxide gel
6. **Formulation of semisolids and evaluation by assay**
   a. Salicyclic acid and benzoic acid ointment
   b. Gel formulation Diclofenac gel
7. **Cosmetic preparations**
   a. Lipsticks
   b. Cold cream and vanishing cream
   c. Clear liquid shampoo
   d. Tooth paste and tooth powders.

8. Tablet coating (demonstration)

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

CPY101-CLINICAL PSYCHOLOGY (THEORY)

Theory: 1 Hrs. /Week

Scope

Clinical psychology is the branch of psychology concerned with the assessment and treatment of mental illness, abnormal behavior, and psychiatric problems. This course focuses on various mental, emotional and behavioral disorders, their diagnostic criteria, treatment and prognosis.

Course Outcomes: After completion of course students will be able to

- **CO01:** Evaluate the nature of abnormal or atypical behavior.
- **CO02:** Classify abnormal behavior based on DSM (Diagnostic and Statistical Manual of Mental Disorders) and ICD (International Classification of Disorders) criteria.
- **CO03:** Understand how mental health professionals classify psychological disorders.
- **CO04:** Recognize the symptoms of various psychological disorders.
- **CO05:** Analyze the treatments and outcomes for various psychological disorders.

Course materials:

References Books

1. Carson, R.C., Butcher, J.N. and Mineka, S. (2000). Abnormal Psychology and Modern Life. Delhi: Pearson Education
2. Butcher, J.N., Hooley, J.M., Mineka, S. and Dwivedi, C.B. (2017). Abnormal psychology. Delhi: Pearson.
3. Plante, T.G. (2005). Contemporary Clinical Psychology. New jersey: John Wiley and Sons Inc.

Syllabus

1. **Introduction to Clinical Psychology:** Nature of Abnormal behavior, Classifying Abnormal Behavior (DSM, ICD), Causes and Risk Factors for Abnormal Behavior, Causal Factors- Biological, Psychosocial and Sociocultural
2. **Stress and Anxiety related Psychological Disorders:** Stress and Adjustment Disorders, Panic Disorder, Generalized Anxiety Disorder, Post Traumatic Stress Disorder, Obsessive Compulsive Disorder, Somatoform and Dissociative Disorders
3. **Personality and Mood Disorders:**Personality Disorders: Paranoid, Schizoid, Schizotypal, Histrionic, Narcissistic, Antisocial, Borderline, Avoidant and Dependant Mood Disorders: Unipolar and Bipolar
4. **Schizophrenia, Delusional Disorder, Brain Disorders:** Nature and Types of Schizophrenia and Paranoia, Treatments and Outcomes, Brain Impairment and Mental Retardation, Learning Disorders
5. **Clinical Assessment and Psychopharmacological Treatment:** Basic Elements in Assessment, Psychosocial Assessment, Psychopharmacological Methods: Antipsychotic Drugs, Antidepressant drugs, Antianxiety Drugs, Mood Stabilizing Drugs

FOURTH YEAR

PDL 4401 PHARMACOTHERAPEUTICS – III (THEORY)

Theory: 3 Hrs. /Week

Scope: 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.

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

- the pathophysiology of selected disease states and the rationale for drug therapy;
- the therapeutic approach to management of these diseases;
- the controversies in drug therapy;
- the importance of preparation of individualized therapeutic plans based on diagnosis;
- 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);
- describe the pathophysiology of selected disease states and explain the rationale

for drug therapy;

- to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;
- to discuss the controversies in drug therapy;
- to discuss the preparation of in dividualised therapeutic plans based on diagnosis; and
- 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).

Course Outcomes: After completion of course students will be able to

- **CO01:** Start the administration of medication and outline the expected therapeutic outcomes through targeted interventions.
- **CO02:** Know the effective use of pharmacological therapeutic interventions in the treatment of specific diseases, conditions and symptoms.
- **CO03:** Demonstrate effective communication and collaborative teamwork
- **CO04:** Have moral reasoning, ethical judgment and professionalism

Course materials:

Text Books

a. Clinical Pharmacy and Therapeutics - Roger and Walker, Churchill Livingstone publication
b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication
b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication
c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication
d. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda - Kimble MA
e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
f. Relevant review articles from recent medical and pharmaceutical literature.

Syllabus

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/ diseases: Title of the topic:

1. **Gastrointestinal system:** Peptic ulcer disease, Gastro Esophageal Reflux Disease, Inflammatory bowel disease, Liver disorders - Alcoholic liver disease, viral hepatitis including jaundice, and Drug induced liver disorders.

2 **Haematological system:** Anaemias, Venous thromboembolism, Drug induced blood

disorders.

3 **Nervous system:** Epilepsy, Parkinsonism, Stroke, Alzheimer's disease,

4 **Psychiatry disorders:** Schizophrenia, Affective disorders, Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders.

5 **Pain management** including Pain pathways, neuralgias, headaches.

6 Evidence Based Medicine.

PDP 2401- PHARMACOTHERAPEUTICS – III (PRACTICAL)

Practical: 3 Hrs./Week

Scope: 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.

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

- the pathophysiology of selected disease states and the rationale for drug therapy;
- the therapeutic approach to management of these diseases;
- the controversies in drug therapy;
- the importance of preparation of individualized therapeutic plans based on diagnosis;
- 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);
- describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
- to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;
- to discuss the controversies in drug therapy;
- to discuss the preparation of in dividualised therapeutic plans based on diagnosis; and
- 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).

Course Outcomes: After completion of course students will be able to

- **CO01:** Start the administration of medication and outline the expected therapeutic outcomes through targeted interventions.
- **CO02:** Know the effective use of pharmacological therapeutic interventions in the treatment of specific diseases, conditions and symptoms.
- **CO03:** Effective communication and collaborative teamwork
- **CO04:** Have moral reasoning, ethical judgment and professionalism

Practicals:

Hospital postings for a period of at least 50 hours is required to understand the principles

and practice involved in ward round participation and clinical discussion on selection of drug therapy. Students are required to maintain a record of 15 cases observed in the ward and the same should be submitted at the end of the course for evaluation. Each student should present at least two medical cases they have observed and followed in the wards.

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/ diseases covered during hospital posting:

Gastrointestinal system, Haematological system, Nervous system, Psychiatry disorders, Pain management, Evidence Based Medicine

Assignments:

Students are required to submit written assignments on the topics given to them. Topics allotted should cover recent developments in drug therapy of various diseases. A minimum of THREE assignments [1500 – 2000 words] should be submitted for evaluation.

Format of the assignment:

1. Minimum & Maximum number of pages
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year
4. It shall be computer draft copy
5. Name and signature of the student
6. Time allocated for presentation may be 8+2 Min.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL4402- HOSPITAL PHARMACY (THEORY)

Theory: 2 Hrs /Week

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.

Objectives: Upon completion of the course, the student shall be able to –

- know various drug distribution methods;
- know the professional practice management skills in hospital pharmacies;
- provide unbiased drug information to the doctors;
- know the manufacturing practices of various formulations in hospital set up;
- appreciate the practice based research methods; and
- Appreciate the stores management and inventory control.

Course Outcomes: After completion of course students will be able to

- **CO01:** Create Basic understanding of organisational structure of a hospital as well as its pharmacy, infrastructure and budgeting
- **CO02:** Understand and remember the working and constitution of different hospital committees and drug formulary,
- **CO03:** Understand the process of procurement, warehousing, inventory control and distribution of drugs with especial emphasis on narcotic and controlled drugs; role of pharmacist in central sterile supply services
- **CO04:** Apply the basic knowledge of manufacturing process of sterile formulations, ointments, liquids, creams, tablets, granules, capsules, powders and total parentral nutrition
- **CO05:** Understand the role of pharmacist in professional relations, practices, education, training and handling, packaging of radiopharmaceuticals

Couse materials:

Text books

a. Hospital pharmacy by William .E. Hassan
b. A text book of Hospital Pharmacyby S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh

Reference books

a. WHO consultative group report.
b. R.P.S. Vol.2. Part –B; Pharmacy Practice section.
c. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.

Syllabus

Topics

1 Hospital - its Organisation and functions

2 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

3 The Budget – Preparation and implementation

4 Hospital drug policy

a) Pharmacy and Therapeutic committee (PTC)

b) Hospital formulary

c) Hospital committees

- Infection committee
- Research and ethical committee

d) developing therapeutic guidelines

e) Hospital pharmacy communication - Newsletter

5 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

c) Drug distribution in the hospital

i) Individual prescription method

ii) Floor stock method

iii) Unit dose drug distribution method

d) Distribution of Narcotic and other controlled substances

e) Central sterile supply services – Role of pharmacist

6 Manufacture of Pharmaceutical preparations

a) Sterile formulations – large and small volume parenterals

b) Manufacture of Ointments, Liquids, and creams

c) Manufacturing of Tablets, granules, capsules, and powders

d) Total parenteral nutrition

7 Continuing professional development programs
Education and training

8 Radio Pharmaceuticals – Handling and packaging

9 Professional Relations and practices of hospital pharmacist

PDP 2402- HOSPITAL PHARMACY (PRACTICAL)

Practical: 3 Hrs./Week

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.

Objectives: Upon completion of the course, the student shall be able to –

- know various drug distribution methods;
- know the professional practice management skills in hospital pharmacies;
- provide unbiased drug information to the doctors;
- know the manufacturing practices of various formulations in hospital set up;
- appreciate the practice based research methods; and
- Appreciate the stores management and inventory control.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand various drug distribution methods
- **CO02:** Apply various professional practice management skills in hospital pharmacies
- **CO03:** Evaluate and provide unbiased drug information to the doctors
- **CO04:** Know the manufacturing practices of various formulations in hospital set up
- **CO05:** Appreciate the practice based research methods
- **CO06:** Understand the stores management and inventory control management

List of experiments:

1. Assessment of drug interactions in the given prescriptions
2. Manufacture of parenteral formulations, powders.
3. Drug information queries.
4. Inventory control

List of Assignments:

1. Design and Management of Hospital pharmacy department for a 300 bedded hospital.
2. Pharmacy and Therapeutics committee – Organization, functions, and limitations.
3. Development of a hospital formulary for 300 bedded teaching hospital
4. Preparation of ABC analysis of drugs sold in one month from the pharmacy.
5. Different phases of clinical trials with elements to be evaluated.
6. Various sources of drug information and systematic approach to provide unbiased drug information.
7. Evaluation of prescriptions generated in hospital for drug interactions and find out the

suitable management.

Special requirements:

1. Each college should sign MoU with nearby local hospital having minimum 150 beds for providing necessary training to the students' on hospital pharmacy activities.
2. Well equipped with various resources of drug information.

Scheme of Practical Examination:

	Sessionals	**Annual**
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

Note: Total sessional marks is 30 (20 for practical sessional plus 10 marks for regularity, promptness, viva-voce and record maintenance).

PDL 4403- CLINICAL PHARMACY (THEORY)

Theory: 3 Hrs. /Week

Objectives of the Subject:

Upon completion of the subject student shall be able to (Know, do, appreciate) –

- To learn Medical chart review and clinical review;
- To obtain medication history interview and counsel the patients;
- To identify and resolve drug related problems;
- To detect, assess and monitor adverse drug reaction;
- To interpret selected laboratory results (as monitoring parameters in therapeutics) ofspecific disease states; and
- To Retrieve, analyse, interpret and formulate drug or medicine information.
- To understand Therapeutic drug monitoring , Pharmacovigilance , and clinical reviews.

Course Outcomes: After completion of course students will be able to

- **CO01:** Monitor patient drug therapy through reviewing medication charts and conducting clinical assessments.
- **CO02:** Conduct medication history interviews with patients about their diseases and provide counseling as needed.

- **CO03:** Identify, evaluate, and monitor adverse drug reactions.
- **CO04:** Analyze specific disease states by interpreting relevant laboratory results used as therapeutic monitoring parameters.
- **CO05:** Retrieve, analyze, interpret and formulate drug or medicine information.

Course materials:

Text books

a. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.
b. Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.
c. Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.
d. A text book of Clinical Pharmacy Practice; Essential concepts and skills, Dr.G.Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026

Reference books

a. Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia
b. Clinical Pharmacokinetics - Rowland and Tozer, Williams and Wilkins Publication.
c. Pharmaceutical statistics. Practical and clinical applications. Sanford Bolton, Marcel Dekker, Inc.

Syllabus

1. **Definitions, development and scope of clinical pharmacy**
2. **Introduction to daily activities of a clinical pharmacist**
   a. Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions)
   b. Ward round participation
   c. Adverse drug reaction management
   d. Drug information and poisons information
   e. Medication history
   f. Patient counseling
   g. Drug utilization evaluation (DUE) and review (DUR)
   h. Quality assurance of clinical pharmacy services.

3. 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.

4. 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
c. Fluid and electrolyte balance

d. Microbiological culture sensitivity tests
e. Pulmonary Function Tests

5. Drug & Poison information

f. Introduction to drug information resources available
g. Systematic approach in answering DI queries
h. Critical evaluation of drug information and literature
i. Preparation of written and verbal reports
j. Establishing a Drug Information Centre
k. Poisons information- organization & information resources

6. Pharmacovigilance

l. Scope, definition and aims of pharmacovigilance
m. Adverse drug reactions - Classification, mechanism, predisposing factors, causality assessment [different scales used]
n. Reporting, evaluation, monitoring, preventing & management of ADRs
o. Role of pharmacist in management of ADR.

7. Communication skills, including patient counselling techniques, medication history interview, presentation of cases.
8. Pharmaceutical care concepts
9. Critical evaluation of biomedical literature
10. Medication errors.

PDP 2403- CLINICAL PHARMACY (PRACTICAL)

Practical: 3 Hrs/Week

Objectives of the Subject:

Upon completion of the subject student shall be able to (Know, do, appreciate) –

- monitor drug therapy of patient through medication chart review and clinical review;
- obtain medication history interview and counsel the patients;
- identify and resolve drug related problems;
- detect, assess and monitor adverse drug reaction;
- interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and
- retrieve, analyse, interpret and formulate drug or medicine information.

Course Outcomes: After completion of course students will be able to

- **CO0**1. Monitor drug therapy of patient through medication chart review and clinical review
- **CO0**2. Obtain medication history interview and counsel the patients
- **CO0**3. Identify and resolve drug related problems

- **CO0**4. Detect, assess and monitor adverse drug reaction
- **CO0**5. Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
- **CO0**6. Retrieve, analyze, interpret and formulate drug or medicine information.

Students are expected to perform 15 practicals in the following areas covering the topics dealtin theory class.

a. Answering drug information questions (4 Nos)
b. Patient medication counselling (4 Nos)
c. Case studies related to laboratory investigations (4 Nos)
d. Patient medication history interview (3 Nos)

Assignment:

Students are expected to submit THREE written assignments (1500 – 2000 words) on the topics given to them covering the following areas dealt in theory class.

Drug information, Patient medication history interview, Patient medication counselling, Critical appraisal of recently published articles in the biomedical literature which deals with a drug or therapeutic issue.

Format of the assignment:

1. Minimum & Maximum number of pages.
2. Reference(s) shall be included at the end.
3. Assignment can be a combined presentation at the end of the academic year.
4. It shall be computer draft copy.
5. Name and signature of the student.
6. Time allocated for presentation may be 8+2 Min.

PDL 4404- BIOSTATISTICS AND RESEARCH METHODOLOGY (THEORY)

Theory: 2 Hrs. /Week

Objectives: The objective of Biostatistics is to advance statistical science and its application to problems of human health and disease, with the ultimate goal of advancing statistics. The role of biostatisticians is an important one, especially when it comes to designing studies and analyzing data from research problems. Research objectives describe concisely what the research is trying to achieve. They summarize the accomplishments a researcher wishes to achieve through the project and provides direction to the study.

Scope: Biostatistics are the development and application of statistical methods to a wide range of topics in biology. It encompasses the design of biological experiments, the collection and analysis of data from those experiments and the interpretation of the results.

Course Outcomes: After completion of course students will be able to

- **CO0**1: Know the various statistical methods to solve different types of problems
- **CO0**2: Operate various statistical software packages
- **CO0**3: Appreciate the importance of Computer in hospital and Community Pharmacy

- **CO0**4: Appreciate the statistical technique in solving the pharmaceutical problems.

Course materials:

Reference books

a. Pharmaceutical statistics- practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. New York.
b. Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006.

Syllabus

1 Research Methodology

a) Types of clinical study designs:
Case studies, observational studies, interventional studies,
b) Designing the methodology
c) Sample size determination and Power of a study
Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study
d) Report writing and presentation of data

2 Biostatistics

2.1 a) Introduction
b) Types of data distribution
c) Measures describing the central tendency distributions- average, median, mode
d) Measurement of the spread of data-range, variation of mean, standard deviation, variance, coefficient of variation, standard error of mean.

2.2 Data graphics

Construction and labeling of graphs, histogram, piecharts, scatter plots, semilogarthimic plots

2.3 Basics of testing hypothesis

a) Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.
b) Level of significance (Parametric data)- students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)
c) Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wall is test (one way ANOVA)
d) Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient.
e) Introduction to statistical software: SPSS, Epi Info, SAS.

2.4 Statistical methods in epidemiology

Incidence and prevalence, relative risk, attributable risk

3. Computer applications in pharmacy

Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy – Patient record 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**: Computerizing the Prescription Dispensing process. 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

PDL 4405- BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)
Theory: 3 Hrs. /Week
Objectives: Objectives of Biopharmaceutics course are to gain a basic understanding of the processes of drug absorption, distribution and elimination + the potentials of dosage form effects on these processes that can be applied to optimization of therapeutic benefit for a patient.
Scope: Biopharmaceutics explore the interrelationship of the physical/chemical properties of the drug, the dosage form (drug product) in which the drug is given, and the route of administration on the rate and extent of systemic drug absorption and the use of this information to optimise the therapeutic efficacy of the drug
Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the concepts of biopharmaceutics and pharmacokinetics.
- **CO02:** Identify and critically assess the various factors affecting drug absorption, distribution, metabolism and elimination
- **CO03:** Describe need for different pharmacokinetic models and differentiate between compartment and non-compartment models.
- **CO04:** Apply various mathemathetical models to calculate different pharmacokinetic parameters following different routes of administration
- **CO05:** Understand nonlinear kinetics and non-compartmental analysis inclusive of factors affecting non-linear pharmacokinetics
- **CO06:** Define various terms related to bioavailability and bioequivalence, understand the biopharmaceutical classification system and assess the significance of in vitro/ in vivo correlation

Course material:
References books

a. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi
b. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.

c. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
d. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
e. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
f. Biopharmaceutics; By Swarbrick
g. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal, Vallabh Prakashan Pitampura, Delhi
h. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
i. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack,

Publishing Company, Pennsylvania 1989.

j. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.

k. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

Syllabus

1. Biopharmaceutics

1. Introduction to Biopharmaceutics
   a. Absorption of drugs from gastrointestinal tract.
   b. Drug Distribution.
   c. Drug Elimination.

2. Pharmacokinetics

2. Introduction to Pharmacokinetics.
   a. Mathematical model
   b. Drug levels in blood.
   c. Pharmacokinetic model
   d. Compartment models
   e. Pharmacokinetic study.
3. One compartment open model.
   a. Intravenous Injection (Bolus)
   b. Intravenous infusion.
4. Multicompartment models.
   a. Two compartment open model.
   b. IV bolus, IV infusion and oral administration
5. Multiple – Dosage Regimens.
   a. Repititive Intravenous injections – One Compartment Open Model
   b. Repititive Extravascular dosing – One Compartment Open model
   c. Multiple Dose Regimen – Two Compartment Open Model
6. Nonlinear Pharmacokinetics.
   a. Introduction
   b. Factors causing Non-linearity.
   c. Michaelis-menton method of estimating parameters.
7. Noncompartmental Pharmacokinetics.
   a. Statistical Moment Theory.
   b. MRT for various compartment models.
   c. Physiological Pharmacokinetic model.
8. Bioavailability and Bioequivalence.
   a. Introduction.
   b. Bioavailability study protocol.

c. Methods of Assessment of Bioavailability.

PDP 2405- BIOPHARMACEUTICS AND PHARMACOKINETICS (PRACTICAL)

Practical: 3 Hrs/Week

Objectives: Objectives of Biopharmaceutics course are to gain a basic understanding of the processes of drug absorption, distribution and elimination + the potentials of dosage form effects on these processes that can be applied to optimization of therapeutic benefit for a patient.

Scope: Biopharmaceutics explore the interrelationship of the physical/chemical properties of the drug, the dosage form (drug product) in which the drug is given, and the route of administration on the rate and extent of systemic drug absorption and the use of this information to optimise the therapeutic efficacy of the drug

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand about the concepts of biopharmaceutics and pharmacokinetics.
- **CO02:** Calculate the various pharmacokinetic parameters by using various mathematical models.
- **CO03:** Design a basic protocol for the conduct of Bioavailability/Bioequivalence study and the interpretation of the Bioavailability/Bioequivalence data.
- **CO04:** Use the concepts of pharmacokinetic principles in the clinical contexts and process simulated data
- **CO05:** Design and perform in-vitro dissolution studies for various drugs as per the standards of official monographs applicable to pharmaceutical industry.

List of Experiments:

2. Improvement of dissolution characteristics of slightly soluble drugs by some methods.
3. Comparison of dissolution studies of two different marketed products of same drug.
4. Influence of polymorphism on solubility and dissolution.
5. Protein binding studies of a highly protein bound drug and poorly protein bound drug.
6. 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.

7. Bioavailability studies of some commonly used drugs on animal/human model.
8. Calculation of Ka, Ke, t1/2, Cmax, AUC, AUMC, MRT etc. from blood profiledata.
9. Calculation of bioavailability from urinary excretion data for two drugs.
10. Calculation of AUC and bioequivalence from the given data for two drugs.
11. In vitro absorption studies.
12. Bioequivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxzole, Trimethoprim, Aspirin etc., on animals and human volunteers.
13. Absorption studies in animal inverted intestine using various drugs.
14. Effect on contact time on the plasma protein binding of drugs.
15. Studying metabolic pathways for different drugs based on elimination kinetics data.
16. Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
17. Determination of renal clearance.

PDL 4406- CLINICAL TOXICOLOGY (THEORY)

Theory: 2 Hrs. /Week

Objectives: The goal of toxicology is to contribute to the general knowledge of the harmful actions of chemical substances, to study their mechanisms of action, and to estimate their possible risks to humans on the basis of experimental work on biological test systems.

Scope: The scope of toxicology is very wide, and contains three principal categories: environmental (pollution, residues, industrial hygiene); economic (medicines, food, food additives, pesticides, dyestuffs, chemicals); and forensic (intoxication, diagnosis, therapy). An overall assessment of the toxicological profile of natural or man-made chemical substances consists of acute, subacute and chronic toxicity studies, mutagenecity, carcinogenecity and teratogenecity studies, and a series of specially designed experiments. In this paper, the relevance of these toxicological studies as well as the place of mutagenecity, carcinogenecity, and teratogenecity studies within the frame of toxicological evaluation are discussed.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the basic principles for the management of poisoning.
- **CO02:** Demonstrate the understanding of the health implications and management for acute toxic exposures and overdose of commonly involved chemicals and drugs including environmental impact.
- **CO03:** Demonstrate and apply an understanding of general toxicology principles and

clinical management for the chronic exposure of heavy metals.

- **CO04:** Demonstrate and apply the understanding of the clinical symptoms and treatment approaches related to envenomations, contaminated food, poisonous plants.
- **CO05:** Comprehend the basics of clinical symptoms and treatment strategies for abused substances.

Course materials:

References:

a. Matthew J Ellenhorn. ELLENHORNS MEDICAL TOXICOLOGY – DIAGNOSIS AND TREATMENT OF POISONING. Second edition. Williams and Willkins publication, London
b. V V Pillay. HANDBOOK OF FORENSIC MEDICINE AND TOXICOLOGY. Thirteenth edition 2003 Paras Publication, Hyderabad.

Syllabus

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications.
3. Supportive care in clinical Toxicology.
4. Gut Decontamination.
5. Elimination Enhancement.
6. Toxicokinetics.
7. **Clinical symptoms and management of acute poisoning with the following agents:**
   a) Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids.
   b) Opiates overdose.
   c) Antidepressants
   d) Barbiturates and benzodiazepines.
   e) Alcohol: ethanol, methanol.
   f) Paracetamol and salicylates.
   g) Non-steroidal anti-inflammatory drugs.
   h) Hydrocarbons: Petroleum products and PEG.
   i) Caustics: inorganic acids and alkali.
   j) Radiation poisoning
8. Clinical symptoms and management of chronic poisoning with the following agents – Heavy metals: Arsenic, lead, mercury, iron, copper
9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.
10. Plants poisoning. Mushrooms, Mycotoxins.
11. Food poisonings
12. Envenomations – Arthropod bites and stings.

Substance abuse:

Signs and symptoms of substance abuse and treatment of dependence

a) CNS stimulants :amphetamine
b) Opioids
c) CNS depressants
d) Hallucinogens: LSD
e) Cannabis group
f) Tobacco

DM 101- DISASTER MANAGEMENT (THEORY)

Theory: 2 Hrs. /Week

Objectives & Scope

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

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand foundations of hazards, disasters and associated natural/social phenomena
- **CO02:** Familiar with disaster management theory (cycle, phases)
- **CO03:** Know about Climate change, existing global frameworks and existing agreements
- **CO04:** Understand the methods of community involvement as an essential part of successful DRR, Humanitarian Assistance before and after disaster
- **CO05:** Understand technological innovations in Disaster Risk Reduction: Advantages and problems
- **CO06:** Experience on conducting independent DM study including data search, analysis and presentation of disaster case study

Syllabus

1 – Disasters: Classification, Causes, Impacts

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

2- Principles of disaster management

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

3 –Hazard Profile (India) , Disaster Risk Management in India

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

4 – Disaster and Development

- Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc. urban disasters, Waste Management
- Global trends in disasters & Adaptation: Global Trends, Complex emergencies, Pandemics Climate change and Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources

NSW1301- CLINICAL SKILLS-AND EMERGENCY INTERVENTIONS
Theory: 2 Hrs. /Week
Objectives & Scope:

- History and physical examination: obtain a patient's history and physical exam in a logical, organized and thorough manner while adapting to the urgency of the medical situation and the time available.
- Diagnostic decision making: formulate a differential diagnosis based on the key findings from the history and physical examination.
- Therapeutic decision making: understand risks, benefits, and compliance issues in choosing a treatment.
- Procedures: be able to perform such procedures as throat cultures, PAP smears, gram stains, wet mounts, and EKGs.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand various clinical procedures on patient.
- **CO02:** Make decision on formulating a differential diagnosis.
- **CO03:** Develop clinical skills and emergency intervention.
- **CO04:** Do various clinical procedures on patient for promoting good health

Course materials:

Text books

- Lippincott Manual of Nursing Practice, Williams & Wilkins, 10th Edition
- Potter Perry, Fundamentals of Nursing, 7th edition, Elsevier
- First Aid and Emergency Care, Dr. Swapna Naskar Williamson, Kumar Publishing House
- Berman and Synder, Kozier and Erb's Fundamentals of Nursing, 9th edition,Pearson.

Reference books

- Taylor C. Lillis C. Lemone P. Fundamentals Of Nursing- The Art And Science of Nursing Care. 4th Edition, Lippincott Publishers
- Student manual of BLS for health care providers, American heart association.

Syllabus

1. Vital signs monitoring: Temperature, Pulse, Respiration, Blood Pressure
2. Venipuncture
3. Regulating Intravenous(IV) flow rates
4. Changing IV dressings &IV solutions and tubing
5. Administering blood transfusions
6. Fluid Electrolytes and Acid Base Balance
7. Drug Administration- Intradermal, subcutaneous, intramuscular, intravenous (Purpose, Site of injection, Equipment, Procedure, Special considerations)
8. Wound dressing & Bandaging
9. Infection Control
10. Cardio-pulmonary Resuscitation

FIFTH YEAR

PDL 4501- CLINICAL RESEARCH (THEORY)

Theory: 3 Hrs. /Week

The objective of clinical research is to establish the effect of an intervention. Treatment effects are efficiently isolated by controlling for bias and confounding and by minimizing variation. Key features of clinical research that are used to meet this objective are randomization (possibly with stratification), adherence to intent-to-treat (ITT) principles, blinding, prospective evaluation, and use of a control group. Compared to other types of study designs (e.g., case-control studies, cohort studies, case reports), randomized trials have high validity but are more difficult and expensiveto conduct.

Scope: Clinical research is a current knowledge-intensive and booming industry. It is one of the industry growing at an astonishing rate and opening up a wide scope of employment opportunities for trained professionals. It provides scientific analysis of the impact, risks and benefits of medicines or a medicinal product.

Course Outcomes: After completion of course students will be able to

- **CO0**1: Know the new drug development process
- **CO0**2: Understand the regulatory and ethical requirements.
- **CO0**3: Appreciate and conduct the **Cl**inical trials activities
- **CO0**4. Know safety monitoring and reporting in **Cl**inical trials
- **CO0**5. Manage the clinical trial **Co**ordination process

Course materials:

References

a. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
b. 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.
c. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian

Council of Medical Research, New Delhi.

d. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
e. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
f. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
g. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

Syllabus

1. **Drug development process:**

   Introduction

   Various Approaches to drug discovery

   1. Pharmacological
   2. Toxicological
   3. IND Application
   4. Drug characterization
   5. Dosage form

2. Clinical development of drug:

1. Introduction to Clinical trials
2. Various phases of clinical trial.
3. Methods of post marketing surveillance
4. Abbreviated New Drug Application submission.
5. Good Clinical Practice – ICH, GCP, Central drug standard control organization (CDSCO) guidelines
6. Challenges in the implementation of guidelines
7. Ethical guidelines in Clinical Research
8. Composition, responsibilities, procedures of IRB / IEC
9. Overview of regulatory environment in USA, Europe and India.
10. 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
11. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)
12. Informed consent Process
13. Data management and its components
14. Safety monitoring in clinical trials.

PDL 4502- PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (THEORY)

Theory: 3 Hrs /Week

Objectives: Pharmacoepidemiology concentrates on clinical patient outcomes from therapeutics by using methods of clinical epidemiology and applying them to understanding the determinants of beneficial and adverse drug effects, effects of genetic variation on drug effect, duration-response relationships etc. Pharmacoeconomics is the science of measuring costs and outcomes associated with the use of pharmaceuticals in health-care delivery. Its objective is to improve public health through rational decision making when selecting among alternative therapies, e.g., for formularies and their impact on costs and outcomes.

Scope: Pharmacoeconomics is a branch of health economics related to the most economical and efficient use of pharmaceuticals. Pharmacoeconomics research identifies measures and compares the costs and outcomes of pharmaceutical products and services. Pharmacoepidemiology is the application of the principles of epidemiology to drug effects and drug use. Hence, Pharmacoepidemiology is the study of the use of and the effects of drugs in larger population. It involves the examination of

a single individual or large groups of people followed for many years.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand the key principles of Pharmacoepidemiology and its significance in public health, focusing on access to safe and affordable medicines.
- **CO02:** Apply pharmacoepidemiology principles to enhance medication use and improve patient outcomes, addressing healthcare disparities.
- **CO03:** Demonstrate skills in designing and evaluating Pharmacoepidemiology studies, ensuring ethical research practices and accountability.
- **CO04:** Understand basic pharmacoeconomic methods for evaluating healthcare costs and outcomes, promoting resource efficiency.
- **CO05:** Demonstrate competency in designing and evaluating Pharmacoeconomic studies, fostering collaborations to improve healthcare delivery and sustainability.

Syllabus

1. Pharmacoepidemiology :

- **Definition and scope:**

  Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.
- **Measurement of outcomes in pharmacoepidemiology**

  Outcome measure and drug use measures

  Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement
- **Concept of risk in pharmacoepidemiology**

  Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio
- **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, meta – analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.
- **Sources of data for pharmacoepidemiological studies**

  Ad Hoc data sources and automated data systems.
- **Selected special applications of Pharmacoepidemiology**

  Studies of vaccine safety, hospital pharmacoepidemiology, pharmacoepidemiology and risk management, drug induced birth defects.

2. Pharmacoeconomics:

- **Definition, history, needs of Pharmacoeconomics evaluations**

Role in formulary management decisions

- **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

3. Applications of Pharmacoeconomics: Software and case studies

PDL 4503- CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC & DRUG MONITORING (THEORY)

Theory: 2 Hrs. /Week

Objectives & Scope: Therapeutic drug monitoring (TDM) is generally defined as the clinical laboratory measurement of a chemical parameter that, with appropriate medical interpretation, will directly influence drug prescribing procedures. It involves the use of drug concentration measurements in body fluids as an aid to the management of drug therapy for the cure, alleviation or prevention of disease. TDM enables the assessment of the efficacy and safety of a particular medication in a varietyof clinical settings. The goal of this process is to individualize therapeutic regimens foroptimal patient benefit.

Course Outcomes: After completion of course students will be able to

- **CO01:** Understand principles of clinical pharmacokinetics and utilize the concepts of Pharmacokinetics to individualize the drug dosage regimen in clinical settings
- **CO02:** Apply nomograms and tabulations in dosage regimen design, ability to convert intravenous to oral dosing and understand Therapeutic Drug Monitoring Services
- **CO03:** Review the various pharmacokinetic drug interactions issues and assess their implications in the clinical settings.
- **CO04:** Adjust the dosage regimen for patients with renal / hepatic impairments
- **CO05:** Understand the significance of population pharmacokinetics, pharmacogenetics and polymorphism in drug metabolism, drug transporters and targets

Syllabus

1. Introduction to Clinical pharmacokinetics.

2. Design of dosage regimens:

Nomograms and Tabulations in designing dosage regimen, Conversion from intravenous to oral dosing, Determination of dose and dosing intervals, Drug dosing in the elderly and pediatrics and obese patients.

3. Pharmacokinetics of Drug Interaction:

a. Pharmacokinetic drug interactions
b. Inhibition and Induction of Drug metabolism
c. Inhibition of Biliary Excretion.

4. 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.

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.

5. Dosage adjustment in Renal and hepatic Disease.

a. Renal impairment
b. Pharmacokinetic considerations
c. General approach for dosage adjustment in Renal disease.
d. 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.

6. Population Pharmacokinetics.

a. Introduction to Bayesian Theory.
b. Adaptive method or Dosing with feed back.
c. Analysis of Population pharmacokinetic Data.
d.

7. Pharmacogenetics

a. Genetic polymorphism in Drug metabolism: Cytochrome P-450 Isoenzymes.
b. Genetic Polymorphism in Drug Transport and Drug Targets.
c. Pharmacogenetics and Pharmacokinetics/Pharmacodynamic considerations.

HR 101- HUMAN VALUES AND PROFESSIONAL ETHICS

Theory: 2 Hrs. /Week

Scope & Objective of the Course:

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

Course Outcomes: After completion of course students will be able to

- **CO01:** Develop critical thinking about character formation, Personal development and value education
- **CO02:** Recognise the National and Professional Values.
- **CO03:** Prioritise the knowledge regarding fundamental rights and promote compliance with

international and national concepts of human rights.

- **CO04:** Appraise the respect to women and children by clearing he concept of their human rights
- **CO05:** Demonstrate the need of meditation, yoga and physical exercise in maintaining a healthy lifestyle

Syllabus

1. **General Concepts:** Introduction about human rights and value education, aim of education, concept of human values and its types. Personal development: Self-analysis, gender equality, respect to age, experience, maturity, family member, coworker. Personality development and its importance in professional world. Character formation through human values: Truthfulness, sacrifice, sincerity, self-control, tolerance, positive attitude, dignity, ethics .
2. **National values:** Democracy, socialism, secularism, equality, justice, liberty, freedom, Social values: Sympathy, universal brother-hood, duty towards our society, Professional Values: Knowledge thirst, sincerity towards responsibility, ethics, regularity, punctuality, and faith, Religious values: Accept and respect others believes, tolerance, understanding, faith.
3. **Fundamental rights :** Introduction and importance of fundamental rights of Indian constitution , Right to Equality: Introduction and its importance, types of right of equality, equality before law, abolition of untouchability, abolition of titles, Right to freedom: Introduction and its importance, types of right, freedom of speech ,freedom to reside and settle , freedom to practice any profession, Rights against exploitation and right to freedom of religion: Introduction and its importance and its effect on human life.
4. **Cultural and educational rights and rights to constitutional remedies, Right to property and right to education :** Introduction and its importance, importance of education on our life, Human rights-general : concepts of human rights and its Indian and international perspective, evolution ofhuman rights, UDHR, significance and purpose of UDHR.
5. **Therapeutic Measures:** Control of mind through physical exercise, meditation, Meditation and yoga: Introduction and its effects on human mind , types of yoga , how to control our thought through yoga and meditation .
6. **Human rights of women and children :** Social practice and constitutional safeguards, gender discrimination in workplace, Female feticide , physical assault and harassment, domestic violence, condition of working of women, child labor, violation by individuals, nuclear weapons and terrorism safeguard.

AMR 1201- AWARENESS ON ANTIMICROBIAL RESISTANCE

Theory: 2 Hrs. /Week

Scope & Objective of the Course:

This course will help the students to understand the concept of antibiotic resistance, its impact on environment and health along with the basics of existing management perspectives for individual care. It will also make them understand their role as pharmacists and its impact on society's health.

The main objectives of the course are:

- To introduce the basic concepts of antibiotics and antibiotic resistance
- To understand the statistics of the incidence and prevalence of ABR
- To understand concept of "One health" related to Environment and ABR
- To aware the "future pharmacists" about the role in lowering the incidence of drug resistant infections
- To enable the students to understand the basic concept of antibiotic stewardship program at hospitals for managing ABR
- To aware the "future healthcare professionals" about the role of "human behavior" in managing ABR

Course Outcomes: After completion of course students will be able to

- **CO01:** Define the basic terminology related to AMR and ABR. Define the mode ofaction of antibiotics. Define the mechanism of antibiotic resistance. Understand the concept of 'One Health' in view of AMR.
- **CO02:** Describe the status of surveillance system for AMR in humans, animals andplants.
- **CO03:** Explain the key goals of global and national action plans to combat AMR.
- **CO04:** Understand and apply advances in antimicrobial stewardship programduring on-field practice.
- **CO05:** Understand the need and importance of antibiotic prescriptions for diseased conditions.

Syllabus

1 Introduction to AMR/ABR

- Definition of Antimicrobial resistance
- Overview on resistance mechanisms
- Spread of AMR
- Impact on health of humans, animals and plants

2 AMR surveillance system

- Introduction to GLASS
- AMR burden in the global and national level

3 Action plans for prevention of ABR

- GAP, NAP and KARSAP, WHO guidelines on AMR

4 Role of clinical pharmacists in preventing AMR as per standard guidelines

- Introduction to antimicrobial Stewardship
- Role of clinical pharmacist in infection control practices

5 Guidelines for appropriate antimicrobial use

- Infectious disease including UTI, pneumonia, skin and soft tissue infections,

CNS infections, abdominal infections, sepsis

PDP 4504- CLERKSHIP (PRACTICAL)
Practical: 1 Hr. /Week
Course Outcomes: After completion of course students will be able to

- **CO01:** Deliver clinical pharmacy services
- **CO02:** Manage Pharmaceutical care planning with knowledge of diseases and therapeutics
- **CO03:** Communicate effectively with patients, caregivers, and healthcare providers.
- **CO04:** Interpret and apply relevant laboratory and diagnostic data in therapeutic decision-making.

PDP 4505- PROJECT WORK (PRACTICAL)
Practical: 20 Hrs. /Week
Course Outcomes: After completion of course students will be able to

- **CO01:** Conduct comprehensive medication histories and patient assessments. Address a problem related to Pharmacy practice in hospital, community service or clinical set up with a wider perspective and generality
- **CO02:** Select appropriate methodology for investigative work, taking into account the pros and cons of the alternatives available and develop solution proposals based on reasoned judgement
- **CO03:** Present a coherent, logically argued, fully referenced report and engage in a professional manner in a viva-voce discussion about the project drug
- **CO04:** Utilize evidence-based practices and clinical guidelines to enhance patient care and safety.

SIXTH YEAR

PDP 6661- INTERNSHIP (PRACTICAL)
Practical: 36 Hrs. /Week
Course Outcomes: After completion of course students will be able to

- **CO01:** Apply pharmaceutical knowledge and skills in real-world clinical settings
- **CO02:** Demonstrate proficiency in medication therapy management.

- **CO03:** Collaborate effectively with healthcare teams to optimize patient health care through knowledge sharing.
- **CO04:** Conduct comprehensive medication histories and patient assessments

Year-VI			
Course Code	**Title of the Course**	**Hours (L+S+P)**	**Credit**
PDP 6661	Internship	6 hours per day 6X6=36 Hour per week	36
Total			**36**

Every student has to undergo one year internship.

Integration of Swayam

Swayam and MOOCs offer a diverse range of online courses across various disciplines, providing students with access to high-quality educational content from esteemed institutions and instructors worldwide. Integrating these courses into our curriculum presents a valuable opportunity to enhance the learning experience of our students, broaden their academic horizons, and equip them with relevant skills for their future endeavors.

12. Assessment and Evaluation

(1) Theory examination shall be of three hours and practical examination shall be of four hours duration.

(2) A Student who fails in theory or practical examination of a subject shall re-appear both in theory and practical of the same subject.

(3) Practical examination shall also consist of a viva –voce (Oral) examination.

(4) Clerkship examination – Oral examination shall be conducted after the completion of clerkship of students. An external and an internal examiner will evaluate the student. Students may be asked to present the allotted medical cases followed by discussion. Students' capabilities in delivering clinical pharmacy services, pharmaceutical care planning and knowledge of therapeutics shall be assessed.

(A) A regular record of both theory and practical class work and examinations conducted in an institution imparting training for Pharm.D. or as the case may be, Pharm.D. (Post Baccalaureate) course, shall be maintained for each student in the institution and 30 marks for each theory and 30 marks for each practical subject shall be allotted as sessional.

(B) There shall be at least two periodic sessional examinations during each academic year and the highest aggregate of any two performances shall form the basis of calculating sessional marks.

(C) The sessional marks in practical's shall be allotted on the following basis:- (i) Actual performance in

the sessional examination (20 marks); (ii) Day to day assessment in the practical class work, promptness, viva-voce record maintenance, etc. (10 marks).

The evaluation will be continuous and the weightage of various components are as given in Table 7 (For Theory courses) and in Table 8 (for Practical Courses).

Table 7: Evaluation components for Theory Courses

For Theory Courses	
Sessional Tests (STs)	30
End Term Examination	70
Total	100

There are three Sessional Tests (STs) for all theory papers, the average of best two are considered.

The End Term examination for practical courses includes conduct of experiment and an oral examination (viva voce)

Table 8: Evaluation Components for Practical Courses

For Lab Courses	
Lab Performance / File work	20
practical class work, promptness, internal viva-voce record maintenance	10
End Term	70
Total	100

(D). Internship (1) Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy and health care and acquires skills under the supervision so that he or she may become capable of functioning independently. (2) Every student has to undergo one year internship.

Table 9: Evaluation Components for Integrated Project

For Integrated Projects	
Performance / Presentation / Project report	100
Total	100

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

Remember

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

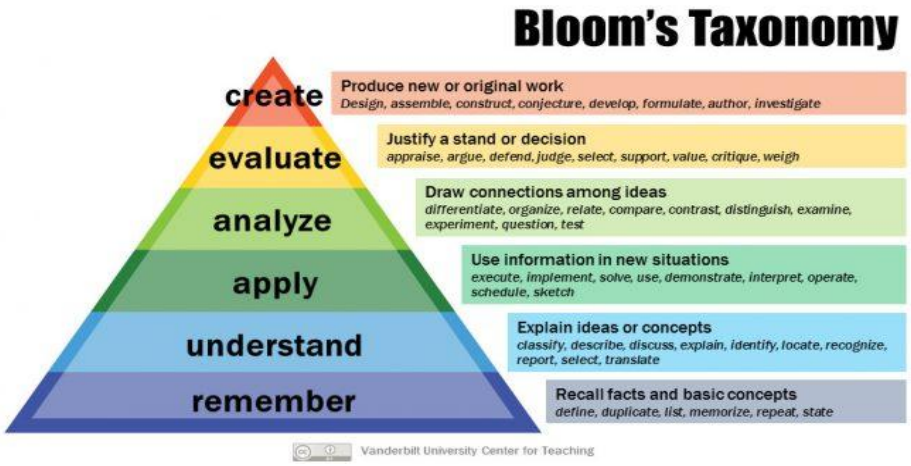


Figure 1. Bloom's Taxonomy [7]

Further a focused effort if also made to align every single Further a focused effort if also made to align every single test item in assessment components with one or the other course learning outcome.
Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

Sample Questions

1. List the neurotransmitter deficits commonly associated with Alzheimer's disease.
2. Name the classes of medications commonly used to treat inflammatory bowel disease.

Understand

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

Sample Questions

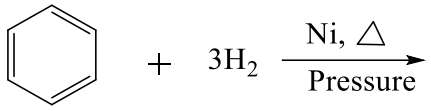
1. Summarize the rationale behind using anticholinergic medications in managing tremors associated with Parkinsonism.
2. Explain the differences between primary insomnia and secondary insomnia to another medical condition.

Applying

Carrying out or using a procedure through executing or implementing.

Sample Questions

1. Determine the product formed in the following reaction



2. Design a monitoring plan for a patient undergoing pharmacological therapy for alcoholic liver disease to assess treatment efficacy and safety.

Analyzing

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

Sample Questions

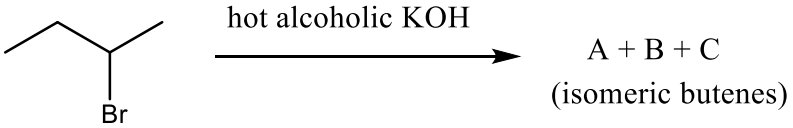
1. Analyze how drug-drug interactions can impact the effectiveness of pain management therapies.
2. Evaluate the efficacy and safety profiles of different antipsychotic agents in the long-term management of schizophrenia.

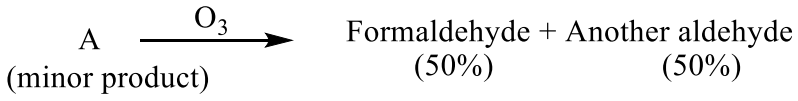
Creating & Evaluating

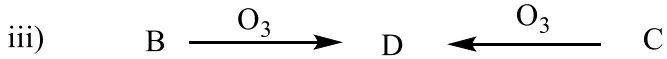
Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning or producing. Making judgments based on criteria and standards through checking and critiquing

Sample Questions

1. Predict the structures of A, B, C and D after proposing the chemical reactions by considering the following clues

i) 

ii) 

iii) 

2. Evaluate the impact of non-pharmacological interventions (e.g., cognitive behavioral therapy, acupuncture) in complementing pharmacotherapy for neuralgia. Discuss their potential to enhance treatment outcomes and reduce reliance on medication.

14. Course Handout

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

1. Objectives of the Course

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

2. Course Learning Outcomes (CLOs)

Student should be able to:

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

CLO-PO Mapping

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO01												

[1] National Higher Education Qualification Framework Level, Refer to annexure
[2] NHEQF Level Descriptor, Refer to Annexure & Learning outcomes descriptors for qualification for all levels on the NHEQF

CLO02												
CLO03												
CLO04												
CLO05												
CLO06												

H=High, M=Medium, L=Low

3. **Recommended Books:**

B01:
B02:
B03:
B04:
B05

4. **Other readings and relevant websites:**

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

5. **Recommended Tools and Platforms**

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

6. **Course Plan: Theory+ Lab**

Plan Theory Plan

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

Lab Plan

Lab No.	Topic(s)

Continuous Evaluation1 (15marks)	
Continuous Evaluation2 (15Marks)	

7. **Delivery/Instructional Resources**

Theory Plan:

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

Lab Plan:

Lab No.	Experiment	TLM	ALM	Web References	Audio-Video

8. **Remedial Classes[5]**

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

9. **Self-Learning[6]**

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

S.No	Topics	CO	ALM	References/MOOCS

10. **Delivery Details of Content Beyond Syllabus[7]**

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

S.No	Advanced	CO	POs	ALM	References/MOOCS

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

	Topics, Additional Reading, Research papers and any				

11. Evaluation Scheme & Components:

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

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

12. Syllabus of the Course:

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

13. Academic Integrity Policy:

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

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

This Document is approved by:

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

15. Program level Course-PO matrix of all courses

Table 10: CO-PO Matrix

S. No.	Course Name	Course Code	Course Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11
			After completion of course students will be able to:											
1	Human Anatomy and Physiology	PDL 4101	**CO01:** Understand the interlinked and physiological mechanisms of different organs of each system that occur within the body, including homeostasis, cell communication and the functioning of different organ system	**H**			M							
			CO02: Connect and correlate distinct structural features of human cells, tissues, bones, organs, and systems of the human body with their normal functions	H									M	

			CO03: Identify structural characteristics (gross anatomy) and comprehensive knowledge of the coordinated working pattern of different organs of each system.	H	M									
			CO04: Develop critical thinking skills by analyzing and interpreting anatomical and physiological data, and solving problems related to human health.	H									H	M
			CO05: Understand the use of appropriate laboratory techniques to examine anatomical structures or physiological functions, blood group determination, Hb estimation, blood pressure measurement etc.	H				M						H
2	Pharmaceutics	PDL 4102	**CO01:** Understand the art of formulating pharmaceutical monophasic formulations as per industry requirement	H		M		L						
			CO02: Critically understand the formulation of biphasic	M		H		L						

			formulations.											
			CO03: Analyse the evaluation parameters used for the quality of the various formulatuion.	H		M		L						
			CO04: Identify the use of various exciepienct on various poperties of formulations.	L		M		H						
			CO05: Undertand the accurate pharmaceutical calculations for medication preparation and dispensing.			M				**L**				
3	Medicinal Biochemistry	PDL 4103	**CO01:** Develop a solid understanding of the fundamental concepts of biochemistry within pharmaceutical sciences, enhancing their ability to understand the biochemical basis of drug action, metabolism, and the physiological effects of drugs on the human body, with an emphasis on promoting good health and well-being.	H	H					M			L	
			CO02: Acquire a comprehensive understanding of the metabolic pathways involved in the	H	H				H			M		L

			metabolism of carbohydrates, lipids, proteins, amino acids, and nucleic acids, and learn to relate these pathways to various metabolic disorders, thereby contributing to the prevention and management of non-communicable diseases in support of healthy lives.										
			CO03: Develop the skills to apply biochemical knowledge in clinical settings, enabling them to interpret laboratory results, understand metabolic disorders, and make informed decisions regarding patient care and therapeutic interventions, fostering quality healthcare and responsible consumption and production.			H	M	L			M			M
			CO04: Apply biochemical principles to clinical scenarios by performing and interpreting various eco-friendly diagnostic tests related to kidney and liver function, lipid profiles,					H	M			M	L	

			and electrolyte balance, thereby linking biochemical knowledge to clinical practice in a manner that supports sustainable healthcare practices.											
			CO05: Apply their biochemical knowledge ethically and professionally in the practice of pharmacy, ensuring they consider the biochemical implications of drug therapies on individual patients, particularly in the context of personalized medicine and innovation within the pharmaceutical industry.	M			L		H			H		H
4	Pharmaceutical Organic Chemistry	PDL 4104	**CO01:** Detect and analyse the structures, physical properties, acid-base theories and isomerism of organic compounds	H	L			L	L				L	
			CO02: Interpret the IUPAC system of nomenclature of simple organic compounds belonging to different classes of organic compounds.	H	L			L	L				L	

			CO03: Conclude nucleophilic substitution reactions, electrophilic substitution reactions and free radical chain reactions with mechanism, stereochemistry and orientation of the reaction, reactions of carbon carbon double bond, order of reactivity and stability of compounds.	H	L			L	M				L	
			CO04: Deduce electrophilic addition, free radical addition, elimination reactions, oxidation and reduction reactions with mechanism, stereochemistry and orientation of the reaction, order of reactivity, stability of compounds.	H	L			L	M				L	
			CO05: Demonstrate the mechanisms involved in various named reactions and methods of preparation, test for purity, principle involved in the assay, medicinal uses of some important	H	H			L	M				L	

			organic compounds.											
5	Pharmaceutical Inorganic Chemistry	PDL 4105	**CO01:** Understand and apply the principles of analytical chemistry and procedures of analysis of drugs as per industry requirement.	H					L		M			
			CO02: Apply and understand the applications of various techniques i.e. volumetric and gravimetric analysis.	H					L		M			
			CO03: Analyze the sources of errors, limit tests and methods to determine the impurities in inorganic drugs and pharmaceuticals.	H							H			
			CO04: Understand about radiopharmaceuticals, their applications and certain miscellaneous agents such as sclerosing agents, expectorants, sedative, antidotes and respiratory stimulants.	H	L	M					H			
			CO05: Understand the medicinal and pharmaceutical importance of inorganic compounds and appreciate the importance	M	M	H					L			

			of inorganic pharmaceuticals in preventing and curing the disease											
6	Remedial Mathematics	PDL 4106	**CO01:** Apply mathematical concepts and principles to perform computations for Pharmaceutical education.						H					
			CO02: Create, use and analyze mathematical representations and mathematical relationships						H					
			CO03: Communicate mathematical knowledge and understanding to help in the field of Clinical Pharmacy				H			M				
			CO04: Perform abstract mathematical reasoning						M					
7	Remedial Biology	PDL 4107	**CO01:** Understande the cell biology (Basic Nature of Plant cell and Animal cell)	M										
			CO02: Classify the both Plants & Animals system		M									
			CO03: Demonstrate tissue system and organ system in plant and animals		H									
			CO04: Analyze the theory of evolution and	M	M									

			various types of poisonous animals and their pathogenic effects.											
			CO05: Understand the physiology of plants and animals with the medicinal uses of plants.	H	H									
8	Human Anatomy & Physiology	PDP 2101	**CO01:** Acquire the knowledge about the interlinked mechanisms of different organs of each system in the maintenance of normal functioning (homeostasis) of the human body.	H			M							
			CO02: Understand and identify the structure of human anatomy and organization of tissues, organs, and systems.	H									M	
			CO03: Understand the structure (gross histology) and physiology of various organs and systems of the human body.	H			M							
			CO04: Create the proficiency in the use of appropriate laboratory techniques to examine anatomical structures or physiological functions, blood group determination, Hb	H				M						H

			estimation, blood pressure measurement, etc. for human health											
			CO05: Effectively communicate their findings and interpretations through written reports, and discussions, using appropriate terminology.	H									M	H
9	Pharmaceutics	PDP 2102	**CO01:** Demonstrate about pharmacy history and pharmacy profession.	H		M		L						
			CO02: Read different parts of prescription and analysing dose adjustments.	M		H		L						
			CO03: Understand various pharmaceutical monodisperse dosage forms.	H		M		L						
			CO04: Understand various pharmaceutical biphasic dosage forms.	L		M		H						
			CO05: Understand pharmaceutical mathematical calculations	L		M		H						
			CO06: Understand the need and formulation of suppositories, galenicals and surgical dressings as per industry requirements.	H		M		L						
10	Medicinal	PDP	**CO01:** Be proficient in	M					H				M	

	Biochemistry	2103	basic laboratory techniques relevant to medicinal biochemistry, including pipetting, solution preparation, and laboratory safety protocols											
			CO02: Acquire knowledge on biochemical assays to analyze the activity of enzymes and other biomolecules relevant to understand the pathological conditions and diseases.	M										
			CO03: Apply knowledge of qualitative and quantitative estimation of the biological macromolecules.	M					H				M	
			CO04: Understand of data interpretation emanating from a Clinical Test Lab.	M			H							
			CO05: Understand of physiological conditions that influence the structures and reactivity's of biomolecules.	M									M	
11	Pharmaceutical Organic Chemistry	PDP 2104	**CO01:** Apply various laboratory techniques such as distillation,	H				L	M				M	

			recrystallization, melting and boiling point.											
			CO02: Practice the use of stereo models in studying isomerism and assigning configuration to various organic compounds.	H					M				M	
			CO03: Propose the methods for the synthesis, purity, and analysis for identification and confirmation of hydrocarbons and organic compounds.	H				L	M				M	
12	Pharmaceutical Inorganic Chemistry	PDP 2105	**CO01:** Create and apply the limit test experimentation for various inorganic compounds.	H							M			
			CO02: Expertise in preparation of different strengths of solutions.	H							L			
			CO03: Evaluate identification, analysis and purity determination of various drugs and inorganic pharmaceuticals as per industry needs.	H					L		M			
			CO04: Understand the volumetric analysis and estimation of mixtures such as Sodium hydroxide	M	L						H			

			and sodium carbonate; Boric acid and Borax and Oxalic acid and sodium oxalate											
13	Remedial Biology	PDP 2107	**CO01:** Understand the cell biology (Basic Nature of Plant cell)	H										
			CO02: Knowledge of plants physiological experiments		H									
			CO03: Understand the various tissue, system and organ system in plant and animals	M										
			CO04: Proficient in transverse section of various natural drugs	H										
			CO05: Identify various plant parts along with its modifications		M									
14	Pathophysiology	PDL 4201	**CO01:** Apply the basic pathogenesis of different disorders, signs and symptoms of the diseases, complications of the diseases.	H	H									
			CO02: Apply the concepts of disease etiology, risk factors, causative agents, micro-organisms of infectious disorders, life cycle of important pathogens		H									

			CO03: Understand various laboratory tests, diagnostic procedures, normal and pathological values of different biomarkers, significance and interpretation		H		M							M
			CO04: Correlate between the pathogenesis of diseases and clinical applications to inhibit mortality and morbidity		H		M				M			M
15	Pharmaceutical Microbiology	PDL 4202	**CO01:** Apply the knowledge to understand, identify and study the comparative characteristics of prokaryotes and eukaryotes, with special emphasis on structural similarities and differences among various physiological groups of bacteria/archaea, fungi and virus.	H	H									
			CO02: Know microbial techniques for cultivation, isolation and identification of pure cultures of bacteria and know the various physical and chemical growth requirements.	L	H						L			M

			CO03: Explain different methods of sterilization their and applications in pharmaceutical microbiology.		M			M			H			
			CO04: Apply the basic knowledge of immunological processes and contrast the key mechanisms of innate and adaptive immunity, concepts of antibody and antigen -antibody reactions. Define the terms bacterial vaccines, toxoids, immunization programme, importance of booster dose.	L	M					H				L
			CO05: EstimatE potency of antibiotic by various microbial assay.			H	M			M	H			L
			CO06: Apply the knowledge related to pathogenesis, modes of transmission for the treatment and control of infectious diseases, along with understanding principles and procedure of various diagnostic tests for diseases.	M	H	L	L					M	H	L
16	Pharmacognosy & Phytopharmaceuticals	PDL 4203	**CO01:** Apply the knowledge about the basic concepts related to	H	M						L			

			the history, applications of pharmacognosy, classification, sources, macroscopy and microscopy of crude plant drugs in their aukthentication and quality assurance											
			CO02: Describe the fundamental principles on cultivation, collection, processing and evaluation of medicinal plants.	L	H						M			
			CO03: Recognize basic features of plant cell, different cell inclusion and cell wall components.	L	M						M			
			CO04: Describe and detect adulteration of crude drugs using morphological, microscopical, chemical and physical methods of evaluation.	L	M		H				L			
			CO05: Discuss regarding natural pesticides and their sources; describe the various plant fibers used in surgical dressings and related products.	L	M					M				H
			CO06: Apply knowledge related to primary and secondary plant		M						H			

			metabolites (lipids, proteins, carbohydrates, alkaloids, flavonoids, terpenes, volatile oils, tannins, resins) with emphasis on their classification, detection and extraction.											
17	Pharmacology- I	PDL 4204	**CO01:** Apply basic concepts in pharmacology in clinical settings, application of pharmacokinetic parameters in patients, classification systems, and therapeutic uses	H	H					L				
			CO02: Correlate the principles of biochemistry and the pathological basis of diseases with pharmacological concepts to promote health education			M								L
			CO03: Apply the knowledge of mechanisms of drug action, ADR, toxicology, and drug interactions in prescription analysis and therapeutic monitoring to foster affordability		H						M		L	
			CO04: Apply the pharmacological principles in therapeutics		H		M							

			to promote public healthcare and education for sustainable development											
			CO05: Appraise the role of pharmacologists in drug development, drug discovery, and drug use to decrease mortality and morbidity		H						M			
18	Community Pharmacy	PDL 4205	**CO01:** Demonstrate the ability to provide patient-centered care to diverse patients by devising, modifying, implementing, documenting, and monitoring evidence-based pharmacotherapy care plans, independently or in collaboration with healthcare teams, while considering patient circumstances.	H	H	H	H							
			CO02: Apply knowledge of business management, professional practice skills, and digital pharmacy tools (e.g., telepharmacy, inventory management software) to effectively operate community pharmacies.			H		M		M				
			CO03: Exhibit proficiency in writing			H	M						M	H

			prescriptions, identifying and preventing medication errors, promoting medication adherence, dispensing over-the-counter (OTC) drugs, providing patient counseling, and conducting health screening services (e.g., blood pressure, glucose monitoring).											
			CO04: Evaluate symptoms of common minor ailments and recommend appropriate over-the-counter medications, ensuring safe and effective patient care.	H	H	H	M							
			CO05: Actively participate in public health initiatives, including prevention programs for communicable and non-communicable diseases (e.g., diabetes, hypertension awareness), to promote community health.		M	M	M							H
19	Pharmacotherapeutics- I	PDL 4206	**CO01:** Understand the pathophysiology and management of		H	M								

			cardiovascular, respiratory, and endocrine diseases.											
			CO02: Cultivate patient case-based assessment skills.			H						H		
			CO03: Evaluate quality use of medicines issues concerning therapeutic agents in treating these diseases.			M	H			M				
			CO04: Apply clinical skills in therapeutic management of these conditions.			M		H						
20	Pharmaceutical Microbiology	PDP 2202	**CO01:** Apply techniques for the growth and control of microbes as well as different bacteriological techniques involved in microbiology.	M	M		H							
			CO02: Identify of unknown bacteria and microbes responsible for different diseases through various staining techniques and biochemical tests	L	M									
			CO03: Isolate specific stains of bacteria from mixed cultures and preserve them for long durations	M	L		H				H			H

			CO04: Apply and perform various sterilization techniques to maintain aseptic conditions and adhere to GLP.				H	H					H	
21	Pharmacognosy & Phytopharmaceuticals	PDP 2203	**CO01:** Apply macroscopic , microscopic and physical techniques for quality assessment of crude plant drugs	L	M	H		M			L			
			CO02: Perform chemical analysis and quality control of crude organized and unorganized drugs	L	H			L						
			CO03: Perform identification tests for detection of phytoconstituents present in plant drugs	L	H						H			
			CO04: Identify and know various crude plant drugs used for the treatment of various diseases		M	L								
22	Pharmacology- I	PDP 2204	**CO01:** Apply pharmacodynamic and pharmacokinetic aspects, adverse effects, and therapeutic uses to promote public healthcare	H	H					L				
			CO02: Apply the knowledge of dose, route		H	H								

			of administration, precautions, and contraindications of various drugs in clinical therapeutics											
			CO03: Analyse pharmacological aspects of drugs used to treat diseases of different organ systems of the body to decrease mortality and morbidity		H		H							
			CO04: Apply the principles of experimental pharmacology in drug discovery by preclinical and clinical trials		H			M						
			CO05: Correlate the basics of pharmacology and toxicology with clinical application of pharmacotherapeutics in health education		H						L			L
23	Pharmacotherapeutics- I	PDP 2206	**CO01:** Understand the proficiency in medication selection tailored to diverse patient needs.		M		H	M		L				H
			CO02: Evaluate drug interactions and adverse effects for safe prescribing.			M								H
			CO03: Analyse the therapeutic planning to			H		H						

			optimise treatment outcomes.											
			CO04: Apply pharmacotherapeutic principles to real-world clinical scenarios.	M			M		L	H				
			CO05: Evaluate drug efficacy and adjust treatment plans accordingly.			M	H							H
24	Pharmacology- II	PDL 4301	**CO01:** Know about the different drugs used for treatment of diseases.		H					H				
			CO02: Know of mode of action, uses, and adverse effects of drugs used in cancer, inflammation, respiratory system, urinay system, and immune system.		H					H				
			CO03: Understand the principles of animal toxicology and bioassay procedures.		H						M			
			CO04: Understand the cell, macromolecules, cell signaling, DNA replication and cell cycle.		H									
			CO05: Know the importance of gene and its structure, genome, gene expression, recombinant DNA		H									

			technology and other associated aspects.											
25	Pharmaceutical Analysis	PDL 4302	**CO01:** Analyze the importance of quality assurance processes including validation methods, Good Laboratory Practice (GLP), and ISO practices, in alignment with industry requirements and their role in promoting sustainable practices and public health.						H					
			CO02: Understand the fundamentals of various chromatographic techniques such as TLC, HPLC, HPTLC, and GC, with a focus on their applications in sustainable pharmaceutical development and environmental safety.						H					
			CO03: Develop knowledge on the theoretical aspects, instrumentation, and interpretation of data/spectra related to electrometric methods, emphasizing their contribution to innovative solutions in analytical						H					

			chemistry and sustainability.											
			CO04: Learn theoretical knowledge on instrumentation, elements of interpretation of data/spectra, and the application of different spectroscopic techniques, highlighting their role in enhancing efficiency and reducing waste in pharmaceutical processes.					M	H					
			CO05: Apply skills and knowledge of instrumentation, applications, and study of pharmaceutically important compounds estimated by fluorimetry, flame photometry, UV-Spectrophotometry, and electrometric methods, focusing on their impact on health outcomes and environmental sustainability.	H					H					
26	Pharmacotherapeutics- II	PDL 4303	**CO01:** Understand pharmacotherapeutic principles tailored to address a spectrum of health conditions including Infectious	M	H		M		H				H	M

			Diseases, Musculoskeletal Disorders, Renal System Dysfunctions, Oncological Maladies, and Dermatological Concerns.										
			CO02: Develop proficiency in selecting optimal pharmaceutical interventions by integrating patient-specific variables including medical history, concurrent illnesses, and potential drug interactions, fostering judicious prescribing practices aimed at maximizing therapeutic efficacy while mitigating adverse outcomes.			M		M					
			CO03: Acquire knowledge in pharmacotherapy tailored to diverse health conditions, focusing on patient-specific factors for optimal prescribing and treatment outcomes.	M	H	H	M	M	M				H
			CO04: Evaluate medical literature and apply evidence-based practices in pharmacotherapy decision-making.	M	M	M	H					M	M

27	Pharmaceutical Jurisprudence	PDL 4304	**CO01:** Assess the principles of pharmaceutical legislation and professional ethics as they apply to the pharmaceutical industry and pharmacy practice	**H**								H		L
			CO02: Summarize objectives, legal definitions, constitution and functions of drugs and cosmetics act, 1940, Pharmacy Act –1948, Medicinal and Toilet Preparation Act –1955, Narcotic Drugs and Psychotropic substances Act-1985					H						
			CO03: Outline the concepts of drugs and magic remedies act, essential commodities act relevant to drugs price control order					H				H		L
			CO04: Analyse various parameters in prevention of cruelty to animals act-1960, patents & design act-1970									H	M	
			CO05: Assess prescription and non-prescription products and drug price control order & national drug policy to	**M**								H		

			foster equality and affordability											
28	Medicinal Chemistry	PDL 4305	**CO01:** Demonstrate the importance of modern concept of rational drug design including energy minimisation.	H	H			M	H		M		L	L
			CO02: Assess the chemistry of drugs with respect to their pharmacological activity	H	H			L	M		M		L	L
			CO03: Conclude the drug metabolic pathways, adverse effects and therapeutic value of drugs	H	H				H		H		L	L
			CO04: Analyse the Structural Activity Relationship (SAR) of different class of drugs	H	H				L		M		L	L
			CO05: Outline the chemical synthesis of some drugs	H	H				L		M		L	L
29	Pharmaceutical Formulations	PDL 4306	**CO01:** Understand various pharmaceutical dosage forms.	H		M		L						
			CO02: Describe various types of tablets, granulation techniques and formulation methods.	M		H		L						
			CO03: Demonstrate different techniques for the formulation and	H		M		L						

			evaluation of capsules and liquid dosage forms.											
			CO04: Apply different in-process and finished product quality control tests for various formulations.	L		M		H						
			CO05: Understand parenteral and semisolid dosage forms along with their evaluation as per industry requirement	L		M		H						
			CO06: Assess importance of controlled and novel drug delivery systems.	H		M		L						
30	Clinical Psychology	CPY 101	**CO01:** Evaluate the nature of medically abnormal or atypical behavior	M	L	M	L	L	L	L	L	H	L	M
			CO02: Classify abnormal behavior based on DSM (Diagnostic and Statistical Manual of Mental Disorders) and ICD (International Classification of Disorders) criteria	M	L	H	M	M	L	L	L	H	L	M
			CO03: Understand how mental health professionals classify psychological disorders	L	L	H	M	L	L	L	L	H	L	M
			CO04: Recognize the symptoms of various	M	L	H	M	L	L	L	L	H	L	M

			psychological disorders											
			CO05: Analyze the treatments and outcomes for various psychological disorders	H	H	H	M	M	M	L	L	H	L	M
31	Pharmacology- II	PDP 2301	**CO01:** Describe about the laboratory animals, handling and its restrain, appliances used and physiological salt solution	H	H			H						
			CO02: Record Drug Response Curve of various drugs		H	L								
			CO03: Know about the anesthetic and euthanasia techniques		H									
			CO04: Understand the basic principles of bioassay and perform the biossasy of various drugs		H									
			CO05: Know the importance of various equipments in animal studies.	H	L									
32	Pharmaceutical Analysis	PDP 2302	**CO01:** Understand the importance of analysis in the pharmaceutical industry, emphasizing ethical practices and sustainability in drug development.					M	H					
			CO02: Gain knowledge about the assay of		M			H						

			pharmaceutical substances and products, focusing on quality assurance and environmental impact assessments.											
			CO03: Develop basic practical skills using instrumental techniques, integrating sustainable methodologies and responsible resource management.					H						
			CO04: Inculcate theoretical knowledge on various instrumental techniques adopted for the analysis of pharmaceuticals, highlighting innovation and sustainable practices in analytical chemistry.	H										
			CO05: Develop various methodologies for the assay of drugs and pharmaceuticals, incorporating skills and knowledge gained to promote sustainability and social responsibility in pharmaceutical practices.					H						
33	Pharmacotherapeutics- II	PDP 2303	**CO01:** Remember the medication selection		M		H	M		L				H

			tailored to diverse patient needs.											
			CO02: Assess drug interactions and adverse effects for safe prescribing.			M								H
			CO03: Create a therapeutic plan to optimise treatment outcomes.			H		H						
			CO04: Apply pharmacotherapeutic principles to real-world clinical scenarios.	M		H	M		L	H				
			CO05: Evaluate drug efficacy and adjusts treatment plans accordingly.			M	H							H
34	Medicinal Chemistry	PDP 2305	**CO01:** Predict partition coefficients, and dissociation constants of compounds for QSAR analysis.	H	L				H	M	M		L	
			CO02: Synthesize various medicinally important compounds in research.	H				M		M		L	L	
			CO03: Assess the purity (assay) of important drugs from the course content.	H				M		M		L	L	
			CO04: Interpret the monograph of important drugs.	H	L			M			M			L

35	Pharmaceutical Formulations	PDP 2306	**CO01:** Understand the principles involved in formulation and evaluation of various pharmaceutical dosage forms as per industry needs.	H						L				
			CO02: Demonstrate the preparation of various formulations with lucid understanding of new drug delivery technologies	M						H				
			CO03: Assess the formulation release through dissolution studies and understand the concept of bioavailability and bioequivalence.	L						L				
36	Pharmacotherapeutics- III	PDL 4401	**CO01:** Start the administration of medication and outline the expected therapeutic outcomes through targeted interventions.		**M**	H						**L**		
			CO02: Know the effective use of pharmacological therapeutic interventions in the treatment of specific diseases, conditions and symptoms.		**H**	**M**		**L**						
			CO03: Demonstrate			H							**M**	**L**

			effective communication and collaborative teamwork											
			CO04: Have moral reasoning, ethical judgment and professionalism	M							**M**	**H**		H
37	Hospital Pharmacy	PDL 4402	**CO01:** Create Basic understanding of organisational structure of a hospital as well as its pharmacy, infrastructure and budgeting			H	M	L		**H**		L	L	M
			CO02: Understand and remember the working and constitution of different hospital committees and drug formulary,			**H**	M					M	H	L
			CO03: Understand the process of procurement, warehousing, inventory control and distribution of drugs with especial emphasis on narcotic and controlled drugs; role of pharmacist in central sterile supply services			**H**	L	L				L	L	M
			CO04: Apply the basic knowledge of manufacturing process of sterile formulations, ointments, liquids,			**H**	L	L				L	L	M

			creams, tablets, granules, capsules, powders and total parentral nutrition											
			CO05: Understand the role of pharmacist in professional relations, practices, education, training and handling, packaging of radiopharmaceuticals;			L	L	M				L	L	M
38	Clinical Pharmacy	PDL 4403	**CO01:** Monitor patient drug therapy through reviewing medication charts and conducting clinical assessments.			**H**	M						L	
			CO02: Conduct medication history interviews with patients about their diseases and provide counseling as needed.			**H**	M							L
			CO03: Identify, evaluate, and monitor adverse drug reactions.			M	M						**H**	
			CO04: Analyze specific disease states by interpreting relevant laboratory results used as therapeutic monitoring parameters.		L	M	**H**							
			CO05: Retrieve, analyze, interpret and formulate drug or medicine	M						L			**H**	

			information.											
39	Biostatistics & Research Methodology	PDL 4404	**CO01:** Know the various statistical methods to solve different types of problems						M			H		
			CO02: Operate various statistical software packages									H		
			CO03: Appreciate the importance of Computer in hospital and Community Pharmacy			H	M							
			CO04: Appreciate the statistical technique in solving the pharmaceutical problems						M			H		
40	Biopharmaceutics & Pharmacokinetics	PDL 4405	**CO01:** Understand the concepts of biopharmaceutics and pharmacokinetics.		L				M	**H**				
			CO02: Identify and critically assess the various factors affecting drug absorption, distribution, metabolism and elimination		M					**H**				
			CO03: Describe need for different pharmacokinetic models and differentiate between compartment and non-compartment models.			L			M	**H**				
			CO04: Apply various mathematical models to							H				

			calculate different pharmacokinetic parameters following different routes of administration											
			CO05: Understand nonlinear kinetics and non-compartmental analysis inclusive of factors affecting non-linear pharmacokinetics		L					**H**	M			
			CO06: Define various terms related to bioavailability and bioequivalence, understand the biopharmaceutical classification system and assess the significance of in vitro/ in vivo correlation							**H**	L			
41	Clinical Toxicology	PDL 4406	**CO01:** Understand the basic principles for the management of poisoning.							M	H			
			CO02: Demonstrate the understanding of the health implications and management for acute toxic exposures and overdose of commonly involved chemicals and drugs including environmental impact.				H			M	H			

			CO03: Demonstrate and apply an understanding of general toxicology principles and clinical management for the chronic exposure of heavy metals.							M	H			
			CO04: Demonstrate and apply the understanding of the clinical symptoms and treatment approaches related to envenomations, contaminated food, poisonous plants.				M			L	H			
			CO05: Comprehend the basics of clinical symptoms and treatment strategies for abused substances.					H			L	M		
43	Disaster Management	DM 101	**CO01:** Understand foundations of hazards, disasters and associated natural/social phenomena							H				
			CO02: Familiar with disaster management theory (cycle, phases)	M									M	
			CO03: Know about Climate change, existing global frameworks and existing agreements						H					L
			CO04: Understand the methods of community involvement as an			H			L					L

			essential part of successful DRR, Humanitarian Assistance before and after disaster											
			CO05: Understand technological innovations in Disaster Risk Reduction: Advantages and problems						M					
			CO06: Experience on conducting independent DM study including data search, analysis and presentation of disaster case study			M								L
44	Clinical Skills & Emergencey Interventions	NSW 1301	**CO01:** Understand various clinical procedures on patient.	H				M		M				L
			CO02: Make decision on formulating a differential diagnosis.											
			CO03: Develop clinical skills and emergency intervention.											
			CO04: Do various clinical procedures on patient for promoting good health											
45	Pharmacotherapeutics- III	PDP 2401	**CO01:** Start the administration of medication and outline the expected therapeutic	**H**	H						**L**		**M**	

			outcomes through targeted interventions.											
			CO02: Know the effective use of pharmacological therapeutic interventions in the treatment of specific diseases, conditions and symptoms.	H	**M**		**L**						H	
			CO03: Demonstrate communication and collaborative teamwork		H							**L**		
			CO04: Have moral reasoning, ethical judgment and professionalism	M						**M**	**H**			H
46	Hospital Pharmacy	PDP 2402	**CO01:** Understand Various Drug Distribution Methods;			H	M							
			CO02: Apply various Professional Practice Management Skills In Hospital Pharmacies;			H							L	H
			CO03: Evaluate and Provide Unbiased Drug Information To The Doctors;			H	M						M	H
			CO04: Know The Manufacturing Practices Of Various Formulations In Hospital Set Up;			H		M			M			H
			CO05: Appreciate The Practice Based Research			H	M						M	M

			Methods;											
			CO06: Understand the stores management and inventory control management										M	
47	Clinical Pharmacy	PDP 2403	**CO01:** Monitor drug therapy of patient through medication chart review and Clinical review			H	M						L	
			CO02: Obtain medication history interview and counsel the patients;		H	M							L	
			CO03: Identify and resolve drug related problems;		M	M						H		
			CO04: Detect, assess and monitor adverse drug reaction;	L	M	H								L
			CO05: Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific states of diseases ; and				H		M					
			CO06: Retrieve, analyze, interpret and formulate drug or medicine information.						L			H		
48	Biopharmaceutics & Pharmacokinetics	PDP 2405	**CO01:** Understand about the concepts of biopharmaceutics and pharmacokinetics.		M					H				
			CO02: Calculate the various pharmacokinetic		M					H				

			parameters by using various mathematical models.											
			CO03: Design a basic protocol for the conduct of Bioavailability/Bioequivalence study and the interpretation of the Bioavailability/Bioequivalence data.		L			M		H				
			CO04: Use the concepts of pharmacokinetic principles in the clinical contexts and process simulated data					L	H		M			
			CO05: Design and perform in-vitro dissolution studies for various drugs as per the standards of official monographs applicable to pharmaceutical industry.		L					H				
50	Clinical Research	PDL 4501	**CO01:** Know the new drug development process as per pharmaceutical industry standards					H						
			CO02: Understand the regulatory and ethical requirements.					M				H		
			CO03: Appreciate and conduct the Clinical trials activities					M				H		

			CO04: Know safety monitoring and reporting in Clinical trials					M				H		
			CO05: Manage the clinical trial Coordination process						H			H		M
51	Pharmacoepidemiology and Pharmacoeconomics	PDL 4502	**CO01:** Understand the key principles of Pharmacoepidemiology and its significance in public health, focusing on access to safe and affordable medicines.			H						H		
			CO02: Apply pharmacoepidemiology principles to enhance medication use and improve patient outcomes, addressing healthcare disparities.			H						H	H	H
			CO03: Demonstrate skills in designing and evaluating Pharmacoepidemiology studies, ensuring ethical research practices and accountability.			L						H	H	
			CO04: Understand basic pharmacoeconomic methods for evaluating healthcare costs and outcomes, promoting resource efficiency.			L						H		M

			CO05: Demonstrate competency in designing and evaluating Pharmacoeconomic studies, fostering collaborations to improve healthcare delivery and sustainability.			L						H	H	
52	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	PDL 4503	**CO01:** Understand principles of clinical pharmacokinetics and utilize the concepts of Pharmacokinetics to individualize the drug dosage regimen in clinical settings		**L**		**M**			**H**				
			CO02: Apply nomograms and tabulations in dosage regimen design, ability to convert intravenous to oral dosing and understand Therapeutic Drug Monitoring Services		**L**		**M**			**H**				
			CO03: Review the various pharmacokinetic drug interactions issues and assess their implications in the clinical settings.		**L**	**L**	**M**			**H**				
			CO04: Adjust the dosage regimen for patients with renal / hepatic impairments		**M**					**H**				

			CO05: Understand the significance of population pharmacokinetics, pharmacogenetics and polymorphism in drug metabolism, drug transporters and targets				**M**						**H**	
53	Human Values and Professional Ethics	HR 101	**CO01:** Develop critical thinking about character formation, Personal development and value education			L	L	L				H	H	H
			CO02: Recognise the National and Professional Values.			H	H	L				H	H	H
			CO03: Prioritise the knowledge regarding fundamental rights and promote compliance with international and national concepts of human rights.			L		L				M	M	M
			CO04: Appraise the respect to women and children by clearing he concept of their human rights			L		L				M	L	M
			CO05: Demonstrate the need of meditation, yoga and physical exercise in maintaining a healthy lifestyle					L				M	L	H
54	Awareness on Antimicrobial	AMR 1201	**CO01:** Define the basic terminology related to	H					M					

	Resistance		AMR and ABR. Define the mode of action of antibiotics. Define the mechanism of antibiotic resistance. Understand the concept of 'One Health' in view of AMR.											
			CO02: Describe the status of surveillance system for AMR in humans, animals and plants.						M		L			
			CO03: Understand the key goals of global and national action plans to combat AMR.			H								
			CO04: Understand and apply advances in antimicrobial stewardship program during on-field practice.						H					
			CO05: Understand the need and importance of antibiotic prescriptions for diseased conditions.			H						L		
55	Clerkship	PDP 4504	**CO01:** Deliver clinical pharmacy services			M	H						H	H
			CO02: Manage Pharmaceutical care planning with knowledge of diseases and therapeutics		M							H	H	
			CO03: Communicate		M	H								H

			effectively with patients, caregivers, and healthcare providers.											
			CO04: Interpret and apply relevant laboratory and diagnostic data in therapeutic decision-making.					M		H				
56	Project work (Six Months)	PDP 4505	**CO01:** Conduct comprehensive medication histories and patient assessments. Address a problem related to Pharmacy practice in hospital, community service or clinical set up with a wider perspective and generality			H	H						L	M
			CO02: Select appropriate methodology for investigative work, taking into account the pros and cons of the alternatives available and develop solution proposals based on reasoned judgement	M			H				H		M	
			CO03: Present a coherent, logically argued, fully referenced report and engage in a professional manner in a viva-voce discussion about the project drug		M				H			H		

			CO04: Utilize evidence-based practices and clinical guidelines to enhance patient care and safety.			M				H				
57	Internship (1 year)	PDP 6661	**CO01:** Apply pharmaceutical knowledge and skills in real-world clinical settings			H	H						H	H
			CO02: Demonstrate proficiency in medication therapy management.	H						H				H
			CO03: Collaborate effectively with healthcare teams to optimize patient health care through knowledge sharing.		M	H			M					
			CO04: Conduct comprehensive medication histories and patient assessments	M				H			H	M		

16. Flexibilities: NA

17. Opportunities for international exposure

Chitkara University boasts of having very strong collaboration with more than 200 international university partners. Students are encouraged to draw the maximum benefit from the same by being in regular touch with #Go Global office at university and participating in various opportunities like short term mobility, internships modules etc. Credits earned by student through these opportunities at international university partners are suitably mapped to eventually get those reflected in the student's grade card.

Placement Opportunities

The Pharm. D. program in Pharmacy provides ample opportunity to a postgraduate to join various areas in pharmaceutical industry set up as well as in a hospital pharmacy support. The level of appointment and compensation there upon may depend upon the job profile and need for further additional post graduate specialization in specific areas. The possible positions are:

I. Research and Formulation Development Executive: Development of new formulations
II. Production Executive: Managing and supervising production of formulations
III. Project Executive (New Products): Coordinating the research, production and marketing activities in a Pharmaceutical organization, deciding as to what and how to develop a new product and plan production and marketing activity as per available capacity.
IV. Project Executive (New Plant): coordinating and erection, installation commissioning of production in a new plant / facility and ensuring that all installation and procedures are as per compliance norms laid out by regulatory agencies.
V. Executive (Administration and Finance)/ management Trainee: in a pharmaceutical organization.
VI. Executive /Astt Manager, Regulatory affairs: Helping the research team to compile drug master files for new drug products for registration and approval with the food and Drug authority of different countries.
VII. Hospital Pharmacist: He may further diversify into Clinical Pharmacist and then specialize into Geriatric, Pediatric or other specific area in a government or private setup in India or in other countries including USA, UK, UAE and others.
VIII. Sales and Marketing: He may take up a career in marketing starting as a sales person and then diversifying into Product Management, training and market research.