Study & Evaluation Scheme

Of

Doctor of Pharmacy

(Pharm. D)

Programme

[Applicable w.e.f. Academic Session - 2019-20 till revised]

[Framed under section 10 of the Pharmacy Act (8 of 1948) of the Doctor of Pharmacy (Pharm.D) course regulations 2008 given by PCI]

TEERTHANKER MAHAVEER UNIVERSITY

N.H.-24, Delhi Road, Moradabad, Uttar Pradesh-244001 Website: www.tmu.ac.in

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*Teerthanker Mahaveer College of Pharmacy (TMCOP), Delhi Road, Moradabad*
Programme	*Pharm. D (Doctor of Pharmacy)*
Duration	*Five year of academics and one year of internship*
Medium	*English*
Minimum Required Attendance	*80 %*
Credits	
Maximum Credits	*294*
Minimum Credits Required for Degree	*294*

A. Program Structure-Pharm. D

Pharm. D: The duration of the program 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 –

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

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

Program Outcomes and Program Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of six-year **Pharm**.**D**

Program Outcomes (POs):

Sl. No.	Program Outcomes (POs)
1.	Acquiring and retrieve sound knowledge on fundamental principles and their applications in the area of Pharmaceutical Sciences.
2.	Understanding and communicate the value of pharmacist's professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
3.	Developing ability for in-depth analytical and critical thinking in order to identify, formulate and solve the issues related to Pharmaceutical Industry, Regulatory Agencies, Hospital and Community Pharmacy Services.
4.	Developing written and oral communication skills.
5.	Developing creativity to solve need based problems in pharmaceutical Industry as well as in healthcare systems for raising quality use of medicine.
6.	Developing professional ethics, entrepreneurship, leadership and team spirit.

Program Specific Outcomes (PSOs):

Sl. No.	Program Outcomes (PSOs)
1.	Understanding the basic concepts of homeostasis, disease etiology and therapeutic management with their principles and applications.
2.	Understanding the various concepts of development of drug and pharmaceuticals
3.	Describing various requirements and methodology used for manufacturing and quality control of various pharmaceutical and cosmetic products.
4.	Demonstrating use of various instruments and equipment with their standard operating procedures (SOPs) for the analysis of drugs and pharmaceuticals.
5.	Demonstrating the ability to compound extemporaneous and commercially available dosage forms, dispense, and administer medications in a variety of healthcare settings.
6.	Applying standards, guidelines, best practices, and established processes related to safe and effective medication use.
7.	Conducting various pharmaceutical research studies such as identify and report drug related problems, ADRs, drug-drug interactions, drug toxicities, DUR etc. during pharmacy practice in clinics/hospitals.
8.	Developing and providing an evidence-based approach to care that considers the cost, care, access, and satisfaction needs of a targeted patient population.
9.	Developing research instinct in the area of community, hospital and clinical pharmacy.

B. Choice Based Credit System

The University has adopted the Choice Based Credit System (CBCS). The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. The following is the course module designed for the Pharm. D program:

Core Course (CC): Core courses of Pharm. D program will provide a holistic approach to pharmacy education, giving students an overview of the field, a basis to build and specialize upon. These core courses are the strong foundation to establish pharmacy knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase. The core courses will provide more practical-based knowledge, case-based lessons and collaborative learning models.

Ability Enhancement Compulsory Course (AECC):As per the guidelines of Choice Based Credit System (CBCS) for all Universities, including the private Universities, the Ability Enhancement Compulsory Course (AECC) is a course designed to develop the ability of students in communication (especially English) and other related courses where they might find it difficult to communicate at a higher level in their prospective job at a later stage due to lack of practice and exposure in the language, etc. Students are motivated to learn the theories, fundamentals and tools of communication which can help them develop and sustain in the corporate environment and culture. We offer three AECCs to all the students two in Year I & one in Year III of the program.

Skill Enhancement Course (SEC): This program has the maximum number of practical course which is designed to provide value-based and/or skill-based knowledge. We offer 18 SECs- across all 5 years. One SEC will carry 3 credits each and the clerkship also included in the SEC which carry 2 credit.

Bridge Course (BC): This is a compulsory course based on their HSC Courses. Students studied Physics / Chemistry / Botany / Zoology at HSC will be offered Remedial Mathematics course and students studied Mathematics / Physics / Chemistry at HSC will be offered Remedial Biology course in their first semester. These courses will fill the gap in their basic knowledge which will help to understand other core courses.

Value Added Course (VAC): A value added course is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life in the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be two courses in Year II. There will be a non-credit CTLD course also for the students which carry no credits, however, it will be compulsory for every student to pass these courses with minimum 45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in these courses in the respective semesters.

Open Elective (Interdisciplinary) Course (OEC): The open elective course is chosen from an unrelated discipline with an intention to seek exposure. The student will have to choose any one open elective courses (OECs) out of two courses namely First-Aid and Emergency care offered by College of Paramedical Sciences, TMU. Each OEC will carry 3 credits.

Pharm. D: 6 Year CBCS Programme			
Basic Structure: Distribution of Courses			
S. No.	Type of Course	Credit Hours	Total Credits
1	Core Course (CC)	17 Courses of 8 Credit Hrs. each (Total Credit Hrs. 17X8) 08 Courses of 6 Credit Hrs. each (Total Credit Hrs. 8X6) 01 Courses of 4 Credit Hrs. each (Total Credit Hrs. 1X4)	188
2	Ability-Enhancement Compulsory Course (AECC)	1 Course of 6 Credit Hrs. each (Total Credit Hrs. 1X6) 1 Course of 4 Credit Hrs. each (Total Credit Hrs. 1X4) 1 Course of 2 Credit Hrs. each (Total Credit Hrs. 1X2)	12
3	Open Elective Course (OEC)	01 Courses of 3 Credit Hrs. each (Total Credit Hrs. 1X3)	03
4	Skill-Enhancement Course (SEC)	17 Courses of 3 Credit Hrs. each (Total Credit Hrs. 17X3) 1 Course of 2 Credit Hrs. each (Total Credit Hrs. 1X2)	53
5	Bridge Course (BC)	1 Course of 12 Credit Hrs. each (Total Credit Hrs. 1X12) OR 1 Course of 8 Credit Hrs. each (Total Credit Hrs. 1X8) 1 Course of 4 Credit Hrs. each (Total Credit Hrs. 1X4)	12
	Value Added Course (VAC)	1 Course of 4 Credit Hrs. each (Total Credit Hrs. 1X4) 1 Course of 2 Credit Hrs. each (Total Credit Hrs. 1X2) 2 Courses of 0 Credit Hrs. (CTLD)	06
8	Project Work (PW)	1 Course of 20 Credit Hrs. each (Total Credit Hrs.1X20)	20
Total Credits			294

C. Course Structure- Pharm. D [Pharmacy Council of India]

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

First Year

S.N.	Category	*Course Code*	*Course*	*Periods*			*Credits*
				L	*T*	*P*	
1	CC-1	PDR101	Human Anatomy and Physiology	3	1	-	8
2	CC-2	PDR102	Pharmaceutics	2	1	-	6
3	CC-3	PDR103	Medicinal Biochemistry	3	1	-	8
4	CC-4	PDR104	Pharmaceutical Organic Chemistry	3	1	-	8
5	CC-5	PDR105	Pharmaceutical Inorganic Chemistry	2	1	-	6
6	BC-1	PDR106	Remedial Mathematics[#]	3	3	-	12
7	BC-2	PDR107	Remedial Biology[$]	3	1	-	8
8	SEC-1	PDR151	Human Anatomy and Physiology (P)	-	-	3	3
9	SEC-2	PDR152	Pharmaceutics (P)	-	-	3	3
10	SEC-3	PDR153	Medicinal Biochemistry (P)	-	-	3	3
11	SEC-4	PDR154	Pharmaceutical Organic Chemistry (P)	-	-	3	3
12	SEC-5	PDR155	Pharmaceutical Inorganic Chemistry (P)	-	-	3	3
13	BC-3	PDR156	Remedial Biology (P)[$]			4	4
			Total	**18**	**09**	**19**	**63**

[$]Applicable to those who opt **Remedial Biology**
[#]Applicable to those who opt **Remedial Mathematics**

Second Year

S.N.	Category	*Course Code*	*Course*	*Periods*			*Credits*
				L	*T*	*P*	
1	CC-6	PDR201	Pathophysiology	3	1		8
2	CC-7	PDR202	Pharmaceutical Microbiology	3	1		8
3	CC-8	PDR203	Pharmacognosy & Phytopharmaceuticals	3	1		8
4	CC-9	PDR204	Pharmacology-I	3	1		8
5	CC-10	PDR205	Community Pharmacy	2	1		6
6	CC-11	PDR206	Pharmacotherapeutics-I	3	1		8
7	AECC-1	PDR207	Communication Skill*	2	-	-	4
8	VAC-1	PDR208	Computer Applications in Pharmacy*	2			4
9	SEC-6	PDR251	Pharmaceutical Microbiology (P)			3	3
11	SEC-7	PDR252	Pharmacognosy & Phytopharmaceuticals (P)			3	3
12	SEC-8	PDR253	Pharmacotherapeutics-I (P)			3	3
13	AECC-2	PDR254	Communication Skill*	-	-	2	2
14	VAC-2	PDR255	Computer Applications in Pharmacy*			2	2
			Total	**21**	**06**	**13**	**67**

*Non university course

Third Year

S.N.	Category	Course Code	Course	Periods			Credits
				L	T	P	
1	CC-12	PDR301	Pharmacology –II	3	1	-	8
2	CC-13	PDR302	Pharmaceutical Analysis	3	1	-	8
3	CC-14	PDR303	Pharmacotherapeutics -II	3	1	-	8
4	CC-15	PDR304	Pharmaceutical jurisprudence	2	-	-	4
5	CC-16	PDR305	Medicinal chemistry	3	1	-	8
6	CC-17	PDR306	Pharmaceutical formulations	2	1	-	6
7	AECC-3	PDR307	Environmental sciences*	3	-	-	6
8	SEC-9	PDR351	Pharmacology –II (P)	-	-	3	3
9	SEC-10	PDR352	Pharmaceutical Analysis (P)	-	-	3	3
10	SEC-11	PDR353	Pharmacotherapeutics -II (P)	-	-	3	3
11	SEC-12	PDR354	Medicinal chemistry (P)	-	-	3	3
12	SEC-13	PDR355	Pharmaceutical formulations (P)	-	-	3	3
			Total	**19**	**05**	**15**	**63**

*Non university course

Fourth Year

S.N.	Category	Course Code	Course	Periods			Credits
				L	T	P	
1	CC-18	PDR401	Pharmacotherapeutics -III	3	1		8
2	CC-19	PDR402	Hospital Pharmacy	2	1		6
3	CC-20	PDR403	Clinical pharmacy	3	1		8
4	CC-21	PDR404	Biostatics & Research Methodology	2	1		6
5	CC-22	PDR405	Biopharmaceutics & Pharmacokinetics	3	1		8
6	CC-23	PDR406	Clinical Toxicology	2	1		6
7	SEC-14	PDR451	Pharmacotherapeutics -III (P)			3	3
8	SEC-15	PDR452	Hospital Pharmacy (P)			3	3
9	SEC-16	PDR453	Clinical pharmacy (P)			3	3
10	SEC-17	PDR454	Biopharmaceutics & Pharmacokinetics (P)			3	3
			Total	**18**	**7**	**15**	**54**

Value Added Course (VAC)

S.N.	Category	Course Code	Course/Paper	Periods			Credit
				L	T	P	
11	VAC-3	TMUPS 701	Managing Self	02	1	-	00

Fifth Year

S. N.	Category	Course Code	Course	Periods			Credits
				L	S	P	
1	CC-24	PDR501	Clinical Research	3	1	-	8
2	CC-25	PDR502	Pharmacoepidemiology and Pharmacoeconomics	3	1	-	8
3	CC-26	PDR503	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	2	1	-	6
4	SEC-18	PDR551	Clerkship*	-	1	-	2
5	PW-1	PDR552	Project Work (Six Months)	-		20	20
			Total	**8**	**7**	**20**	**44**

Value Added Course (VAC)

S.N.	Category	Course Code	Course/Paper	Periods			Credit
				L	T	P	
6	VAC-4	TMUPS 801	Managing Work and Others	02	1	-	00

Sixth Year

Internship:

Internship or residency training including postings in specialty units. Students will independently provide the clinical pharmacy services to the allotted wards.

(i) Six months in General Medicine department, and

(ii) Two months each in three other specialty departments

- Pediatrics
- Gynecology and Obstetrics
- Psychiatry
- Skin and VD
- Orthopedics

Open Elective Course (OEC): Students have to select one open elective (interdisciplinary) course from the following two courses offered by College of Paramedical Sciences, TMU, during their internship.

1. First Aid (PAR-501) - 3 credits
2. Emergency Care (PAR-502) - 3 credits

D. ATTENDANCE, EVALUATION & EXAMINATION

A student shall be required to have a minimum attendance of 80% in a course/ in aggregate of all the courses including practical's during a year. The period of attendance shall be taken from the first day of the start of the Academic year to one week before the last scheduled day of class. This shall also be notified in the academic calendar. However, under special circumstances the Dean/Principal of the college may forward to the Vice Chancellor a request of a student for some relaxation of attendance for reasons to be recorded, which however shall not be a matter of routine.

Under normal circumstance, a student who has an aggregate attendance of less than 80% in a course / cumulative attendance in all courses including practical in a year shall not be allowed to appear in the course/ in year-end examination as decided by the University from time to time. Student who has been detained due to shortage of attendance shall be required to repeat course(s) of the said year with the next batch of the next session or will have the option to attend the special classes during the summer vacation if conducted by the college and appear for the examination there after whenever conducted by the University. **A student can avail the opportunity of attending summer special classes only once during the complete duration of the program**. The University Enrolment number of such student shall however remain unchanged and s/he shall be required to complete the Program in a maximum permissible period of (n+2) years as mentioned in clause 3.4. of the Ordinance for Pharm. D Programme.

Principal of the College shall announce the names of all such students who are not eligible to appear in the year-end examination, at-least one week before the commencement of the examinations and simultaneously intimate the same to the Controller of Examinations and office of the Registrar. The Principal of the college will ensure that a monthly attendance record is posted on the Notice board of all departments and a copy sent to the office of the Registrar for information.

In case, any student appears by default, who in fact has been detained by the College, his/her result shall be treated as null and void.

D.1. EVALUATION & EXAMINATION

Every year there shall be an examination to examine the students. Each examination may be held twice every year. The first examination in a year shall be the annual examination and the second examination shall be supplementary examination. The examinations shall be of written and practical nature; Theory examination shall be of three hours and practical examination shall be of four hours duration. The distribution of weightage for various components of evaluation shall be as mentioned below:

S. No.		MARKS DISTRIBUTION
A	**THEORY COURSES**	
	Year End Examination	70
	Internal Assessment	30
B	**PRACTICAL/LABORATORY COURSES**	
	Year -end examination	70
	Internal Assessment	30
C	**DISSERTATION/THESIS/PROJECTS**	
	Assessment by External Examiner	70
	Assessment by Internal Examiner	30

The above weightage scheme shall prevail unless otherwise specified for a particular course of programs in the Schemes of Teaching & Evaluation duly recommended by the Board of Studies with the approval of the Vice-Chancellor. A Student who fails in theory or practical examination of a Course shall re-appear both in theory and practical of the same Course. Practical examination shall also consist of a viva –voce (Oral) examination.

Internal Assessment

The general procedure for internal evaluation and the weightage of the marking to calculate the internal marks to be sent to the university shall be as follows. In specific case(s) if, the curriculum so requires, the change in the composition of internal evaluation shall be permitted with the prior approval of the Vice Chancellor.

For Theory Papers

S. No.	Evaluation	Weightage out of 30 Marks
1	Class Quiz./ Class Tutorial/ Project work/Assignments & Activity	5
2	Internal Examination – best two	20
3	Attendance	5
	Total	**30**

Note: In case of the Class Quiz/ Class Tutorial/ Project work/ Assignments & Activities, the Course/course teacher will inform the marking pattern on the first day of the class with the lecture plan and also put the same on the web site after being duly approved by the Principal of the College.

The college will hold class tests as per the University Academic Calendar. The third class test would be held on completion of the Annual classes and during the preparatory leave for the year end examination. The evaluated answer scripts shall be shown to the students by the faculty and the same shall be discussed for improvement in the class during tutorials.

The internal assessment marks shall be submitted to the HOD by each faculty. The HOD will compile the class marks and send the same to the Academic Review Committee for review, records and its onward transmission to the Controller of Examinations.

For Practical

S. No.	Evaluation	Weightage out of 30 Marks
1	Performance in Practical (Experiment, file preparation & viva)	10
2	Internal practical exam & Viva Voce	15
3	Attendance	5
	Total	**30**

Note: Marks for attendance would be given as per the following criteria:

Attendance - +90% - 5 marks; 85 to 90% - 4 marks; 80-85% - 3 marks; 75-80% - 2 marks; less than 75% - 1 (one) mark

The examinations carrying maximum marks for each part of a Course as indicated in Tables below:

First Year

S.N.	Category	*Course Code*	*Course*	*Credits*	*Evaluation Scheme*		
					Internal	*External*	*Total*
1	CC-1	PDR101	Human Anatomy and Physiology	8	30	70	100
2	CC-2	PDR102	Pharmaceutics	6	30	70	100
3	CC-3	PDR103	Medicinal Biochemistry	8	30	70	100
4	CC-4	PDR104	Pharmaceutical Organic Chemistry	8	30	70	100
5	CC-5	PDR105	Pharmaceutical Inorganic Chemistry	6	30	70	100
6	BC-1	PDR106	Remedial Mathematics[#]	12	30	70	100
7	BC-2	PDR107	Remedial Biology[$]	8	30	70	100
8	SEC-1	PDR151	Human Anatomy and Physiology (P)	3	30	70	100
9	SEC-2	PDR152	Pharmaceutics (P)	3	30	70	100
10	SEC-3	PDR153	Medicinal Biochemistry (P)	3	30	70	100
11	SEC-4	PDR154	Pharmaceutical Organic Chemistry (P)	3	30	70	100
12	SEC-5	PDR155	Pharmaceutical Inorganic Chemistry (P)	3	30	70	100
13	BC-3	PDR156	Remedial Biology (P)[$]	4	30	70	100
			Total	**63**	**390**	**910**	**1300**

*Non university course

[$]Applicable to those who opt **Remedial Biology**

[#]Applicable to those who opt **Remedial Mathematics**

Second Year

S.N.	Category	Course Code	Course	Credits	Evaluation Scheme		
					Internal	External	Total
1	CC-6	PDR201	Pathophysiology	8	30	70	100
2	CC-7	PDR202	Pharmaceutical Microbiology	8	30	70	100
3	CC-8	PDR203	Pharmacognosy & Phytopharmaceuticals	8	30	70	100
4	CC-9	PDR204	Pharmacology-I	8	30	70	100
5	CC-10	PDR205	Community Pharmacy	6	30	70	100
6	CC-11	PDR206	Pharmacotherapeutics-I	8	30	70	100
8	AECC -1	PDR207	Communication Skill*	4	30	70	100
7	VAC-1	PDR208	Computer Applications in Pharmacy*	4	30	70	100
8	SEC-6	PDR251	Pharmaceutical Microbiology (P)	3	30	70	100
9	SEC-7	PDR252	Pharmacognosy & Phytopharmaceuticals (P)	3	30	70	100
10	SEC-8	PDR253	Pharmacotherapeutics-I (P)	3	30	70	100
15	AECC-2	PDR254	Communication Skill*	2	30	70	100
11	VAC-2	PDR255	Computer Applications in Pharmacy*	2	30	70	100
			Total	**67**	**330**	**770**	**1100**

*Non university course

Third Year

S.N.	Category	Course Code	Course	Credits	Evaluation Scheme		
					Internal	External	Total
1	CC-12	PDR301	Pharmacology –II	8	30	70	100
2	CC-13	PDR302	Pharmaceutical Analysis	8	30	70	100
3	CC-14	PDR303	Pharmacotherapeutics -II	8	30	70	100
4	CC-15	PDR304	Pharmaceutical jurisprudence	4	30	70	100
5	CC-16	PDR305	Medicinal chemistry	8	30	70	100
6	CC-17	PDR306	Pharmaceutical formulations	6	30	70	100
7	AECC-3	PDR307	Environmental sciences*	6	30	70	100
8	SEC-9	PDR351	Pharmacology –II (P)	3	30	70	100
9	SEC-10	PDR352	Pharmaceutical Analysis (P)	3	30	70	100
10	SEC-11	PDR353	Pharmacotherapeutics -II (P)	3	30	70	100
11	SEC-12	PDR354	Medicinal chemistry (P)	3	30	70	100
12	SEC-13	PDR355	Pharmaceutical formulations (P)	3	30	70	100
			Total	**63**	**360**	**840**	**1200**

*Non university course

Fourth Year

S.N.	Category	*Course Code*	*Course*	*Credits*	*Evaluation Scheme*		
					Internal	*External*	*Total*
1	CC-18	PDR401	Pharmacotherapeutics -III	8	30	70	100
2	CC-19	PDR402	Hospital Pharmacy	6	30	70	100
3	CC-20	PDR403	Clinical pharmacy	8	30	70	100
4	CC-21	PDR404	Biostatics & Research Methodology	6	30	70	100
5	CC-22	PDR405	Biopharmaceutics & Pharmacokinetics	8	30	70	100
6	CC-23	PDR406	Clinical Toxicology	6	30	70	100
7	SEC-14	PDR451	Pharmacotherapeutics -III (P)	3	30	70	100
8	SEC-15	PDR452	Hospital Pharmacy (P)	3	30	70	100
9	SEC-16	PDR453	Clinical pharmacy (P)	3	30	70	100
10	SEC-17	PDR454	Biopharmaceutics & Pharmacokinetics (P)	3	30	70	100
			Total	**54**	**330**	**770**	**1100**

Value Added Course (VAC)

S.N.	**Category**	**Course Code**	**Course/Paper**	**Credit**	**Evaluation Scheme**		
					Internal	**External**	**Total**
11	VAC-3	TMUPS 701	Managing Self	00	50	50	100

Fifth Year

S. N.	Category	*Course Code*	*Course*	*Credits*	*Evaluation Scheme*		
					Internal	*External*	*Total*
1	CC-24	PDR501	Clinical Research	8	30	70	100
2	CC-25	PDR502	Pharmacoepidemiology and Pharmacoeconomics	8	30	70	100
3	CC-26	PDR503	Clinical Pharmacokinetics & Pharmacotherapeutic Drug Monitoring	6	30	70	100
4	SEC-18	PDR551	Clerkship*	2	30	70	100
5	PW-1	PDR552	Project Work (Six Months)	20	30	70	100**
			Total	**44**	**150**	**350**	**500**

*Attending ward round on daily basic.

** 30 Marks – 1 seminars & 70 Marks –Thesis work & viva Voce.

Value Added Course (VAC)

S.N.	**Category**	**Course Code**	**Course/Paper**	**Credit**	**Evaluation Scheme**		
					Internal	**External**	**Total**
10.	VAC-4	TMUGS 501	Managing Work and Others	00	50	50	100

Sixth Year

Assessment of Internship: The intern shall maintain a record of work which is to be verified and certified by the preceptor (teacher practioner) under whom he works. Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of the training. Based on the record of work and date of evaluation, the Dean or Principal shall issue certificate of satisfactory completion of training following which the university shall award the degree or declare him/her eligible for it.

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

(1)	Proficiency of knowledge required for each case management	SCORE 0-5
(2)	The competency in skills expected for providing Clinical Pharmacy Services	SCORE 0-5
(3)	Responsibility, punctuality, work up of case, involvement in patient care	SCORE 0-5
(4)	Ability to work in a team (Behaviour with other healthcare professionals including medical doctors, nursing staff and colleagues).	SCORE 0-5
(5)	Initiative, participation in discussions, research aptitude.	SCORE 0-5

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

D.2. 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.

D.3. Minimum marks for passing examination

A student shall not be declared to have passed examination unless he or she secures at least 50% marks in each of the Courses separately in the theory examinations including internal marks and at least 50% marks in each of the practical examinations including internal marks. The students securing 60% marks or above in aggregate in all Courses in the Pharm. D. or, Pharm. D. (Post Baccalaureate) course examination, shall be declared to have passed in first class. Students securing 75% marks or above in any Course or Courses shall be declared to have passed with distinction in the Course or those Courses provided he or she passes in all the Courses in a single attempt.

D.4. Eligibility for promotion to next year

All students, who have appeared for all the Courses and passed the first year annual examination, are eligible for promotion to the second year and, so on. However, failure in more than two courses shall debar

him/her from promotion to the next year classes. There will be one supplementary after each end-year examination within three months from the date of publication of the result. All the failure candidates will appear and clear their back papers. Those who pass all such papers/ carry not more than two papers, will be promoted to the next year while those failing in more than two papers will have to repeat the same year of the programme.

D.5. Internship programme— Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy & health care and acquires skills under the supervision so that he/she may become capable of functioning independently. Every student has to undergo one-year internship as per Pharm. D. education regulation 2008.

E. Practical Training

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

E.2. Project work— (1) 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 at the end of the year. External and the internal examiners shall do the assessment of the project work. (2) Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

E.3. Objectives of project work— The main objectives of the project work is to— (i) show the evidence of having made accurate description of published work of others and of having recorded the findings in an impartial manner; and (ii) develop the students in data collection, analysis and reporting and interpretation skills.

E.4. Methodology— To complete the project work following methodology shall be adopted, namely:— (i) students shall work in groups of not less than *two* and not more than *four* under an authorised teacher; (ii) project topic shall be approved by the Head of the Department or Head of the Institution; (iii)project work chosen shall be related to the pharmacy practice in community, hospital and clinical setup. It shall be patient and treatment (Medicine) oriented, like drug utilisation reviews, pharmacoepidemiology,

pharmacovigilance or pharmacoeconomics; (iv) project work shall be approved by the institutional ethics committee; (v) student shall present at least three seminars, one in the beginning, one at middle and one at the end of the project work; and (vi) two-page write-up of the project indicating title, objectives, methodology anticipated benefits and references shall be submitted to the Head of the Department or Head of the Institution.

E.5. Reporting — (1) 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 (2) 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. (3) Submission of the project report shall be done at least one month prior to the commencement of annual or supplementary examination.

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

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

(ii) Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of four students). (iii)Three seminars presented by students shall be evaluated for twenty marks each and the average of best two shall be forwarded to the university with marks of other Courses.

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

(v) Final evaluation of project work shall be done on the following items:	**Marks**
a) Write up of the seminar	(17.5)
b) Presentation of work	(17.5)
c) Communication skills	(17.5)
d) Question and answer skills	(17.5)
Total	(70 marks)

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

F. Teaching Pedagogy & Unique practices adopted in TMCOP

"Pedagogy is the method and practice of teaching, especially for teaching an academic Course or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on **experiential learning.**

***1. Case Based Learning*:** Case based learning enhances student skills at delineating the critical decision dilemmas faced by organizations, helps in applying concepts, principles and analytical skills to solve the delineated problems and develops effective templates for business problem solving. Case method of teaching is used as a critical learning tool for effective learning and we encourage it to the fullest. We make it compulsory to teach at least one case study in each unit of every course in Pharm. D program.

2. Role Play & Simulation: Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

3. Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their Lectures. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

***4. Field / Live Projects*:** The students, who take up experiential projects in hospitals, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

5. Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

6. Special Guest Lectures (SGL)): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry, we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and provide greater insights.

7. Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

8. Industry Focused programs: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses/contents are to be delivered by industry experts to provide practice based insight to the students.

9. Special Assistance Programme for Slow & Fast Learners: The College gets a diverse group of students every year. They differ in terms of their intelligence, efforts and interest. We make efforts to identify them as Slow and fast learners within first three months of their joining. Slow learners are given extra time and sessions to bridge the learning gap under the guidance of faculty coordinator and Fast learners are provided challenging assignments/Projects/Readings and learning opportunity.

10. Orientation Program: The Orientation Programme is designed keeping in mind the guidelines of UGC & the Council. This Programme is for 01 or 02 days duration. The Programme designed by the College is approved by the office of the Vice Chancellor. The purpose is to make the fresh students comfortable and provide awareness about the college and the university. The Topics covered are multi -faceted encompassing: Academic rules & regulation, Examination rules & regulation, Learning resources, participation in Extra -curricular & extra Mural Activities, Discipline, Conduct, Motivational talks, Industry talks, & Bridge Courses/content etc.

11. Mentoring Scheme*:* Every Student shall be provided with a faculty Mentor to help him /her in their personal & Academic Issues. The mentor maintains a register of al all his/her mentees with complete personal & parents 'details. It is essential to have at least to meet once in a month. The mentor enters the discussions held, advice given and efforts & improvements made by the mentee. This register of the mentor must be counter signed by the HOD once a month and by the Principal once in a semester

12. Career & Personal Counseling: Counseling is a process that assists individuals in gaining insightful information about themselves, others, and the world around them as they problem solve and make decisions

to improve their quality of life. Counseling emphasizes the value of individuals making their own decisions. Career counseling is a specialization of personal counseling much like other specialty areas (i.e., school, family, etc.). Every Student shall be counselled as and when it is required.

13. Competitive Exam Preparation: A competitive examination is an examination where candidates are ranked according to their grades and/or percentile and then top rankers are selected. Competitive examinations are considered an egalitarian way to select worthy applicants without risking influence peddling, bias or other concerns. In this type of exam Courses, candidates under peer pressure are much stressed, while self-motivated candidates find it much simpler. The students will be motivated, taught and trained to qualify different national level competitive examinations.

14. Extra-curricular Activities: organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

***15. Participation in Workshops, Seminars & writing & Presenting Papers*:** The students will be encouraged to participate in workshops, seminars, writing and presenting papers which will help them to get to know other people in their field, they may get to know about the latest research, improve their presentation and communication skills, engage in high-level debates and refine their ideas and adding weightage to their CV.

16. Formation of Student Clubs, Membership & Organising & Participating events: With an objective of help students to pursue their hobbies and interests and to bring people together the student clubs are created at the Institute. As a club member one knows about one's self, one's interests and one's goals. Students can unravel their strengths like multitasking, organization skills, team Building skills, leadership skills and service mindedness. They can also add skills to their repertoire. The clubs also help in pursuing an old hobby. Networking opportunities being major benefit Club members develop bond among themselves which help in growing their careers. Association of students with clubs help in showcasing ones domain interest, balance between work and hobbies. Activities organized/participated as a club member looks good on the resume.

17. Capability Enhancement & Development Schemes: Effective nurturing, growth and development of the students are considered as core values at the institute. This is of prime importance as it helps students to develop their personality, meet the market needs, and excel in the dynamic global environment. With an endeavor to empower the students to become assets to the organizations and contribute meaningfully to the entire world, students are supported and facilitated through various capability enhancement and development schemes like Guidance for Competitive Examinations, Career Counselling, Soft Skills Development, Remedial Coaching, Language Lab and Bridge Courses etc. The capability enhancement and

development schemes are the stimulating factors in getting the students corporate-ready and become a responsible social citizen.

18. Library Visit & Utilization of E-Learning Resources: Visiting the library can encourage reading and exploration in students. Student can learn at every turn. Even being responsible for returning books on time can teach some basics of responsibility. The library is home to a wealth of free items, such as **free newspaper, magazine, audiobook, CD, DVD, and e-Books.**

19. Online Classes / Webinars / Flipped Classes: An online education is preferred by individuals who may not be able to make it for classes in a traditional brick and mortar kind of college due to various reasons. Students have the freedom to juggle their personal life and school because they aren't tied down to a fixed schedule and gives them power over how they will delegate their time towards their different projects. The materials are made available in the University websites prior to the schedule which help them to read and understand the concept.

20. Hospital posting: Every student shall be posted in constituent hospital for a period of not less than fifty hours to be covered in not less than 200 working days in each of second, third & fourth year course. Each student shall submit report duly certified by the preceptor and duly attested by the Head of the Department or Institution as prescribed.

Course Code: PDR101	Pharm D.: First Year HUMAN ANATOMY & PHYSIOLOGY (THEORY)	L-3 T-1 P-0, C-8
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the structure and functions of various organs of the human body.	
CO2.	Describing various homeostatic mechanisms and their imbalances in various Systems.	
CO3.	Applying the hematological tests and vital signs and symptoms.	
CO4.	Analyzing the interlinked mechanisms of homeostasis in human body.	
Course Content:		
Unit-I	Scope of anatomy and physiology, basic terminologies used in this Course Structure of cell – its components and their functions, Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues-their sub-types and characteristics, **Osseous system** - structure, composition and functions of the Skeleton. (done in practical classes - 6hrs). **Classification of joints,** Types of movements of joints and disorders of joints (Definitions only).	**10 Hours**
Unit-II	**Haemopoetic System**: Composition and functions of blood, Haemopoesis and disorders of blood components (definition of disorders), Blood groups, Clotting factors and mechanism, Platelets and disorders of coagulation **Lymph:** Lymph and lymphatic system, composition, formation and circulation, Spleen: structure and functions, Disorders of lymphatic system (definition only).	**6 Hours**
Unit-III	**Cardiovascular system:** Anatomy and functions of heart, Blood vessels and circulation (Pulmonary, coronary and systemic circulation), Electrocardiogram (ECG), Cardiac cycle and heart sounds, Blood pressure – its maintenance and regulation, Definition of the following disorders Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias.	**10 Hours**
Unit-IV	**Respiratory system:** Anatomy of respiratory organs and functions, Mechanism / physiology of respiration and regulation of respiration, Transport of respiratory gases, Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation. **Digestive system:** Anatomy and physiology of GIT, Anatomy and functions of accessory glands of GIT, Digestion and absorption, Disorders of GIT (definitions only).	**10 Hours**
Unit-V	**Nervous system:** Definition and classification of nervous system, Anatomy, physiology and functional areas of cerebrum, Anatomy and physiology of cerebellum, Anatomy and physiology of mid brain, Thalamus, hypothalamus and Basal Ganglia, Spinal cord: Structure & reflexes – mono-poly-planter, Cranial nerves – names and functions ANS – Anatomy & functions of sympathetic & parasympathetic N.S.	**14 Hours**
Unit-VI	**Urinary system:** Anatomy and physiology of urinary system, Formation of urine, Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance, Clearance tests and micturition	**10 Hours**

Unit-VII	**Endocrine system:** Pituitary gland, Adrenal gland, Thyroid and Parathyroid glands, Pancreas and gonads. Reproductive system: Male and female reproductive system, Their hormones – Physiology of menstruation, Spermatogenesis & Oogenesis, Sex determination (genetic basis), Pregnancy and maintenance and parturition, Contraceptive devices. **Sense organs:** Eye, Ear, Skin, Tongue & Nose.	**10 Hours**
Unit-VIII	**Skeletal muscles:** Histology, Physiology of Muscle contraction, Physiological properties of skeletal muscle and their disorders (definitions). **Sports physiology:** Muscles in exercise, Effect of athletic training on muscles and muscle performance, Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, Drugs and athletics.	**10 Hours**
Text Books:	1. *Chaurasia B.D., Human Anatomy, Regional & Applied, Part I, II & III, CBS Publishers & Distributors, New Delhi.* 2. *Ross & Wilson, Anatomy & Physiology in Health & Illness, Churchill Livingstone.*	
Reference Books:	1. *Guyton arthur C., Physiology of human body, Holt saunders Publisher.* 2. *Chatterjee C.C., Human physiology. Volume 1&11, Publisher: medical allied agency, Calcutta.* 3. *Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H., Gray's anatomy, Publisher: Churchill Livingstone, London.* 4. *Tortora Gerard J. and Nicholas, P., Principles of anatomy and physiology, Publisher Harpercollins College New York.* 5. *Wilson, K.J.W., Ross and Wilson's foundations of anatomy and physiology, Publisher: Churchill Livingstone, Edinburg.* 6. *Guyton AC., Hall JE., Text book of Medical Physiology, WB Saunders Company.* 7. *Tortora G.J., & Anagnodokos N.P., Principles of Anatomy & Physiology, Harper & Row Publishers, New Delhi.* ** Latest editions of all the suggested books are recommended.*	

Course Code: PDR102	Pharm D.: First Year PHARMACEUTICS (THEORY)	L-2 T-1 P-0 C-6
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the formulation aspects of different dosage forms	
CO2.	Applying different pharmaceutical calculation involved in formulation.	
CO3.	Formulating different types of dosage forms.	
CO4.	Evaluating the formulations for effectiveness.	
Course Content:		
Unit-I	**Introduction to dosage forms** - classification and definitions **Prescription:** definition, parts and handling **Posology**: Definition, Factors affecting dose selection. Calculation of children and infant doses. Historical background and development of profession of pharmacy and pharmaceutical industry in brief	**10 Hours**
Unit-II	Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.	**10 Hours**
Unit-III	**Powders and Granules**: Classification advantages and disadvantages, Preparation of simple & compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth & effervescent powders and granules.	**10 Hours**
Unit-IV	**Monophasic Dosage forms**: Theoretical aspects of formulation including adjuvants used 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.	**10 Hours**
Unit-V	**Biphasic dosage forms**: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the different types of emulsion formulations, stability and evaluation.	**10 Hours**
Unit-VI	**Suppositories and pessaries**: Definition, advantages and disadvantages, types of bases used, method of preparation, Displacement value and evaluation. **Galenicals**: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.	**10 Hours**
Unit-VII	**Pharmaceutical calculations** **Surgical aids:** Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.	**10 Hours**
Unit-VIII	**Incompatibilities**: Introduction, classification and methods to overcome incompatibilities. Compounding of prescriptions based on incompatibility.	**10 Hours**
Text Books:	1. *Cooper and Gunns, Dispensing for pharmacy students., Media Algonquin, 1981* 2. *N. K.Jain and S. N. Sharma., A text book of Professional Pharmacy Pitampura : Vallabh Publication, 2001.*	

Reference Books:	1. *Howard C. Ansel, Loyd V. Allen, Jr.; Nicholas G. Popvich, Pharmaceutical dosage forms and drug delivery systems, 7th ed, Philadelphia : Lippincott Williams & Wilkins, 1999.* 2. *Arthur Osol, Remington's Pharmaceutical Sciences, Edition16th, Pennsylvania: Mack Publications, 1980.* 3. *Cooper and Gunn, Register of General Pharmacy, Geneva.* 4. *M L Schroff, General Pharmacy, Calcutta: Five star Enterprises, 1971.* 5. *Perry R.H. & Chilton C.H., Chemical Engineers Handbook, Mc Graw Kogakusha Ltd.* 6. *McCabe W.L. & Smith J.C., Unit Operation of Chemical Engineering, Mc Graw Hill International Book Co., London.* 7. *Sambhamurthy, Pharmaceutical Engineering, New Age Publishers.* 8. *Gavhane, K.A., Unit Operation-I, Nirali Prakashan.* 9. *Badger W.L. & Banchero J.T., Introduction to Chemical Engineering, Mc Graw Hill International Book Co., London.* ** Latest editions of all the suggested books are recommended.*	

Course Code: PDR103	Pharm D.: First Year MEDICINAL BIOCHEMISTRY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the role and importance of enzymes in the diagnosis of diseases.	
CO2.	Defining the genetics, mutation and repair mechanism of human body.	
CO3.	Explaining the metabolic process of biomolecules in health and illness.	
CO4.	Demonstrating the biochemical principles in organ function and their biochemical tests in body fluids.	
Course Content:		
Unit-I	**Introduction to biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance. **Enzymes**: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic & diagnostic applications; Coenzymes, their biochemical roles and deficiency diseases.	**10 Hours**
Unit-II	**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.	**10 Hours**
Unit-III	**Lipid metabolism:** Oxidation of saturated (β-oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver and hypercholesterolmiea).	**10 Hours**
Unit-IV	**Biological oxidation:** Coenzyme systems involved in biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC and Oxidative phosphorylation;	**10 Hours**
Unit-V	**Protein and amino acid metabolism:** protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids. **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.	**10 Hours**
Unit-VI	**Introduction to clinical chemistry: Cell**; composition; malfunction; Role of the clinical chemistry laboratory. **The kidney function tests:** Role of kidney; Laboratory tests for normal function: - Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.), Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid), Urine concentration test and Urinary tract calculi. (stones)	**10 Hours**

Unit-VII	**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.	**10 Hours**
Unit-VIII	**Immunochemical techniques** for determination of hormone levels and protein levels in serum for endocrine and infectious diseases. Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA) **Electrolytes:** Body water, compartments, water balance and electrolyte distrubution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.	**10 Hours**
Text Books:	1. *Text book of biochemistry – D. Satyanarayana* 2. *Text book of biochemistry -- Ramarao*	
Reference Books:	1. *Principles of biochemistry -- Lehninger* 2. *Practical Biochemistry-David T.Plummer.* 3. *Practical Biochemistry-Pattabhiraman.* 4. *Harpers review of biochemistry - Martin* 5. *Text book of clinical chemistry- Alex Kaplan & Laverve L. Szabo*	

Course Code: PDR104	Pharm D.: First Year PHARMACEUTICAL ORGANIC CHEMISTRY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding important physical & chemical properties of organic compounds	
CO2.	Explaining various nomenclature systems of organic compounds.	
CO3.	Applying the mechanism of organic chemical reactions.	
CO4.	Analyzing methods of preparation, tests for purity, assay, medicinal uses of important organic compounds.	
Course Content:		
Unit-I	**Structures and Physical properties:** 1. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non ionic & ionic solutes, protic and aprotic Solvents, ion pairs, Acids and bases, Lowry bronsted and Lewis theories, 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. **Free radicals chain reactions of alkane**: Mechanism, relative reactivity and stability.	**10 Hours**
Unit-II	**Alicyclic compounds**: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain. **Nuclophilic aliphatic substitution mechanism**: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 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.	**10 Hours**
Unit-III	**Dehydro halogenation of alkyl halides:** 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement, isotope effect, absence of hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation. **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, halohydrin 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.	**10 Hours**
Unit-IV	**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	**10 Hours**

	rearrangements **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, nucleophilic substitution in allylic substrate, SN1 reactivity, allylic rearrangement, SN2 nucleophilic substituion in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, 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	
Unit-V	**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 halogenation of alkyl benzene, resonance stabilization of benzyl radical.	**10 Hours**
Unit-VI	**Nucleophilic addition reaction:** Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.	**10 Hours**
Unit-VII	Mechanism of aldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation,crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel & Reformatsky reactions, Wittig reaction and Michael addition. **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.	**10 Hours**
Unit-VIII	**Nucleophilic aromatic substitution:** Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic type. **Oxidation reduction reaction.** 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..	**10 Hours**
<u>Text Books:</u>	1. *Robert Thornton Morrison and Robert Neilson Boyd, Organic chemistry, 2nd Ed, New Delhi: Prentice-Hall, 1971.* 2. *L. M. Atherden, Bentley and river, Text book of Pharmaceutical chemistry, 8th edition, Delhi: Oxford university press, 1998.*	

Reference Books:	1. *D. J. Cram, Hammond, George S, Organic chemistry, New York: Mcgraw Hill, 1964.* 2. *William Henry Brown, Introduction to organic chemistry, 4th ed., Pacific Grove: Brooks/ Cale Publishing, 1988.* 3. *Jerry March, Advanced organic chemistry: reactions, mechanisms, and structure , Ed.4th, University of Michigan, Wiley Interscience. 1992.* 4. *Donald J Cram, Hammond, George S, Organic Chemistry, Mcgraw Hill Book Co., 1959.* 5. *L. Finer- Organic chemistry, Lonodn: English Language Book Society, 1959.*	

Course Code: PDR105	**Pharm D.: First Year** **PHARMACEUTICAL INORGANIC CHEMISTRY (THEORY)**	**L-2 T-1 P-0 C-6**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the principles and procedures of analysis of drugs and the application of inorganic pharmaceuticals	
CO2.	Demonstrating the importance of inorganic pharmaceuticals in preventing and curing the disease	
CO3.	Analyzing the inorganic pharmaceuticals and their application	
Course Content:		
Unit-I	1. Errors 2. Volumetric analysis 3. Acid-base titrations	**10 Hours**
Unit-II	1. Redox titrations 2. Non aqueous titrations	**10 Hours**
Unit-III	1. Precipitation titrations 2. Complexometric titrations	**10 Hours**
Unit-IV	1. Theory of indicators 2. Gravimetry 3. Limit tests	**10 Hours**
Unit-V	1. Medicinal gases 2. Acidifiers 3. Antacids 4. Cathartics	**10 Hours**
Unit-VI	1. Electrolyte replenishers 2. Essential Trace elements	**10 Hours**
Unit-VII	1. Antimicrobials 2. Pharmaceutical aids 3. Dental Products	**10 Hours**
Unit-VIII	1. Miscellaneous compounds 2. Radio Pharmaceuticals	**10 Hours**
Text Books:	*1. Pandeya Surendra N., A textbook of Medicinal Chemistry, 3rd ed., Varanasi: SG Publisher, 2004.* *2. Gundu p. Rao, Inorganic Pharmaceutical Chemistry, Delhi: Vallabh, 2006.*	
Reference Books:	*1. G R Chatwal , Pharmaceutical Chemistry Inorganic, New Delhi : Himalaya Publication house,2008.* *2. Nagavi B G Pharmaceutical Inorganic chemistry, Newdelhi.: Arihant Publication, Mysore.* *3. John H.Kennedy , Analytical chemistry: principles , New York : Sauders College, 1990.* *4. Beckett A H, Stenlake J B, Practical Pharmaceutical Chemistry Vol-I & Vol-II , CBS Publishers, 2007.*	

Course Code: PDR106	**Pharm D.: First Year** **REMEDIAL MATHEMATICS (THEORY)**	**L-3 T-1 P-0 C-8**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the basic concepts of mathematical theory, formulas and their applications in Pharmacy.	
CO2.	Demonstrating the important application of Mathematics in Pharmacy.	
CO3.	Applying formulas to solve the different types of pharmaceutical calculations.	
Course Content:		
Unit-I	**Algebra:** Determinants, Matrices	**10 Hours**
Unit-II	**Trignometry:** Sides and angles of a triangle, solution of triangles	**10 Hours**
Unit-III	**Analytical Geometry:** Points, Straight line, circle, parabola	**10 Hours**
Unit-IV	**Differential Calculus I:** Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function	**10 Hours**
Unit-V	**Differential Calculus II:** Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables	**10 Hours**
Unit-VI	**Integral Calculus:** Integral Calculus: Definite integrals, integration by substitution and by parts, Properties of definite integrals.	**10 Hours**
Unit-VII	**Differential equations**: Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order	**10 Hours**
Unit-VIII	**Laplace transform:** Definition, Laplace transform of elementary functions, Properties of linearity and shifting	**10 Hours**
Text Books:	1. *R.D. Sharma, Applied Mathematics, Vol. I & II (Dhanpat Rai Publications)* 2. *Rao, Sreenivasa BM and Nagaraj, S., Text book of Mathematics for second year pre-university, 3rd Ed. Excellent Educational Enterprises.*	
Reference Books:	1. *Shanthinarayan, Integral calculus, 9th ed. New Delhi: S. Chand Publication.1980* 2. *B. S. Grewal, Higher Engineering Mathematics, Delhi: Khanna Publication. 2003* 3. *Loney S. L. Plane Trignometry Vol. I 6th ed. SURJEET Publication. 1998* 4. *H. K. Das, Introduction to Engineering Mathematics, Volume I (S.Chand).* 5. *Dr. Mohd. Vaseem Ismail, Dr. Qazi Shoeb Ahmad & Shadab Ahmed Khan, Remedial Mathematics, (Birla Publications Pvt. Ltd.)*	

	6. *M. L. Khanna, J N Sharma., Mathematics for I I T. 134th ed. Meerut: Jai Prakash Nath Publication. 2002-3.* 7. *Shantinarayan, Differential calculus, 1st Ed. Delhi: S.CHAND Publication. 1996.*	

Course Code: PDR107	Pharm D.: First Year REMEDIAL BIOLOGY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	On completion of the course, the students will be:	
CO1.	Understanding classification and salient features of plant and animal kingdoms.	
CO2.	Demonstrating about naturally occurring drugs its sources and use.	
CO3.	Analyzing tools and techniques used in herbal drug and cell biology study	
Course Content:		
Unit-I	Introduction General organization of plants and its inclusions	**10 Hours**
Unit-II	Plant tissues Plant kingdom and its classification	**10 Hours**
Unit-III	Morphology of plants Root, Stem, Leaf and Its modifications	**10 Hours**
Unit-IV	Inflorescence and Pollination of flowers Morphology of fruits and seeds	**10 Hours**
Unit-V	Plant physiology Taxonomy of Leguminosae, umbelliferae, Solanaceae, Lilliaceae, Zinziberaceae, Rubiaceae Study of Fungi, Yeast, Penicillin and Bacteria	**10 Hours**
Unit-VI	Study of Animal cell Study animal tissues	**10 Hours**
Unit-VII	Detailed study of frog Study of Pisces, Raptiles, Aves	**10 Hours**
Unit-VIII	Genearal organization of mammals Study of poisonous animals	**10 Hours**
Text Books:	1. *Gokhale S.B. Text book of Biology. 11th ed. Bangalore: Nirali Prakashan. 1993.* 2. *Thulajappa Y and Seetharam. A Textbook of pre-university biology. V1. I PUC. Excellent Educational Enterprises. 1993.*	
Reference Books:	1. *B.V.Sreenivasa Naidu, A Text book of Biology.* 2. *Krishna Murthy K, A Text book of Biology, Delhi: Ajanta Publications. 1990.* 3. *Dutta A.C., Botany: for degree students. New Delhi: Oxford university, 2002. Ekambaranathaayyer M Outlines of Zoology. 1996.* 4. *Gokhale S.B. & Kokate C.K. Practical Pharmacognosy. 8th Ed. Pune : Nirali Prakashan. 2005.*	

Course Code: PDR151	Pharm D.: First Year HUMAN ANATOMY & PHYSIOLOGY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	On completion of the course the students will be	
CO1.	Understanding the anatomy and physiology of different systems of our body.	
CO2.	Describing various homeostatic mechanisms and their imbalances of various systems.	
CO3.	Demonstrating various hematological tests and record vital signs.	
CO4.	Applying the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.	
Course Content:		3 Hrs. /Week

1. Study of tissues of human body: Epithelial tissue and Muscular tissue.
2. Study of tissues of human body: Connective tissue and 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 Erythrocyte Sedimentation Rate, Hemoglobin content of Blood and Bleeding time & Clotting time.
8. Determination of Blood Pressure and Blood groups.
9. Study of various systems with the help of charts, models & specimens

    i. Skeleton system part I-axial skeleton.
    ii. Skeleton system part II- appendicular skeleton.
    iii. Cardiovascular system.
    iv. Respiratory system.
    v. Digestive system.
    vi. Urinary system.
    vii. Nervous system.
    viii. Special senses.
    ix. 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 & after load using gastroenemius sciatic nerve preparation.
17. To record simple fatigue curve using gastroenemius sciatic nerve preparation.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.

6. Scheme of Practical Examination: Following scheme will be practiced for the said purpose.

	Internal examination	End year (External)
Identifications	4	10
Synopsis	4	10
Major experiments	7	20
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

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: N* ** Latest editions of all the suggested books are recommended.*	

Course Code: PDR152	Pharm D.: First Year PHARMACEUTICS (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding formulation aspects of different dosage forms.	
CO2.	Explaining physical, chemical and therapeutic incompatibilities in formulations.	
CO3.	Demonstrating the manufacturing of various dosage forms by understanding the use of equipment.	
Course Content:		**3 Hrs. /Week**

Preparation of Syrups: Simple Syrup I.P, Syrup of Ephedrine Hcl NF, Syrup Vasaka IP, Syrup of ferrous Phosphate IP and Orange Syrup.
Preparation of Elixir: Piperizine citrate elixir BP, Cascara elixir BPC and Paracetamol elixir BPC
Preparation of Linctus: Simple Linctus BPC and Pediatric simple Linctus BPC.
Preparation of Solutions: Solution of cresol with soap IP, Strong solution of ferric chloride BPC, Aqueous Iodine Solution IP, Strong solution of Iodine IP and Strong solution of ammonium acetate IP
Preparation of Liniments: Liniment of turpentine IP* and Liniment of camphor IP.
Suspensions*: Calamine lotion and Magnesium Hydroxide mixture BP
Emulsions*: Cod liver oil emulsion and Liquid paraffin emulsion.
Powders: Eutectic, Explosive & Dusting powders and Insufflations
Suppositories: Boric acid suppositories and Chloral suppositories
Incompatibilities: Mixtures with Physical and Chemical & Therapeutic incompatibilities.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal examination	End year (External)
Identifications	4	10
Synopsis	4	10
Major experiments	7	20
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Carter S.J., Cooper & Gunn's Tutorial Pharmacy, CBS Publishers, Delhi.*	
Reference Books:	1. *Rawlins E.A., Bentley's Text Book of Pharmaceutics, ELBS Bailliere Tyndall.* 2. *Lachman L.,Liberman H.A.& Kanig J.L., Theory and Practice of Industrial Pharmacy, Le & Febiger.* 3. *Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers, New Delhi.* 4. *Pharmacopoeia of India, The Controller of Publications, Delhi.* 5. *British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.*	

Course Code: PDR153	Pharm D.: First Year MEDICINAL BIOCHEMISTRY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the qualitative and quantitative estimation of biochemical Parameters.	
CO2.	Analyzing the biochemical tests for blood and urine.	
Course Content:		3 Hrs. /Week

1. Qualitative analysis of normal constituents of urine * and abnormal constituents of urine.* Quantitative estimation of urine sugar by Benedict's reagent method.** urine chlorides by Volhard's method.** urine creatinine by Jaffe's method.** urine calcium by precipitation method.** serum cholesterol by Libermann Burchard's method and** Preparation of Folin Wu filtrate from blood.*
2. Quantitative estimation of blood creatinine ** and blood sugar Folin-Wu tube method.**
3. Estimation of SGOT in serum.** Estimation of SGPT in serum.** Estimation of Urea in Serum and** Estimation of Proteins in Serum. **
4. Determination of serum bilirubin** and Glucose by means of Glucoseoxidase.**
5. Enzymatic hydrolysis of Glycogen/Starch by Amylases**, Study of factors affecting Enzyme activity. (pH & Temp.)** and Preparation of standard buffer solutions and its pH measurements (any two)*
6. Experiment on lipid profile tests**
7. Determination of sodium, calcium and potassium in serum. **

** Major Experiments & * Minor Experiments

Assignments:

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.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Plummer, David J., An Introduction to Practical Biochemistry, Tata Mc Graw Hill, New Delhi.* 2. *Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.*	
Reference Books:	1. *Harpers, Review of Biochemistry, Lange Medical Publication.* 2. *Conn E.E. & Stumph P.K., Outline of Biochemistry, John Willery & Sons, New York.* 3. *Nelson D.L. & Cox M.M., Lehninger Principles of Biochemistry, Macmillan Worth Publishers.* 4. *Stryer L., Biochemistry, WH, Freeman & Company, San Francisco.*	

Course Code: PDR154	Pharm D.: First Year PHARMACEUTICAL ORGANIC CHEMISTRY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	On completion of the course the students will be	
CO1.	Understanding various stereo models of organic molecules.	
CO2.	Explaining various laboratory techniques involved in synthesis of organic Compounds.	
CO3.	Illustrating schematic qualitative organic analysis for identification of organic functional groups.	
Course Content:		3 Hrs. /Week

I. **Introduction to the various laboratory techniques through demonstration involving synthesis of the following compounds (at least 8 compounds to be synthesised):**

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. 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, aldehydes and ketones, Alcohols, esters, hydrocarbons, anilides, nitrocompounds.

III. **Introduction to the use of stereo models:** Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene and inversion of configuration

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the

said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Mann P.G. & Saunders B.C., Practical Organic Chemistry, ELBS/Longman, London.* 2. *Singh Harkrishan & Kapoor V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.*	
Reference Books:	1. *Finar I.L., Organic Chemistry, Vol I & II, ELBS/ Longman, London.* 2. *Furniss B.A., Hannaford A.J., Smith P.W.G. and Tatehell A.R., Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London*	

Course Code: PDR155	Pharm D.: First Year PHARMACEUTICAL INORGANIC CHEMISTRY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	On completion of the course the students will be	
CO1.	Understanding the principle and procedures involved in limit tests and volumetric analysis.	
CO2.	Identifying the presence and the purity of inorganic compounds based on official monograph.	
CO3.	Preparing inorganic pharmaceutical compounds	
Course Content:		3 Hrs./ Week

Limit test (6 exercises): Limit tests for;

- Chlorides
- Sulphates
- Iron
- Heavy metals
- Arsenic
- Modified limit tests for chlorides and sulphates

Assays (10 exercises): Estimation of the following

- Ammonium chloride- (Acid-base titration)
- Ferrous sulphate (Cerimetry)
- Copper sulphate (Iodometry)
- Calcilugluconate (Complexometry)
- Hydrogen peroxide (Permanganometry)
- Sodium benzoate (Nonaqueous titration)
- Sodium chloride (Modified volhard's method)
- Assay of KI (KIO3 titration)
- Gravimetric estimation of barium as barium sulphate, Sodium antimony gluconate or antimony potassium tartarate.

Estimation of mixtures (Any two exercises)

- Sodium hydroxide & sodium carbonate
- Boric acid & Borax
- Oxalic acid & sodium oxalate

Test for identity (Any three exercises)

- Sodium bicarbonate
- Barium sulphate
- Ferrous sulphate
- Potassium chloride

Test for purity (Any two exercises)

- Swelling power in Bentonite
- Acid neutralising capacity in aluminium hydroxide gel
- Ammonium salts in potash alum
- Adsorption power of heavy Kaolin and Presence of Iodates in KI

Preparations (Any two exercises)

- Boric acids

- Potash alum
- Calcium lactate
- Magnesium suphate

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Block, J.H. Roche, E, Soine, T and Wilson, C., Inorganic, Medicinal & Pharmaceutical Chemistry, Lea & Febiger.* 2. *Discher, C.A.,et.alModern Inorganic Pharmaceutical Chemistry, Waveland Press*	
Reference Books:	1. *Indian Pharmacopoeia.* 2. *Atherden L.M., Bentley & Drivers' Text Book of Pharmaceutical Chemistry, Oxford University Press, London*	

Course Code: PDR156	Pharm D.: First Year REMEDIAL BIOLOGY (PRACTICAL)	L-0 T-0 P-4 C-4
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the basic morphology of animals and plants.	
CO2.	Defining the plant physiology.	
CO3.	Preparing the transvers sections and permanent slides of given plant samples.	
Course Content:		**4Hrs./ Week**

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

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Gokhale S.B. Text book of Practical Biology. 11th ed. Bangalore : Nirali Prakashan. 1993.* 2. *Thulajappa Y and Seetharam. A Textbook of pre-university Practical biology. V1. I PUC. Excellent Educational Enterprises. 1993.*	

Reference Books:	1. *B.V.Sreenivasa Naidu, A Text book of Practical Biology.* 2. *Krishna Murthy K, A Text book of Practical Biology, Delhi: Ajanta Publications. 1990.* 3. *Dutta A.C., Practical Botany: for degree students. New Delhi: Oxford university, 2002. Ekambaranathaayyer M Outlines of Zoology. 1996.* 4. *Gokhale S.B. & Kokate C.K. Practical Pharmacognosy. 8th Ed. Pune : Nirali Prakashan. 2005.*	

Course Code: PDR201	Pharm D.: Second Year PATHOPHYSIOLOGY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the etiology, pathogenesis and clinical features of the selected disease conditions and immunogenic reactions.	
CO2.	Explaining the pathophysiologic conditions of some common and infectious diseases.	
CO3.	Analyzing laboratory values of clinical significance for disease identification.	
Course Content:		
Unit-I	**Basic principles of cell injury and Adaptation:** Causes, Pathogenesis and morphology of cell injury reversible & irreversible tissue injury, neurosis and apoptosis, Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen storage diseases	**10 Hours**
Unit-II	Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation & Repairs of wounds in the skin, factors influencing healing of wounds	**8 Hours**
Unit-III	Diseases of immunity: Introduction to Tand B cells, MHC proteins or transplantation antigens Immune tolerance: Hypersensitivity its types (I, II, III & IV) and their Biological significance, Allergy due to food, chemicals and drugs, 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., Acquired immune deficiency syndrome (AIDS), Amylodosis	**12 Hours**
Unit-IV	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 bio logy of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.	**10 Hours**
Unit-V	Shock: Types of shock, mechanisms, stages and management Biological effects of radiation	**8 Hours**
Unit-VI	Environmental and nutritional diseases:Air pollution and smoking- SO2, NO, NO2, and CO & Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.	**8 Hours**
Unit-VII	Pathophysiology of common diseases: Parkinsonism, Schizophrenia, Depression and mania, Hypertension, Stroke (ischaemic and hemorrhage), Angina, CCF, Atherosclerosis, Myocardial infarction. Diabetes Mellitus, Peptic ulcer and inflammatory bowel diseases, Cirrhosis and Alcoholic liver diseases, Acute and chronic renal failure, Asthma and chronic obstructive airway diseases.	**12 Hours**
Unit-VIII	Infectious diseases: Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), Urinary tract infections, Pneumonia, Typhoid, Tuberculosis, Leprosy, Malaria Dysentery (bacterial and amoebic), Hepatitis- infective hepatitis	**12 Hours**

Text Books:	1. *Ramzi S. Cotran, Vinay Kumar; Tucker Collins. Robbins pathologic basis of disease. 6th ed. Singapore: Hercourt Asia Publication. 2000.* 2. *Harsh Mohan. Text book of pathology. 4th ed. New Delhi : Jaypee Publications. 1998.*	
Reference Books:	1. *Roger Walker, Cate Whittlesea. Clinical Pharmacy and Therapeutics. 5th ed. New York : Elsevier Publications. 2012.* 2. *Dipiro J.L., Pharmacotherapy – A Pathophysiological Approach, Elsevier* 3. *Bhende Y.M., General pathology, Bombay: Popular Prakashan. 1969.*	

Course Code: PDR202	Pharm D.: Second Year PHARMACEUTICAL MICROBIOLOGY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	On completion of the course the students will	
CO1.	Understanding the structure, classification, identification of microorganisms and disinfection & sterilization techniques.	
CO2.	Demonstrating the mode of transmission, sign and symptoms of disease caused by microorganisms.	
CO3.	Experimenting various identification and diagnostic tests for microorganisms.	
Course Content:		
Unit-I	Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them, Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae & Spirochetes	**10 Hours**
Unit-II	Nutritional requirements, growth and cultivation of bacteria and virus. Study of different media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched and selective, maintenance of lab cultures	**10 Hours**
Unit-III	Nutritional requirements, growth and cultivation of bacteria and virus. Study of different media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched and selective, maintenance of lab cultures.	**10 Hours**
Unit-IV	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.	**10 Hours**
Unit-V	**Disinfectants:** Study of disinfectants, antiseptics, fungicidal and virucidal agents factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteriostatic, & virucidal activities and evaluation of preservatives in pharmaceutical preparations.	**10 Hours**
Unit-VI	**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.	**10 Hours**
Unit-VII	Diagnostic tests: Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite. Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays,	**10 Hours**
Unit-VIII	1. Microbiological assay of Penicillin, Streptomycin, vitamin B2 and B12. Standardisation of vaccines and sera. 2. **Study of infectious diseases:** Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis, Gonorrhea and HIV.	**10 Hours**

Text Books:	1. *Vanitha Kale and Kishor Bhusari, Applied Microbiology, Himalaya Publishing house Mumbai.*	
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* 7. *Mary Louis Turgeon, Immunology and Serology in Laboratory Medicines, 2nd edition, 1996 Mosby- Year book inc St. Louis Missouri 63146.*	

Course Code: PDR203	Pharm D.: Second Year PHARMACOGNOSY & PHYTOPHARMACEUTICALS (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the basic principles of cultivation, collection, storage and sources of adulteration of crude drugs.	
CO2.	Identifying the sources, its active constituents and use of crude drugs.	
CO3.	Demonstrating the application of primary and secondary metabolites of plants.	
CO4.	Estimating different values for standardization of crude drugs.	
Course Content:		
Unit-I	Introduction, Definition, history and scope of Pharmacognosy.	**10 Hours**
Unit-II	Classification of crude drugs	**10 Hours**
Unit-III	Cultivation, collection, processing and storage of crude drugs	**10 Hours**
Unit-IV	Detailed method of cultivation of crude drugs:	**10 Hours**
Unit-V	Study of cell wall constituents and cell inclusions. Microscopical and powder Microscopical study of crude drugs	**10 Hours**
Unit-VI	Study of natural pesticides. Detailed study of various cell constituents.	**10 Hours**
Unit-VII	Carbohydrates and related products. Detailed study carbohydrates containing drugs.(11 drugs) Definition sources, method extraction, chemistry and method of analysis of lipids. Detailed study of oils.	**10 Hours**
Unit-VIII	Definition, classification, chemistry and method of analysis of protein. Study of plants fibers used in surgical dressings and related products. Different methods of adulteration of crude drugs.	**10 Hours**
Text Books:	1. *C.K. Kokate, A.P. Purohit, S.B. Gokhale , Pharmacognosy, 24th , Pune : Nirali prakashan, 2003.*	
Reference Books:	1. *Claus, Edward P. : **Tyler** Varro **E**. & **Brady** Lynn R , Pharmacognosy, Philadelphia : Lea & Febiger, 1970.* 2. *T.E. Wallis, Textbook of pharmacognosy, Edi. 5th, Delhi: CBS Pub, 2005.* 3. *C.S.Shah & J.S.Qadry, Textbook of pharmacognosy, 11th, Ahmedabad: B. S. Shah Prakashan, 1996.* 4. *M A Iyengar, A handbook of pharmacognosy, India: Department of pharmacy, 1974.* 5. *G. E. Trease and William Charles Evans, Trease and Evans', pharmacognosy, 14th , London : WB.*	

Course Code: PDR204	Pharm D: Second Year PHARMACOLOGY – I (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the pharmacology of different classes of drugs acting on different systems of human body.	
CO2.	Classifying the drugs on the basis of their pharmacological action and therapeutic uses.	
CO3.	Illustrating the associated side effect and toxicities of drugs and its interaction in between them.	
CO4.	Explaining the mechanism of drug's action.	
Course Content:		
Unit-I	**General Pharmacology:** Introduction, definitions and scope of pharmacology, Routes of administration of drugs- local and systemic routes, Pharmacokinetics (absorption, distribution-plasma protein binding, metabolism and excretion)	**10 Hours**
Unit-II	Pharmacodynamics, Factors modifying drug effects, Drug toxicity - Acute, sub- acute and chronic toxicity, Pre-clinical evaluations & Drug interactions.	**10 Hours**
Pharmacology with reference to the classification, mechanism of action, pharmacokinetics, pharmacodynamics, adverse effects, contraindications, Therapeutic uses, interactions, dose and route of administration of following classes of Drugs:		
Unit-III	**Pharmacology of drugs acting on ANS:** 1. Adrenergic and antiadrenergic drugs 2. Cholinergic and anticholinergic drugs 3. Neuromuscular blockers 4. Mydriactics and miotics 5. Drugs used in myasthenia gravis 6. Drugs used in Parkinsonism	**10 Hours**
Unit-IV	**Pharmacology of drugs acting on cardiovascular system:** 1. Antihypertensives 2. Anti-anginal drugs 3. Anti-arrhythmic drugs 4. Drugs used for therapy of Congestive Heart Failure 5. Drugs used for hyperlipidaemias	**10 Hours**
Unit-V	**Pharmacology of drugs acting on Central Nervous System** 1. General anesthetics 2. Sedatives and hypnotics 3. Anticonvulsants 4. Analgesic and anti-inflammatory agents 5. Psychotropic drugs 6. Alcohol and methyl alcohol 7. CNS stimulants and cognition enhancers 8. Pharmacology of local anaesthetics	**10 Hours**
Unit-VI	**Pharmacology of Drugs acting on Respiratory tract:** 1. Bronchodilators 2. Mucolytics 3. Expectorants 4. Antitussives 5. Nasal Decongestants	**10 Hours**
Unit-VII	**Pharmacology of Hormones and Hormone antagonists:** 1. Thyroid and Antithyroid drugs 2. Insulin, Insulin analogues and oral hypoglycemic agents	**10 Hours**

	3. Sex hormones and oral contraceptives 4. Oxytocin and other stimulants and relaxants	
Unit-VIII	**Pharmacology of autocoids and their antagonists** 1. Histamines and Antihistaminics 2. 5-Hydroxytryptamine and its antagonists 3. Lipid derived autocoids and platelet activating factor	**10 Hours**
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.*	
Reference Books:	3. *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.* 4. *Craig, C. R. & Stitzel, R.E., Modern Pharmacology, Latest edition. Publisher: Little Brown.Co* 5. *Katzung, B.G., Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, Int.* 6. *Shargel and Leon, Applied Biopharmaceutics and pharmacokinetics, Latest edition. Publisher: Prentice Hall, London.* 7. *Rang, H.P. & Dale, M.M., Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.*	

Course Code: PDR205	Pharm D.: Second Year COMMUNITY PHARMACY (THEORY)	L-2 T-1 P-0 C-6
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding professional practice management and pharmaceutical care services in community pharmacy.	
CO2.	Demonstrating patient counselling and practicing health screening services in community pharmacy.	
CO3.	Practicing community services and responding to minor ailments proving appropriate medications with professional code of ethics.	
CO4.	Supporting health education services to the community.	
Course Content:		
Unit-I	Definition & scope of community pharmacy Roles and responsibilities of Community pharmacist	**10 Hours**
Unit-II	**Community Pharmacy Management:** Selection of site, Space layout, and design**,** Staff, Materials- coding, stocking, Legal requirements**,** Maintenance of various registers**,** Use of Computers: Business and health care softwares. **Inventory control in community pharmacy:** Definition, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock	**10 Hours**
Unit-III	**Prescriptions** – parts of prescription, legality & identification of medication related problems like drug interactions. **Pharmaceutical care** Definition and Principles of Pharmaceutical care.	**10 Hours**
Unit-IV	**Patient counseling**: Definition, outcomes, various stages, barriers, Strategies to overcome barriers**.** Patient information leaflets- content, design, & layouts, advisory labels**.** **Patient medication adherence:** Definition, Factors affecting medication adherence, role of pharmacist in improving the adherence	**10 Hours**
Unit-V	**Health screening services** Definition, importance, methods for screening. Blood pressure/ blood sugar/ lung function and Cholesterol testing. **OTC Medication**- Definition, OTC medication list & Counselling.	**10 Hours**
Unit-VI	**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	**10 Hours**
Unit-VII	**Responding to symptoms of minor ailments:** Relevant pathophysiology, common drug therapy to Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhoea, constipation), Pyrexia, Opthalmic symptoms, worm infestations.	**10 Hours**
Unit-VIII	Essential Drugs concept and Rational Drug Therapy, Role of community pharmacist Code of ethics for community pharmacists	**10 Hours**
Text Books:	***1.*** *Mohammad Ali and Jyoti, Gupta**,** Drug store and business management**,** New Delhi: CBS.*	
Reference Books:	*1. Robin J Harman, Handbook of pharmacy – health care. The Pharmaceutical press, 2002.* *2. Leon Shargel, Comprehensive Pharmacy Review. Lippincott Williams & Wilkins, 2009* *3. N S Parmar, Health education & community pharmacy, Delhi : C B S Pub., 2008.* *4. WHO consultative group report.*	

Course Code: PDR206	Pharm D: Second Year PHARMACOTHERAPEUTICS – I (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the pathophysiology of selected disease states and rationale behind drug therapy.	
CO2.	Identifying patient specific parameters in initiating and monitoring drug therapy.	
CO3.	Demonstrating different therapeutic approaches in management of selected disease conditions.	
CO4.	Devising individualized drug therapy based on diagnosis of selected disease conditions.	
Course Content:		
Etiopathogenesis and pharmacotherapy of diseases associated with different diseased/clinical conditions		
Unit-I	**Cardiovascular System-I:** Hypertension, Congestive heart failure, Angina Pectoris, Myocardial infarction	**10 Hours**
Unit-II	**Cardiovascular System-II:** Hyperlipidaemias, Electrophysiology of heart and arrhythmias	**10 Hours**
Unit-III	**Respiratory System:** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases	**10 Hours**
Unit-IV	**Endocrine system-I:** Diabetes, Thyroid diseases	**10 Hours**
Unit-V	**Endocrine system-II:** Oral contraceptives, Hormone replacement therapy, Osteoporosis	**10 Hours**
Unit-VI	**General prescribing guidelines for:** 1. Paediatric patients: 2. Geriatric patients 3. Pregnancy and breast feeding	**10 Hours**
Unit-VII	**Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial	**10 Hours**
Unit-VIII	**Introduction to rational drug use:** Definition, Role of pharmacist Essential drug concept Rational drug formulations	**10 Hours**
Text Books:	1. *Roger and Walker, Clinical Pharmacy and Therapeutics, Churchill Livingstone publication.*	
Reference Books:	1. *Robins SL, Pathologic basis of disease -, W. B. Saunders publication.* 2. *Green and Harris, Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice, Chapman and Hall publication.* 2. *Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication.* 3. *Joseph T. Dipiro et al., Pharmacotherapy: A Pathophysiologic approach - Appleton & Lange.* 4. *Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA*	

	5. *Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.* 6. *Relevant review articles from recent medical and pharmaceutical literatur* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR207	Ability-Enhancement Compulsory Course – 1 Pharm D.: First Year COMMUNICATION SKILL	L-2 T-0 P-0 C-4
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the principles and process of communication.	
CO2.	Recognizing the barriers of communication.	
CO3.	Analysing the verbal and non-verbal communication.	
CO4.	Developing interpersonal skills, oral and written communication skills.	
Course Contents:		
Unit-1:	• **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context • **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers • **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.	**07 hours**
Unit-2:	• **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication • **Communication Styles:** Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	**07 hours**
Unit-3:	• **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations • **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades ofMeaning, Formal Communication • **Writing Effectively:** Course Lines, Put the Main Point First, Know Your Audience, Organization of the Message.	**07 hours**
Unit-4:	• **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview • **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.	**05 hours**
Unit-5:	**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	**04 hours**
Text Books: (Latest Edition)	1. *Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011* 2. *Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011*	

Reference Books:	1. *Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011* 2. *The Ace of Soft Skills: Attitude, Communication and Etiquette for success, GopalaSwamy Ramesh, 5thEdition, Pearson, 2013* 3. *Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press,2011* 4. *Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999* 5. *Organizational Behaviour, Stephen. P. Robbins, 1st Edition, Pearson, 2013* 6. *Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Greenhall, 1st Edition Universe of Learning LTD, 2010* 7. *Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011* 8. *Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd,2011* 9. *Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc GrawHill Education, 2011* 10. *Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR208	Value Added Course – 1 Pharm D: Second Year COMPUTER APPLICATIONS IN PHARMACY	L-3 T-0 P-0 C-6
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding application of computers in pharmacy.	
CO2.	Recognising concept of information system, software and bioinformatics.	
CO3.	Applying computers for data analysis in preclinical development.	
Course Contents:		
Unit-1:	**Number system**: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division **Concept of Information Systems and Software: I**nformation requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	06 hours
Unit-2:	**Web technologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06 hours
Unit-3:	**Application of computers in Pharmacy** –Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring, Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.	06 hours
Unit-4:	**Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics, Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06 hours
Unit-5:	**Computers as data analysis in Preclinical development**: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	06 hours
Text Books: (Latest Edition)	1. *Computer Application in Pharmacy – William E. Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.*	
Reference Books:	1. *Bioinformatics (Concept, Skills and Applications) – S.C. Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)* 2. *Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley- Interscience, A John Willey and Sons, INC., Publication, USA* 3. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road,Daryagani, New Delhi - 110002*	

Course Code: PDR251	Pharm D.: Second Year PHARMACEUTICAL MICROBIOLOGY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the basics of experimental microbiology.	
CO2.	Identifying the presence of microorganism in some infectious diseases & pharmaceutical preparation.	
CO3.	Demonstrating the microbiological assay of antibiotics and vitamins.	
Course Content:		**3 Hrs./ Week**

1. Study of apparatus used in experimental microbiology*.
2. Sterilisation 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 a nd equipment/instruments used and reporting the same.
2. Visit to milk dairies (Pasturization) and microbial laboratories (other sterilization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments
   ii. Report of recent microbial techniques developed in diagnosing some common diseases.
   iii. 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.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	5	15
Major experiments	10	25
Minor experiments	3	15
Viva	2	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max marks	30	70
Duration	**3Hrs**	**4Hrs**

Text Books:	1. *Prescott L.M., Harley J.P. & Klien D.A., Microbiology, Tata McGraw Hill.*	
Reference Books:	1. *Hugo & Russell, Pharmaceutical Microbiology, Black Well Scientific Publication, Oxford.* 2. *Ananthanarayan R. & Paniker C.K.J., Textbook of Microbiology, Orient Longman.* 3. *Sykes, Disinfection & Sterilization.* 4. *Virella G., Microbiology& Infectious Diseases.* 5. *Stanier R.Y., Ingraham, J.L., Wheelis M.L. & Painter P.R., General Microbiology, Macmillan Press Limited.* 6. *Pelczar & Reid, Microbiology, Tata McGraw Hill, Delhi.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR252	Pharm D.: Second Year PHARMACOGNOSY & PHYTOPHARMACEUTICALS (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the microscopic evaluations of crude/herbal drugs including internal structure (T.S.), powder analysis, leaf surface microscopy to confirm plant species and variety.	
CO2.	Identifying crude drugs with morphology, chemical tests for active chemical constituents as compared with official standards.	
CO3.	Analyzing the fixed & volatile oils by saponification, acid value, ester values, physic-chemical evaluations for purity.	
CO4.	Developing plant monographs, herbarium and authentication for official comparison.	
Course Content:		**3Hrs./ Week**

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

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Mohammad Ali, Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.* 2. *Prof. S. H. Ansari, Essentials of Pharmacogosy, Birla Publishers, Rohtas Nagar, Delhi.*	
Reference Books:	1. *Tyler, Brady and Robbers, Pharmacognosy, Lea & Febiger, 1981.* 2. *WHO Quality Control Methods of Medicinal Plant Materials, WHO.* 3. *Indian Herbal Pharmacopoeia, Vol. 1 & 2* 4. *Pulok K. Mukherjee, Quality Control of Herbal drugs. An Approach to Evaluation of Botanicals, Business Horizons.* 5. *V. Rajpal, Standardization of Botanicals, Vol. I & II, Eastern Publishers, New Delhi.* 6. *Kalia, A.N., Text Book of Industrial Pharmacognosy. Satish Kumar Jain for CBS.* 7. *Vyas, S.P., Dixit, V.K., Pharmaceutical Biotechnology. CBS Publishers.*	

Course Code: PDR253	Pharm.D: Second Year PHARMACOTHERAPEUTICS - I (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the principles and practices involved in selection of drug therapy including clinical discussions for selected diseases.	
CO2.	Interpreting the follow up, progress and changes made in drug therapy.	
CO3.	Analyzing the pharmaceutical care issues and their solutions.	
CO4.	Developing the evidence based pharmaceutical care plans for allotted patients.	
Course Content:		**3Hrs./ Week**

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.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examinations:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA*	
Reference Books:	1. *Robins SL, Pathologic basis of disease -, W. B. Saunders publication.* 2. *Green and Harris, Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice, Chapman and Hall publication.* 3. *Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication.* 4. *Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.* 5. *Satoskar & Bhandarkar, Pharmacology & Pharmacotheropeutics., Popular Prakashan Pvt. Ltd. Bombay.* 6. *Goodman & Gilman, The Pharmacological basis of Therapeutics, Editors: J.G. Hardman, L.E. Limbird, P.B. Molinos, R.W. Ruddon and A.G. Gil, Pergamon press.* 7. *Relevant review articles from recent medical and pharmaceutical literature*	

Course Code: PDR254	**Ability-Enhancement Compulsory Course – 2** **Pharm. D: Second Year** **COMMUNICATION SKILLS (PRACTICAL)**	**L-0** **T-0** **P-2** **C-2**
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding the basics of communication skills.	
CO2.	Applying oral and written communication skills with proper pronunciation and presentation.	
Course Contents:		**2 Hrs./ Week**

The following learning modules are to be conducted using words worth® English language lab software

I. Basic communication covering the following topics Meeting People, Asking Questions, Making Friends What did you do? Do's and Dont's

II. Pronunciations covering the following topics
Pronunciation (Consonant Sounds), Pronunciation and Nouns, Pronunciation (Vowel Sounds)

III. Advanced Learning
Listening Comprehension / Direct and Indirect Speech, Figures of Speech, Effective Communication Writing Skills, Effective Writing, Interview Handling Skills, E-Mail etiquette, Presentation Skills

Text Books: (Latest Edition)	1. *Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011* 2. *Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011*	
Reference Books:	1. *Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011* 2. *The Ace of Soft Skills: Attitude, Communication and Etiquette for success, GopalaSwamy Ramesh, 5thEdition, Pearson, 2013* 3. *Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press,2011* 4. *Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999* 5. *Organizational Behaviour, Stephen. P. Robbins, 1st Edition, Pearson, 2013* 6. *Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Greenhall, 1st Edition Universe of Learning LTD, 2010* 7. *Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011* 8. *Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd,2011* 9. *Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc GrawHill Education, 2011* 10. *Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR208	Value Added Course – 2 Pharm.D: Second Year COMPUTER APPLICATION IN PHARMACY (PRACTICAL)	L-0 T-0 P-2 C-2
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding basic concepts of HTML and its use in creating websites.	
CO2.	Demonstrating the information of any drug and its adverse effects using online tools.	
CO3.	Deploying MS Office tools to store and retrieve patient information from the Database.	
CO4.	Generating and printing report from patient database.	
Course Contents:		2 Hrs./ Week

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3. Retrieve the information of a drug and its adverse effects using online tools
4. Creating mailing labels Using Label Wizard, generating label in MS WORD
5. Create a database in MS Access to store the patient information with the required fields using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Text Books: (Latest Edition)	1. *Computer Application in Pharmacy – William E. Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.*	
Reference Books:	1. *Bioinformatics (Concept, Skills and Applications) – S.C. Rastogi- CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002 (INDIA)* 2. *Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley- Interscience, A John Willey and Sons, INC., Publication, USA* 3. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002.*	

Course Code: PDR301	Pharm D.: Third Year PHARMACOLOGY – II (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the pharmacological aspects of selected drugs.	
CO2.	Applying the pharmacology of drugs and correlate therapeutics.	
CO3.	Evaluating and interpreting the drugs action through animal toxicology.	
Course Content:		
Unit-I	**Pharmacology of Drugs acting on Blood and blood forming agents** 1. Anticoagulants 2. Thrombolytics and Antiplatelet agents 3. Haemopoietics and plasma expanders	**10 Hours**
Unit-II	**Pharmacology of drugs acting on Renal System** 1. Diuretics 2. Antidiuretics	**10 Hours**
Unit-III	**Chemotherapy-I:** 1. Introduction 2. Sulfonamides and co-trimoxazole 3. Penicillins and Cephalosporins 4. Tetracyclins and Chloramphenicol	**10 Hours**
Unit-IV	**Chemotherapy-II:** 1. Macrolides, Aminoglycosides, Polyene & Polypeptide antibiotics 2. Quinolines and Fluroquinolones 3. Antifungal antibiotics 4. Antiviral agents	**10 Hours**
Unit-V	1. Chemotherapy of tuberculosis and leprosy 2. Chemotherapy of Malaria 3. Chemotherapy of protozoal infections (amoebiasis and Giardiasis) 4. Pharmacology of Anthelmintic drugs 5. Chemotherapy of cancer (Neoplasms)	**10 Hours**
Unit-VI	**Immunopharmacology:** Pharmacology of immunosuppressants and stimulants **Principles of Animal toxicology** Acute, sub- acute and chronic toxicity	**10 Hours**
Unit-VII	**The dynamic cell: The structures and functions of the components of the cell** a) Cell and macromolecules: Cellular classification, subcellular 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.	**10 Hours**

Unit-VIII	**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 transcription in pro and eukaryotes. Transcription factors that regulate transcription in pro and eukaryotes. RNA processing: rRNA, tRNA and mRNA processing. Protein synthesis: Mechanisms of protein synthesis, initiation in eukaryotes, translation control and post-translation events Altered gene functions: Mutations, deletions, amplifications, LOH, traslocations, trinucleotide repeats and other genetic abnormalities. Oncogenes and tumor suppressor genes. The gene sequencing, mapping and cloning of human disease genes. Introduction to gene therapy and targeting. Recombinant DNA technology: principles. Processes (gene transfer technology) and applications	**10 Hours**
Text Books:	*1. Tripathi, K. D. Essentials of medical pharmacology, 4th edition, 1999. Publisher: Jaypee, Delhi.* *2. Satoskar, R.S. and Bhadarkar, S.D., Pharmacology and pharmacotherapeutics, 16th edition (single volume), 1999. Publisher: Popular, Dubai.*	
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 edition, 1996. Publisher: Mc Graw Hill, Pergamon press.* *2. Craig, C.R. and Stitzel, R.E., Modern Pharmacology, Latest edition. Publisher: Little Brown and company.* *3. Katzung, B.G. Basic and clinical pharmacology, Latest edition. Publisher: Prentice Hall, International.* *4. 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.* *5. Alberts B., Bray, D., Lewis, J., Raff M., Roberts, K and Watson JD, Molecular Biology of the Cell, , 3rd edition.* *6. Lodish, H., Baltimore, D., Berk, A et al., Molecular Cell Biology , 5th edition.* *7. Turner, PC., McLennan, AG., Bates, AD and White MRH, Molecular Biology, 2nd edition.* *8. Lewin, B., Genes VIII, (2004)* *9. Crommelin, DJA and Sindelar RD, Pharmaceutical Biotechnology, (1997)* *10. Watson, JD., Gilman, M., et al., Recombinant DNA, (1996)* *11. Walsh, G., Biopharmaceutical: Biochemistry and Biotechnology, (1998)* *12. Rang, H.P. and Dale, M.M., Pharmacology, 4th edition, 1999. Publisher: Churchill Living stone.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR302	Pharm D.: Third Year PHARMACEUTICAL ANALYSIS (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the concept of quality assurance, principles of instrumental techniques such as chromatography, spectroscopy, thermal and electro chemical techniques in drug analysis.	
CO2.	Analyzing drugs and pharmaceuticals using different analytical techniques.	
CO3.	Estimating the drug content in various formulations	
Course Content:		
Unit-I	**Quality Assurance:** Introduction, sources of quality variation, control of quality variation, Concept of statistical quality control, Validation methods- quality of equipment, validation of equipment and analytical instruments & calibration, GLP, ISO 9000, Total quality management, quality review and documentation, ICH-international conference for harmonization-guidelines, Regulatory control.	**10 Hours**
Unit-II	**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. **Column Chromatography**: Adsorption column chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography **TLC**: Introduction, principle, techniques, Rf value and applications. **Paper Chromatography:** Introduction, principle, types of paper chromatography, preparation & development techniques and applications. **Ion-exchange chromatography**: Introduction, principles, types of ion exchange, synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.	**10 Hours**
Unit-III	**HPLC**: Introduction, theory, instrumentation and applications. **HPTLC**: Introduction, theory, instrumentation, and applications. **Gas Chromatography**: Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors-Flame ionization, electron capture and thermal conductivity detectors. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography and applications. **Electrophoresis**: Principles of separation, equipment for paper and gel electrophoresis and applications. **Gel filtration** and **affinity chromatography**: Introduction, techniques and applications.	**10 Hours**
Unit-IV	**Electrometric Methods:** Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics. **Potentiometry**: Electrical potential, electrochemical cell,	**10 Hours**

	reference & indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point and Karl Fischer titration. **Conductometry**: Introduction, conductivity cell, conductometric titrations and applications. **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. **Amperometric Titrations:** Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of amperometry over potentiometry. Pharma applications.	
Unit-V	**Spectroscopy:** Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on: **Absorption Spectroscopy:** Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer-Lambert's Law, application and its deviation, limitation of Beer's law and its application to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic, hypsochromic, hyperchromic and hypochromic effect, effects 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	**10 Hours**
Unit-VI	**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. **Flame Photometry:** Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.	**10 Hours**
Unit-VII	**Atomic Absorption Spectrometry:** Introduction, Theory, types of electrodes, instrumentation and applications. **Atomic Emission Spectroscopy**: Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection. **NMR & ESR (introduction only):** Introduction, theoretical aspects and applications. **Mass Spectroscopy**: (**Introduction only**) – Fragmentation, types of ions produced mass spectrum and applications	**10 Hours**

Unit-VIII	**Polarimetry: (Introduction only**) – Introduction to optical rotatory dispersion and circular dichroism & polarimeters **X-RAY Diffraction: (Introduction only**) – Theory, reciprocal lattice concept, diffraction patterns and applications. **Thermal Analysis**: Introduction, instrumentation, applications, and DSC & DTA	**10 Hours**
Text Books:	***1.*** *Willard H.H. & Merrit L. Jr, and Dean J.A., Instrumental Methods of Analysis, Van Nostrand Renhold, New York.* ***2.*** *Silver stein R.M. & Webster F.X., Spectrometric Identification of Organic Compounds, John Wiley & Sons.*	
Reference Books:	*1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle, P.A., Instrumental Methods of Analysis, Van Nostrand.* *2. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.* *3. Haswell, S.J., ed. Atomic Absorption Spectroscopy, Elsevier.* *4. Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.* *5. Sethi, P.D., Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, New Delhi.* *6. Kalsi, P.S., Spectroscopy of Organic Compounds, new age publishers, New Delhi.* *7. Gross J.H., Mass Spectrometry, Springer Berlin, Heidelberg.* *8. Haffmann D. H. Advances in Chromatography, Marcel Dekker.* *9. Braun Robert D., Introduction to Instrumental Analysis, McGraw-Hill.* *10. Wilfried, M.A. Niessen, Liquid Chromatography-Mass Spectrometry, Marcel Dekker.* *11. Pharmacopoeia of India, Ministry of Health, Govt of India.* *12. Becket A.H. & Stenlake J.B., Practical Pharmaceutical Chemistry Vol. I and II, the Athlone Press of the University of London.* *13. Skoog V., Principles of Instrumental Analysis, Holler-Neimen* *14. Chatten L.G., A text book of Pharmaceutical Chemistry Vol. I & II Marcel, Dekker, New York.*	

Course Code: PDR303	Pharm D.: Third Year PHARMACOTHERAPEUTICS – II (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Relating the pathophysiology of selected disease states and the rationale for drug therapy.	
CO2.	Demonstrating different therapeutic approaches in management of selected disease conditions.	
CO3.	Assessing the needs for monitoring the drug therapy for selected diseases Conditions.	
CO4.	Devising individualized drug therapy plans based on diagnosis for selected disease.	
Course Content:		
Unit-I	**Infectious diseases** Guidelines for the rational use of antibiotics and surgical Prophylaxis against the following infections Tuberculosis, Meningitis, Respiratory tract infections	**10 Hours**
Unit-II	1. Gastroenteritis: 2. Endocarditis: 3. Septicemia	**10 Hours**
Unit-III	1. Urinary tract infections 2. Protozoal infections- Malaria 3. HIV 4. Opportunistic infections	**10 Hours**
Unit-IV	1. Fungal infections 2. Viral infections 3. Gonarrhoea 4. Syphillis:	**10 Hours**
Unit-V	**Musculoskeletal disorders** 1. Rheumatoid arthritis 2. Osteoarthritis 3. Gout 4. Spondylitis 5. Systemic lupus erythematosus	**10 Hours**
Unit-VI	**Renal system** 1. Acute Renal Failure 2. Chronic Renal Failure. 3. Renal Dialysis: 4. Drug induced renal disorders	**10 Hours**
Unit-VII	**Oncology** 1. Basic principles of Cancer therapy 2. General introduction to cancer chemotherapeutic agents 3. Chemotherapy of breast cancer 4. Leukemia 5. Management of chemotherapy nausea and emesis	**10 Hours**
Unit-VIII	**Dermatology** 1. Psoriasis 2. Scabies	**10 Hours**

	3. Eczema 4. Impetigo	
Text Books:	*1. Roger and Walker, Clinical Pharmacy and Therapeutics, Churchill Livingstone publication*	
Reference Books:	*1. Joseph T. Dipiro et al., Pharmacotherapy: A Pathophysiologic approach, Appleton & Lange* *2. Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication* *3. Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA* *4. Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.* *5. Satoskar & Bhandarkar, Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR304	**Pharm D.: Third Year** **PHARMACEUTICAL JURISPRUDENCE (THEORY)**	**L-2 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Recognizing the role of regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.	
CO2.	Illustrating various concepts of the pharmaceutical legislation in India including drug and cosmetic act and rules, drug policies, DPCO, Patent and design act.	
CO3.	Practicing professional ethics during handling of drugs, pharmaceuticals and cosmetics.	
CO4.	Employing the concepts of different acts and related laws as prescribed by the Pharmacy Council of India and International drug regulatory authorities.	
Course Content:		
Unit-I	**Pharmaceutical Legislations:** A brief review **Principle and Significance of professional ethics:** Critical study of the code of pharmaceutical ethics drafted by PCI.	**10 Hours**
Unit-II	**Drugs and Cosmetics Act, 1940,and its rules 1945**: Objectives, Legal definition, Study of Schedule's with reference to Schedule B, C&C1, D, E1, F&F1, F2, F3, FF, G, H, J, K, M, N, P, R, V, W, X, Y. Sales, Import, labeling and packaging of drugs & cosmetics. Provisions Relating to Indigenous Systems.	**10 Hours**
Unit-III	Constitution and Functions of Drugs Technical Advisory Board (DTAB), Drugs Consultative Committee (DCC) and Central Drugs laboratory (CDL). Qualification and duties: Govt. analyst and Drugs Inspector, (qualifications, powers & duties).	**10 Hours**
Unit-IV	**Pharmacy Act –1948:** Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Councils, Registration Procedure, Education Regulations-91 (ER-91). **Medicinal and Toilet Preparation Act –1955**: Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.	**10 Hours**
Unit-V	**Narcotic Drugs and Psychotropic substances Act-1985** and Rules. Objectives, Legal Definitions, General Study, offences and penalties, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act. **Study of Salient Features of Drugs and magic remedies Act and its rules**	**10 Hours**
Unit-VI	Study of essential Commodities Act 1955 Relevance to drugs price control Order. Drug Price control Order & National Drug Policy (Current).	**10 Hours**

Unit-VII	Prevention Of Cruelty to animals Act-1960	**10 Hours**
Unit-VIII	Patents & design Act-1970 Brief study of prescription and Non-prescription Products.	**10 Hours**
Text Books:	***1.*** *Jain N.K., A Textbook of Forensic Pharmacy, Vallabh Prakashan, N. Delhi.* ***2.*** *Mittal B.M.,Textbook of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta*	
Reference Books:	*1. Relevant Acts & Rules, Published by the Govt. of India.* *2. Singh H., History of Pharmacy in India- Vol.-I, II & III, Vallabh Prakashan.* ** Latest editions of all the suggested books are recommended.*	

Course Code: PDR305	Pharm D.: Third Year MEDICINAL CHEMISTRY (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding various modern approaches in drug design, QSAR and CADD.	
CO2.	Demonstrating the chemistry & SAR of various categories of drugs with respect to their biological activities.	
CO3.	Explaining the metabolism, adverse effects and therapeutic activities of various categories of drugs.	
CO4.	Estimating drugs qualitatively and quantitatively in formulations through assays.	
CO5.	Synthesizing drugs using different chemical reaction approach.	
Course Content:		
Unit-I	**Modern concept of rational drug design:** A brief introduction to Quantitative Structure Activity Relationship (QSAR), prodrug, combinatorial chemistry, computer aided drug design (CADD) and concept of antisense molecules. A study of the development of the following classes of drugs including classification, SAR, mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.	**10 Hours**
Unit-II	**Anti-infective agents-I** **3.** Local anti-infective agents **4.** Preservatives **5.** Antifungal agents **6.** Urinary tract anti-infectives	**10 Hours**
Unit-III	**Anti-infective agents-II** 1. Antitubercular agents 2. Antiviral agents and Anti AIDS agents 3. Antiprotozoal agents 4. Anthelmentics 5. Antiscabies and Antipedicular agents	**10 Hours**
Unit-IV	1. Sulphonamides and sulphones 2. Antibiotics	**10 Hours**
Unit-V	1. Antimalarials 2. Antineoplastic agents	**10 Hours**
Unit-VI	**Cardiovascular agents:** 1. Antihypertensive agents 2. Antianginal agents and vasodilators 3. Antiarrhythmic agents 4. Antihyperlipidemic agents 5. Coagulants and Anticoagulants	**10 Hours**
Unit-VII	1. Hypoglycemic agents 2. Thyroid and Antithyroid agents 3. Diureties	**10 Hours**

Unit-VIII	1. Diagnostic agents 2. Endocrine & Steroidal Hormones 3. Adrenocorticoids	**10 Hours**
Text Books:	*1. Singh Harkrishan and Kapoor V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan, Delhi.*	
Reference Books:	*1. Delgado J.N., Remers WA eds, Wilson & Giswolds Text Book of Organic Medicinal & Pharmaceutical Chemistry, Lippincott, New York.* *2. Alex Gringauz- , Introduction to Medicinal Chemistry, Wiley-VCH, Inc. New York.* *3. Abraham DJ,ed., Burger's Medicinal Chemistry & Drug Discovery, Vol-I-VI, John Wiley & Sons, New Jersey.* *4. Mann P.G. & Saunders B.C., Practical Organic Chemistry, ELBS/Longman, London.* *5. Furniss B.A., Hannaford A.J., Smith P.W.G. and Tatehell A.R., Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.* *6. Pharmacopoeia of India, Minsitry of Health, Govt. of India.* *7. Wolff, Burger's Medicinal Chemistry, John Wiley & Sons, New York.* *8. Nogrady T., Medicinal Chemistry – A Biochemical Approach, Oxford University Press, New York* *9. Foye W.C., Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia.* *10. Finar I.L., Organic Chemistry, Vol I & II, ELBS/ Longman, London.* *11. A Text book of Organic Medicinal Chemistry, Wilson & Griswold.* *12. Abraham D.J., ed., Burger's Medicinal Chemistry & Drug Discovery, Vol.-I-VI, John Wiley & sons, New Jersey.* *13. Laszlo Kurti, Barbara Czako, Strategic Applications of Name Reaction in Organic Synthesis, Elsevier, Academic Press, New York.* *14. Monographs and relevant review articles appearing in various periodicals and journals.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR306	**Pharm.D: Third Year** **PHARMACEUTICAL FORMULATIONS (THEORY)**	**L-2** **T-1** **P-0** **C-6**
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the principles involved in formulation of various pharmaceutical forms.	
CO2.	Demonstrating the concept of bioavailability and bioequivalence and their role in clinical situations.	
CO3.	Formulating various dosage forms.	
CO4.	Evaluating various dosage forms.	
Course Content:		
Unit-I	**Pharmaceutical dosage form:** concept and classification	**10 Hours**
Unit-II	**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.	**10 Hours**
Unit-III	**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.	**10 Hours**
Unit-IV	**Liquid orals:** Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations	**10 Hours**
Unit-V	**Parenterals:** Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization	**10 Hours**
Unit-VI	**Ophthalmic preparations (semi-solids):** Introduction and classification, Factors affecting absorption, anatomy of skin, Packaging, storage and labeling. **Ointments:** Types of Ointment Base, Preparation of ointment and evaluation	**10 Hours**
Unit-VII	**Jellies:** Types of jellies, Formulation of jellies and evaluation. **Suppositories:** Method of preparation, Types of Packaging.	**10 Hours**
Unit-VIII	**Definition and concept of Controlled and novel Drug delivery systems**: with available examples, viz. Parenteral, transdermal, buccal, rectal, nasal, implants and ocular.	**10 Hours**
Text Books:	1. *Carter S J ,Tutorial Pharmacy Cooper and Gunns, New Delhi : CBS Publishers, 2004*	
Reference Books:	1. *Remington, Pharmaceutical Sciences, Pennsylvania, 1970* 2. *U S Pharmacopeia and national formulary USP 24 - NF 19 supplement Vol-2, Pharamacopeiapub,2000.* 3. *H.M.S.O., British pharmacopoea, London : HMSO 1988-I.* 4. *Government of India ministry of Health & Family welfare ,Indian Pharmacopoea 1996.Vol-I,Vol-II,Vol- III,2007* 5. *Lieberman Herbert A, Lachman Leon, Schwartz Joseph B*	

	,Pharmaceutical dosage forms, Vol, I,II and III, infforma Healthcare, 2007 6. *E.A. Rawlins , Bentley's Text book of Pharmaceutics**,** Delhi : AITBS Publishers and Distributors,2005* **Latest editions of all the suggested books are recommended*	

Course Code: PDR307	Ability-Enhancement Compulsory Course – 3 Pharm.D: Third Year ENVIRONMENTAL SCIENCES	L-3 T-0 P-0 C-6
Course Outcomes:	On completion of the course, the students will be :	
CO1.	Understanding concepts &sources of environment and its associated problems and measures to control.	
CO2.	Describing the ecosystems.	
CO3.	Analysing human impacts on the environment.	
Course Contents:		
Unit-1:	The Multidisciplinary nature of environmental studies Natural Resources, Renewable and non-renewable resources: Natural resources and associated problems Forest resources; a) Water resources; b) Mineral resources; c) Food resources; d) Energy resources; e) Land resources: Role of an individual in conservation of natural resources.	10 hours
Unit-2:	Ecosystems, Concept of an ecosystem. Structure and function of an ecosystem. Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10 hours
Unit-3:	Environmental Pollution: Air pollution; Water pollution; Soil pollution.	10 hours
Text Books: (Latest Edition)	1. *Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore* 2. *Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.* 3. *Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,*	
Reference Books:	1. *Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p* 2. *Clark R.S., Marine Pollution, Clanderson Press Oxford* 3. *Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p* 4. *De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down of Earth, Centre for Science and Environment*	

Course Code: PDR351	Pharm D.: Third Year PHARMACOLOGY – II (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the animal handling and route of drug administration of several types of dosage forms.	
CO2.	Recognizing the different types of experimental instruments dealing with pharmacological research.	
CO3.	Demonstrating the several molecular level target in *in-vitro* and *in-vivo* technology.	
CO4.	Evaluating currently accepted experimental methods, instrumental techniques and procedure.	
Course Content:		**3 Hrs./ Week**

1. Study of laboratory animals and their handling (Frogs, Mice, Rats, Guinea pigs, 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 rotorod.
    f. Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

Items	Internal	End year (External)
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
Regularity, Promptness, viva-voce and Record Maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Kulkarni, S. K. and Dandia, P. C. Hand book of experimental pharmacology. Latest edition, Publisher: Vallab, Delhi.*	
Reference Books:	1. *Macleod, L.J., Pharmacological experiments on intact preparations, Latest edition, Publisher: Churchill livingstone.* 2. *Macleod, L.J., Pharmacological experiments on isolated preparations, Latest edition, Publisher: Churchill livingstone.* 3. *Ghosh, M.N., Fundamentals of experimental pharmacology, Latest edition, Publisher: Scientific book agency, Kolkata.* 4. *Ian Kitchen, Textbook of in vitro practical pharmacology, Latest edition, Publisher: Black well Scientific.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR352	Pharm D.: Third Year PHARMACEUTICAL ANALYSIS (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the principles and procedures involved in estimation of drugs and pharmaceuticals.	
CO2.	Demonstrating different analytical techniques and instruments.	
CO3.	Interpreting the data and spectra for analysis.	
Course Content:		**3Hrs./ Week**

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-Visible spectroscopy.
6. Conductometric titration of mixture of acids with a strong base
7. Potentiometric titration of an 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
12. Assay of Salicylic Acid by colourimetry
13. Determination of Chlorides and Sulphates in Calcium gluconate by Nepheloturbidimetric Method.
14. Determination of Na/K by Flame Photometry.
15. Determination of pKa using pH meter.
16. Determination of specific rotation.
17. Comparison of the IR spectrum of a compound with that of its derivatives.
18. Demonstration of HPLC
19. Demonstration of HPTLC.
20. Demonstration of GC-MS.
21. Demonstration of DSC.
22. Interpretation of NMR spectra of any one compound.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *P.D. Sethi., Textbook of Drug Analysis, CBS Publishers, Delhi.*	
Reference Books:	1. *Silverstein, Spectroscopy, John & Wiley & Sons. Inc., Canada & Singapore.* 2. *P.P. Sharma, How to practise GMP-A Plan for total quality control , Vandana Publications, Agra.* 3. *Remington Vol-I & II, The Science & Practice of Pharmacy , Mack Publishing Co. Pennsylvania.* 4. *TLC by Stahl, Spring Verlay.* 5. *Chatten, Text Book of Pharm. Chemistry, CBS Publications.* 6. *William Kemp, Spectroscopy, ELBS with Macmillan Press, Hampshire.* 7. *I.P.-1996, The Controller of Publications, New Delhi.* 8. *BPC- Dept. of Health, U.K. for HMSO.* 9. *USP - Mack Publishing Co., Easton, PA.* 10. *The Extra Pharmacopoeia – The Pharm. Press, London.* 11. *Higuchi. T and Hasen. E. B., Text Book of Pharm. Analysis, New York Inter Science Publishers.* 12. *Jenkins, Quantitative Pharma. Analysis, The Blakiston division, New York.* 13. *Garrot. D, Quantitative Drug Analysis, Chapman & Hall Ltd., London.* 14. *James. E., Undergraduate Instrumental Analysis, CBS Publishers.* 15. *Willard and Merritt, EWP, Instrumental Analysis, East West Press Ltd., Delhi/Madras.* 16. *Skoog and West, Pharm Analysis , Sounders Manipal College Publishing.* 17. *A.I.Vogel, Text Book of Chemical Analysis, ELBS with Macmillan press, Hampshire.* 18. *K.A.Connors, Textbook of Pharm. Analysis , John Wiley & Sons, New York, Brisbane, Singapore.* 19. *Beckett & Stenlake, Textbook of Pharm. Analysis (Practical), CBS Publishers, Delhi.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR353	Pharm. D: Third Year PHARMACOTHERAPEUTICS – II (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the principles and practices involved in selection of drug therapy including clinical discussions for selected diseases.	
CO2.	Interpreting the follow up, progress and changes made in drug therapy.	
CO3.	Analyzing pharmaceutical care issues and their solutions.	
CO4.	Developing the evidence based pharmaceutical care plans for allotted patients	
Course Content:		**3 Hrs./ Week**

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.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Roger and Walker, Clinical Pharmacy and Therapeutics, Churchill Livingstone publication*	
Reference Books:	1. *Joseph T. Dipiro et al., Pharmacotherapy: A Pathophysiologic approach, Appleton & Lange* 2. *Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication* 3. *Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA* 4. *Goodman & Gilman, The Pharmacological basis of Therapeutics, Pergamon Press.* 5. *Satoskar & Bhandarkar, Pharmacology & Pharmacotherapeutics, Popular Prakashan Pvt. Ltd., Bombay.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR354	Pharm D.: Third Year MEDICINAL CHEMISTRY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Recognizing various mechanisms for synthesis of drugs or their intermediates.	
CO2.	Illustrating different physico-chemical properties of various classes of drug.	
CO3.	Applying the principles involved in assay of drugs in dosage forms	
Course Content:		**3 Hrs./ Week**

Practical:

1. Assays of important drugs from the course content.
2. Preparation of medicinally important compounds or intermediates required for synthesis of drugs.
3. Monograph analysis of important drugs.
4. Determination of partition coefficients, dissociation constants and molar refractivity of compounds for QSAR analysis

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *A Text Book of Medicinal Chemistry Vol. I and II by Surendra N. Pandeya, S.G. Publisher, 6, Dildayal Nagar, Varanasi -10.*	
Reference Books:	1. *Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.* 2. *Organic Drug Synthesis-Ledniser Mitzsher Vol. I and II.* 3. *Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.* 4. *The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton,*	

	Pennsylvania. 5. *Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.* 6. *Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, Lippincott- Raven Publishers-New York, Philadelphia.* 7. *William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.* 8. *Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wiley- interscience Publication, New York, Toranto.*	

Course Code: PDR355	Pharm.D: Third Year PHARMACEUTICAL FORMULATIONS (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course the students will be**	
CO1.	Understanding the principle involved in formulation of various pharmaceutical dosage forms.	
CO2.	Recalling the concept of bioavailability and bioequivalence.	
CO3.	Evaluating pharmaceutical dosage forms.	
CO4.	Preparing various pharmaceutical formulations.	
Course Content:		**3 Hrs./ Week**

1. **Manufacture of Tablets:** Ordinary compressed tablet-wet granulation, tablets prepared by direct compression, soluble tablet and Chewable tablet.
2. **Formulation and filling of hard gelatin capsules**
3. **Manufacture of parenterals:** Ascorbic acid injection, calcium gluconate injection, sodium chloride infusion, dextrose and Sodium chloride injection/ infusion.
4. **Evaluation of Pharmaceutical formulations (QC tests):** Tablets, capsules and injections
5. **Formulation of two liquid oral preparations and evaluation by assay:** Solution: Paracetamol Syrup and Antacid suspensions- Aluminum hydroxide gel.
6. **Formulation of semisolids and evaluation by assay:** Salicyclic acid and benzoic acid ointment and Gel formulation Diclofenac gel.
7. **Cosmetic preparations:** lipsticks, cold cream and vanishing cream, clear liquid shampoo and tooth paste and tooth powders
8. **Tablet coating (demonstration)**

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Sethi, P.D., Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, New Delhi.*	
Reference Books:	1. *Gross J.H., Mass Spectrometry, Springer Berlin, Heidelberg.* 2. *Haffmann D. H. Advances in Chromatography, Marcel Dekker.* 3. *Robert D. Braun, Introduction to Instrumental Analysis, McGraw-Hill.* 4. *Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry, Marcel Dekker.*	

	5. *Kalsi, P.S., Spectroscopy of Organic Compounds, New Age Publishers, New Delhi.* 6. *Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.* 7. *Haswell, S.J., ed. Atomic Absorption Spectroscopy, Elsevier.* 8. *Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR 401	Pharm.D: Fourth Year PHARMACOTHERAPEUTICS – III (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the pathophysiology of selected disease states and the rational drug therapy.	
CO2.	Demonstrating different therapeutic approaches in management of selected disease conditions.	
CO3.	Developing individualized therapeutic plans based on diagnosis.	
CO4.	Evaluating therapeutic drug monitoring for selected diseases conditions.	
Course Content:		
Unit-1:	Etiopathogenesis and pharmacotherapy of following diseases: Gastrointestinal System- 1. Peptic ulcer disease 2. Gastro Esophageal Reflux Disease 3. Inflammatory bowel disease.	**10 hours**
Unit-2:	Etiopathogenesis and pharmacotherapy of following diseases: Liver Disorders 1. Alcoholic liver disease 2. Viral hepatitis 3. Drug induced liver disorders	**10 hours**
Unit-3:	Etiopathogenesis and pharmacotherapy of following diseases: Hematological System 1. Anemias 2. Venous thromboembolism 3. Drug induced blood disorders	**10 hours**
Unit-4:	Etiopathogenesis and pharmacotherapy of following diseases: Nervous system 1. Epilepsy 2. Parkinsonism 3. Stroke 4. Alzheimer's disease	**10 hours**
Unit-5:	Etiopathogenesis and pharmacotherapy of following diseases: Psychiatry disorders 1. Schizophrenia 2. Affective disorders 3. Anxiety disorders	**10 hours**
Unit-6:	1. Sleep disorders 2. Obsessive Compulsive disorders	**10 hours**
Unit-7:	1. Pain Management including pain pathways 2. Neuralgias 3. Headaches	**10 hours**

Unit-8:	Evidence Based Medicine	**10 hours**
Text Books:	1. *Roger and Walker, Clinical Pharmacy and Therapeutics, Churchill Livingstone publication*	
Reference Books:	1. *Robins SL, Pathologic basis of disease, W.B.Saunders publication* 2. *Green and Harris, Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Chapman and Hall publication* 3. *Joseph T. Dipiro et al., Pharmacotherapy: A Pathophysiologic approach - Appleton & Lange* 4. *Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication* 5. *Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA* 6. *Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.* 7. *Relevant review articles from recent medical and pharmaceutical literature.*	

Course Code: PDR 402	**Pharm.D: Fourth Year** **HOSPITAL PHARMACY (THEORY)**	**L-2** **T-1** **P-0** **C-6**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding drug distribution and professional practice management skills in hospital pharmacies.	
CO2.	Demonstrating unbiased drug information to the patients and physicians.	
CO3.	Formulating extemporaneous drug preparations in the hospital pharmacies.	
CO4.	Practicing drug dispensing, store management and inventory control in hospitals.	
CO5.	Developing practice-based research methods.	
Course Content:		
Unit-1:	**1.** Hospital - its organization and functions **2.** Hospital pharmacy-Organization and management: Organizational Structure-Staff, Infrastructure & work load statistics, Management of materials and finance, Roles & responsibilities of hospital pharmacist	**10 hours**
Unit-2:	**1.** The Budget - Preparation and implementation **2.** Hospital drug policy: i. Pharmacy and Therapeutic committee (PTC) ii. Hospital formulary iii. Hospital committees: Infection control, Research and ethical committee iv. Developing therapeutic guidelines v. Hospital pharmacy communication - Newsletters	**10 hours**
Unit-3:	Hospital pharmacy services **1.** Procurement & warehousing of drugs and Pharmaceuticals **2.** Inventory control: Definition, Importance, various methods of Inventory Control ABC, VED, EOQ, Lead time, safety stock	**10 hours**
Unit-4:	Drug distribution in the hospital Individual prescription method, Floor stock method and Unit dose drug distribution methods.	**10 hours**
Unit-5:	**1.** Distribution of Narcotic and other controlled substances. **2.** Central sterile supply services-Role of pharmacist	**10 hours**
Unit-6:	Manufacture of Pharmaceutical preparations 1. Sterile formulations – large and small volume parenteral 2. Manufacture of Ointments, Liquids, and creams 3. Manufacturing of Tablets, granules, capsules, and powders	**10 hours**

	4. Total parenteral nutrition	
Unit-7:	1. Continuing professional development programs: Education and training. 2. Radio Pharmaceuticals – Handling and packaging	**10 hours**
Unit-8:	Professional Relations and practices of hospital pharmacist	**10 hours**
Text Books:	*1. A text book of Hospital Pharmacy by S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh*	
Reference Books:	*1. WHO consultative group report.* *2. R.P.S. Vol.2. Part –B; Pharmacy Practice section.* *3. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.* *4. Hospital pharmacy by William .E. Hassan, Lea & Febiger, Philadelphia.*	

Course Code: PDR 403	**Pharm.D: Fourth Year** **CLINICAL PHARMACY (THEORY)**	**L-3 T-1 P-0 C-8**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Identifying and resolving drug related problems.	
CO2.	Assessing adverse drug reactions.	
CO3.	Interpreting selected laboratory results (as monitoring parameters in therapeutics) for specific diseased conditions and providing medicine information.	
CO4.	Practicing medication history interviews and patients counselling.	
Course Content:		
Unit-1:	**1. Definitions, Development and scope of clinical pharmacy** **2. Introduction to daily activities of a clinical pharmacist:** Drug therapy monitoring (medication chart review, clinical review, pharmacist interventions), Ward round participation, Adverse drug reaction management, Drug and poisons information, Medication history, Patient counseling, Drug utilization evaluation (DUE) and review (DUR), Quality assurance of clinical pharmacy services.	**10 hours**
Unit-2:	**Patient data analysis:** Patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.	**10 hours**
Unit-3:	**Clinical laboratory tests used in the evaluation of diseased states and interpretation of test results:** a. Hematological, 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	**10 hours**
Unit-4:	**Drug & Poison information:** Introduction to drug information resources, Systematic approach in answering Drug Information queries, Critical evaluation of drug information and literature, Preparation of written and verbal reports, Poisons information-organization & information resources.	**10 hours**
Unit-5:	**Pharmacovigilance** a. Scope, definition and aims of pharmacovigilance b. Adverse drug reactions - Classification, mechanism, predisposing factors, causality assessment [different scales used] c. Reporting, evaluation, monitoring, preventing & management of ADRs d. Role of pharmacist in management of ADR.	**10 hours**
Unit-6:	Communication skills, including patient counselling techniques, medication history interview, presentation of cases.	**10 hours**

Unit-7:	1. Pharmaceutical care concepts 2. Critical evaluation of biomedical literature	**10 hours**
Unit-8:	**Medication errors**	**10 hours**
Text Books:	1. *A text book of Clinical Pharmacy Practice; Essential concepts and skills, Dr. G. Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026*	
Reference Books:	1. *Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia.* 2. *Rowland and Tozer, Clinical Pharmacokinetics - Williams and Wilkins Publication.* 3. *Practical and clinical applications. Pharmaceutical statistics. Sanford Bolton, Marcel Dekker, Inc.* 4. *Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.* 5. *Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.* 6. *Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.*	

Course Code: PDR 404	Pharm.D: Fourth Year BIOSTATISTICS AND RESEARCH METHEDOLOGY (THEORY)	L-2 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding research methodology.	
CO2.	Applying biostatistical tools and techniques to test hypothesis, optimize and correlate different types of data and its analysis.	
CO3.	Employing computer application in hospital pharmacy, community pharmacy, drug information retrieval and managing stores.	
Course Content:		
Unit-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	**10 hours**
Unit-2:	**Biostatistics** 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.	**10 hours**
Unit-3:	1. **Data graphics:** Construction and labelling of graphs, histogram, pie charts, scatter plots, semi - logarithmic plots. 2. **Basics of testing hypothesis:** Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.	**10 hours**
Unit-4:	**1. Level of significance (Parametric data) -** students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way). **2. Level of significance (Non-parametric data)**- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wallis test (one way ANOVA)	**10 hours**
Unit-5:	**Linear regression and correlation**- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient,	**10 hours**
Unit-6:	**1. Introduction to statistical software**: SPSS, Epi Info, SAS. **2. Statistical methods in epidemiology:** Incidence and prevalence, relative risk, attributable risk	**10 hours**

Unit-7:	**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.	**10 hours**
Unit-8:	1. **Computer in Community Pharmacy:** Computerizing the Prescription Dispensing process, Use of Computers for Pharmaceutical Care in community pharmacy, Accounting and General ledger system. 2. **Drug Information Retrieval & Storage**: Introduction– Advantages and use of Computerized Literature Retrieval, Use of Computerized Retrieval.	**10 hours**
Text Books:	1. *Bolton, Pharmaceuticals Statistics- Practical & Clinical Applications, Marcel & Dekker, New York.* 2. *Li wan Po, Statistics for Pharmacist, Wiley-Blackwell.*	
Reference Books:	1. ***Pharmaceutical statistics*** *- practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.* 2. ***Drug Information****- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006* 3. *Fisher, R.A., Statistical Methods for Research Works, Oliver & Boyd, Edinburgh.* 4. *Chow, Statistical Design and Analysis of Stability Studies, Marcel Dekker, New York.* 5. *Buncher, Statistics in the Pharmaceutical Industry, Marcel Dekker, New York.* 6. *Finney, D.J., Statistical Methods in Biological Assays, Hafner, New York.* 7. *Montgomery, D.C., Introduction to Statistical Quality Control, Willy.* 8. *Lipschutz, Introduction to Probability and Statistics, McGraw-Hill.*	

Course Code: PDR 405	**Pharm.D: Fourth Year** **BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)**	**L-3 T-1 P-0 C-8**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the basic concepts of Biopharmaceutics and Pharmacokinetics.	
CO2.	Experimenting *in-vitro* dissolution studies and *in-vivo* bioavailability studies for various drugs and its formulations.	
CO3.	Analyzing plasma drug availability data and pharmacokinetic parameters of a drug to fix its dosage regimen.	
CO4.	Developing bioavailability and bio-equivalence study for new drug formulations.	
Course Content:		
Unit-1:	**Biopharmaceutics** Introduction to Biopharmaceutics a. Absorption of drugs from gastrointestinal tract. b. Drug Distribution. c. Drug Elimination.	**10 hours**
Unit-2:	**Pharmacokinetics** Introduction to Pharmacokinetics a. Mathematical models b. Drug levels in blood c. Pharmacokinetic Models d. Compartment models e. Pharmacokinetic study	**10 hours**
Unit-3:	**One Compartment Open model:** a. Intravenous injection (bolus) b. Intravenous injection	**10 hours**
Unit-4:	**Multiple Compartment models** a. Two compartment open model b. IV bolus, IV infusion and oral administration	**10 hours**
Unit-5:	**Multiple Dosage regimen:** a. Repetitive Intravenous injections – One Compartment Open Model b. Repetitive Extravascular dosing – One Compartment Open model c. Multiple Dose Regimen – Two Compartment Open Model	**10 hours**
Unit-6:	**Non-Linear Pharmacokinetics** a. Introduction b. Factors causing non-linearity c. Michaelis menton method of estimating various parameters	**10 hours**
Unit-7:	**Non-Compartmental Pharmacokinetics** a. Statistical moment theory b. MRT for various compartment models c. Physiological pharmacokinetic model	**10 hours**

Unit-8:	**Bioavailability and Bioequivalence** a. Introduction. b. Bioavailability study protocol. c. Methods of Assessment of Bioavailability	**10 hours**
Text Books:	1. *D. M. Brahmankar and Sunil B.Jaiswal, Bio pharmaceutics and Pharmacokinetics-A Treatise, Vallabh Prakashan Pitampura, Delhi* 2. *L Shargel, S. WU Pong, A B C Yu. Applied Biophrmaceutics& Pharmacokinetics, Mc Graw Hill.*	
Reference Books:	1. *Milo Glbaldi Donald, Pharmacokinetics: R. Mercel Dekker Inc.* 2. *Milo Gibaldi and Laurie Prescott, Hand Book of Clinical Pharmacokinetics, by ADIS Health Science Press.* 3. *Abdou H.M, Mack, Dissolution, Bioavailability and Bioequivalence, Publishing Company, Pennsylvania 1989.* 4. *James Swarbrick, James, C. Roylan, Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York 1996.* 5. *Rebort F Notari Marcel Dekker Inn, Biopharmaceutics and Clinical Pharmacokinetics-An Introduction, 4th edition Revised and expanded by, New York and Basel, 1987.* 6. *Remington's Pharmaceutical Sciences, Mack Publishing Company, Pennsylvnia.* 7. *Malcolm Rowland and Thomas, N. Tozen, Cilincal Pharmacokinetics, Concepts and Applications: Lea and Febrger, Philadelphia, 1995.* 8. *Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi* 9. *Notari, R.E., Biopharmaceutics and Pharmacokinetics – An introduction, Marcel Dekker Inc. N.Y.* 10. *Rowland M., and Tozer T.N., Clinical Pharmacokinetics, Lea and Febriger, N.Y.* 11. *Wagner J.G., Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.* 12. *4. Wagner J.G., Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.* *Latest editions of all the suggested books are recommended.*	

Course Code: PDR 406	Pharm.D: Fourth Year CLINICAL TOXOCOLOGY - THEORY	L-2 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the concept of poisoning, drug toxicities, its general management and Supportive care.	
CO2.	Analyzing various toxicities, poisonings, bites and stings with their clinical features, diagnosis and management.	
CO3.	Managing acute & chronic poisoning due heavy metals, plants and food.	
Course Content:		
Unit-1:	1. General principles involved in the management of poisoning 2. Antidotes and the clinical applications.	**8 hours**
Unit-2:	1. Supportive care in clinical Toxicology 2. Gut Decontamination	**8 hours**
Unit-3:	1. Elimination Enhancement 2. Toxicokinetics	**8 hours**
Unit-4:	**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 hours**
Unit-5:	**Clinical symptoms and management of chronic poisoning with the following agents** – Heavy metals: Arsenic, lead, mercury, iron, copper	**8 hours**
Unit-6:	1. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries. 2. Plants poisoning: Mushrooms and mycotoxins 3. Food poisonings **Envenomation: Arthropod bites and stings**	**8 hours**
Unit-7:	**Substance abuse** Signs and symptoms of substance abuse and treatment of dependence a) CNS stimulants: amphetamine b) Opioids c) CNS depressants d) Hallucinogens: LSD	**8 hours**

	e) Cannabis group f) Tobacco	
Text Books:	1. *Matthew J Ellenhorn. Ellenhorns Medical Toxicology – Diagnosis And Treatment Of Poisoning. Second edition. Publisher- Williams and Willkins publication, London*	
Reference Books:	1. *V V Pillay, Handbook of forensic medicine and toxicology, Thirteenth edition 2003, Publisher -Paras Publication, Hyderabad.* 2. *Frank A. Barile, Clinical Toxicology: Principles and Mechanisms, Publisher - CRC Press India* 3. *Thomas A. Gossel, J. Douglas Bricker Principles of clinical toxicology, Publisher- Lippincott Williams & Wilkins , India* 4. *Marsha D. Ford, Clinical toxicology, Publisher -W.B. Saunders, United States* 5. *TOXNET Data base*	

Course Code: PDR 451	Pharm.D: Fourth Year PHARMACOTHERAPEUTICS-III (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the rational drug use in selection of drug therapy including clinical discussions for selected diseases.	
CO2.	Interpreting the follow up, progress and changes made in drug therapy.	
CO3.	Analyzing the pharmaceutical care issues and their solutions.	
CO4.	Developing the evidence based pharmaceutical care plans including pharmacological, nonpharmacological counselling for allotted patients.	
Course Content:		**3 Hrs./ Week**

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.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments (Case studies of most common diseases).
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. The evaluation will be conducted both by external & internal examiners.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record Maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *Roger and Walker, Clinical Pharmacy and Therapeutics, Churchill Livingstone publication*	
Reference Books:	1. *Robins SL, Pathologic basis of disease, W.B. Saunders publication* 2. *Green and Harris, Pathology and therapeutics for*	

	Pharmacists: A Basis for Clinical Pharmacy Practice - Chapman and Hall publication 3. *Joseph T. Dipiro et al., Pharmacotherapy: A Pathophysiologic approach - Appleton & Lange* 4. *Eric T. Herfindal, Clinical Pharmacy and Therapeutics, Williams and Wilkins Publication* 5. *Lloyd Young and Koda, Applied Therapeutics: The clinical Use of Drugs, Kimble MA* 6. *Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.* 7. *Relevant review articles from recent medical and pharmaceutical literature.*	

Course Code: PDR 452	Pharm.D: Fourth Year HOSPITAL PHARMACY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:		
CO1.	Understanding inventory control for hospitals.	
CO2.	Assessing drug interactions in the given prescriptions.	
CO3.	Analyzing drug information queries in the given prescription.	
CO4.	Formulating parenteral and powder preparations.	
Course Content:		**3 Hrs./ Week**

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.

Guidelines:

1. Students will be required to prepare a record of all the assignments presentable in soft copy and hard copy to be submitted at the end year external exams duly signed by the teacher preceptor.
2. The evaluation will be conducted both by external & internal examiners.
3. The external evaluation will be conducted for 70 marks.
4. The external examiner will be appointed from the approved panel of examiners.
5. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
6. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
7. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record Maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *A text book of Hospital Pharmacy by S.H.Merchant & Dr. J.S. Qadry. Revised by R.K.Goyal & R.K. Parikh*	
Reference Books:	1. *WHO consultative group report.* 2. *R.P.S. Vol.2. Part –B; Pharmacy Practice section.* 3. *Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.* 4. *Hospital pharmacy by William .E. Hassan, Lea & Febiger, Philadelphia.*	

Course Code: PDR 453	Pharm.D: Fourth Year CLINICAL PHARMACY (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:		
CO1.	Understanding the concept and procedures involved in patient medication history interviews and counseling.	
CO2.	Analyzing laboratory investigations in case studies.	
CO3.	Evaluating drug information queries.	
Course Content:		**3 Hrs./ Week**

Objective: The basic objective of this course is to get familiar with patient medication counseling and different patient case studies.

Practical:

Students are expected to perform 15 practicals in the following areas covering the topics dealt in theory classes:

1. Answering drug information questions (4 Nos)
2. Patient medication counselling (4 Nos)
3. Case studies related to laboratory investigations (4 Nos)
4. 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.

Guidelines:

1. Students will be required to maintain and submit the precisely compiled diary containing the assignments.
2. These assignments will be of two categories i.e. major & minor.
3. The entire practical exams will be evaluated through record compilation & oral presentation.
4. The evaluation will be conducted both by external & internal examiners.
5. A committee of senior teachers including the teacher preceptor will evaluate for internal assessment (30 marks).
6. There will be three internal (sessional) practical examinations and average of best two will be sent to the University for the Computation of final result.
7. The external evaluation will be conducted for 70 marks.
8. The external examiner will be appointed from the approved panel of examiners.
9. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
10. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result
11. **Scheme of Practical Examination:** Following scheme will be practiced for the said purpose.

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record Maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *A text book of Clinical Pharmacy Practice; Essential concepts and skills, Dr. G. Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026*	
Reference Books:	1. *Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia.* 2. *Rowland and Tozer, Clinical Pharmacokinetics - Williams and Wilkins Publication.* 3. *Practical and clinical applications. Pharmaceutical statistics. Sanford Bolton, Marcel Dekker, Inc.* 4. *Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.* 5. *Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.* 6. *Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.*	

Course Code: PDR 454	Pharm.D: Fourth Year BIOPHARMACEUTICS AND PHARMACOKINETICS (PRACTICAL)	L-0 T-0 P-3 C-3
Course Outcomes:		
CO1.	Understanding the concepts of bioavailability and pharmacokinetics in clinical context.	
CO2.	Interpreting the various pharmacokinetic parameters from blood profile and urine excretion data.	
CO3.	Analyzing *in-vitro* dissolution studies for different drugs as per the standards.	
Course Content:		**3 Hrs./ Week**

List of Experiments:

1. Improvement of dissolution characteristics of slightly soluble drugs by some methods.
2. Comparison of dissolution studies of two different marketed products of same drug.
3. Influence of polymorphism on solubility and dissolution.
4. Protein binding studies of a highly and poorly protein bound drugs.
5. 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.
6. Bioavailability studies of some commonly used drugs on animal/human model.
7. Calculation of Ka, Ke, t1/2, Cmax, AUC, AUMC, MRT etc. from blood profile data.
8. Calculation of bioavailability from urinary excretion data for two drugs.
9. Calculation of AUC and bioequivalence from the given data for two drugs.
10. In vitro absorption studies.
11. Bio equivalency studies on the different drugs marketed. (eg) Tetracycline, Sulphamethoxzole, Trimethoprim, Aspirin etc., on animals and human volunteers.
12. Absorption studies in animal inverted intestine using various drugs.
13. Effect on contact time on the plasma protein binding of drugs.
14. Studying metabolic pathways for different drugs based on elimination kinetics data.
15. Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
16. Determination of renal clearance.

Guidelines:

1. The evaluation will be conducted both by external & internal examiners.
2. The external evaluation will be conducted for 70 marks.
3. The external examiner will be appointed from the approved panel of examiners.
4. The internal examiner will be the Course teacher concerned who has taught for the entire year of the programme/may be arranged in some special cases, by the director of the institute.
5. There will be three internal practical examinations and average of best two will be sent to the University for the Computation of final result.
6. Scheme of Practical Examination:

	Internal	End year (External)
Synopsis	05	15
Major Experiment	10	25
Minor Experiment	03	15
Viva	02	15
Regularity, Promptness, viva-voce and Record Maintenance	10	-
Max Marks	**30**	**70**
Duration	**03hrs**	**04hrs**

Text Books:	1. *D. M. Brahmankar and Sunil B.Jaiswal, Bio pharmaceutics and Pharmacokinetics-A Treatise, Vallabh Prakashan Pitampura, Delhi* 2. *L Shargel, S. WU Pong, A B C Yu. Applied Biophrmaceutics& Pharmacokinetics, Mc Graw Hill.*	
Reference Books	1. *Milo Glbaldi Donald, Pharmacokinetics: R. Mercel Dekker Inc.* 2. *Milo Gibaldi and Laurie Prescott, Hand Book of Clinical Pharmacokinetics, by ADIS Health Science Press.* 3. *Abdou H.M, Mack, Dissolution, Bioavailability and Bioequivalence, Publishing Company, Pennsylvania 1989.* 4. *James Swarbrick, James, C. Roylan, Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York 1996.* 5. *Rebort F Notari Marcel Dekker Inn, Biopharmaceutics and Clinical Pharmacokinetics-An Introduction, 4th edition Revised and expanded by, New York and Basel, 1987.* 6. *Remington's Pharmaceutical Sciences, Mack Publishing Company, Pennsylvnia.* 7. *Malcolm Rowland and Thomas, N. Tozen, Cilincal Pharmacokinetics, Concepts and Applications: Lea and Febrger, Philadelphia, 1995.* 8. *Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi* 9. *Notari, R.E., Biopharmaceutics and Pharmacokinetics – An introduction, Marcel Dekker Inc. N.Y.* 10. *Rowland M., and Tozer T.N., Clinical Pharmacokinetics, Lea and Febriger, N.Y.* 11. *Wagner J.G., Fundamentals of Clinical Pharmacokinetics, Drugs Intelligence Publishers, Hamilton.* 12. *4. Wagner J.G., Pharmacokinetics for the Pharmaceutical Scientist, Technomic Publishing A.G. Basel, Switzerland.* *Latest editions of all the suggested books are recommended.*	

Course Code: PDR501	**Pharm.D: Fifth Year** **CLINICAL RESEARCH (THEORY)**	**L-3 T-1 P-0 C-8**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding various approaches to drug discovery, developments an requirements of drug regulatory bodies at national and international level.	
CO2.	Demonstrating various phases of clinical trials and various methods of post marketing surveillance.	
CO3.	Applying good clinical practice as per ICH guidelines.	
CO4.	Designing clinical study documents and safety monitoring in clinical trials.	
Course Content:		
Unit-1:	**Drug development process:** Introduction, Various Approaches to drug discovery**,** Pharmacological & Toxicological aspects, IND Application, Drug characterization and Dosage forms.	**10 hours**
Unit-2:	**Clinical development of drug:** 1. Introduction to Clinical trials, 2. Various phases of clinical trial	**10 hours**
Unit-3:	1.Methods of Post Marketing Surveillance 2. Abbreviated New Drug Application submission:	**10 hours**
Unit-4:	**1. Good Clinical Practice:** ICH, GCP, Central drug standard control organisation (CDSCO) guidelines, 2. Challenges in the implementation of guidelines**,** 3. Ethical guidelines in clinical research.	**10 hours**
Unit-5:	1. Composition, responsibilities, procedures of IRB / IEC 2. Overview of regulatory environment in USA, Europe and India.	**10 hours**
Unit-6:	**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	**10 hours**
Unit-7:	1. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment) 2. Informed consent process	**10 hours**
Unit-8:	1. Data management and its components 2. Safety monitoring in clinical trials	**10 hours**
Text Books:	*1. David Machin, Textbook of Clinical Trials edited, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.*	
Reference Books:	*1. Giovanna di Ignazio, Principles of Clinical Research edited, Di Giovanna andHaynes.* *2. R K Rondels, S A Varley, Clinical Data Management edited, C F Webbs. Second Edition, Jan 2000, Wiley Publications.*	

	3. *JG Hardman, Goodman &Gilman:, LE Limbard, 10th Edn. McGraw Hill Publications,2001.* 4. *Central Drugs Standard Control Organization, Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health;2001.* 5. *International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May1996.* 6. *Ethical Guidelines for Biomedical Research on Human Courses 2000. Indian Council of Medical Research, NewDelhi.* *Latest editions of all the suggested books are recommended.*	

Course Code: PDR 502	Pharm.D: Fifth Year PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (THEORY)	L-3 T-1 P-0 C-8
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the concept of pharmacoepidemiology and pharmacoeconomics.	
CO2.	Identifying risk factors related to the occurrence of disease.	
CO3.	Comparing the costs and outcomes of pharmaceutical products and services to reduce monetary burden on the consumers.	
CO4.	Evaluating out comes based case study reports to minimize cost of drug therapy.	
Course Content:		
Unit-1:	**Pharmacoepidemiology:** **Definition and scope:** Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.	**10 hours**
Unit-2:	**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	**10 hours**
Unit-3:	**Concept of risk in pharmacoepidemiology** Measurement of risk, attributable and relative risk, time-risk relationship and odds ratio.	**10 hours**
Unit-4:	**Pharmacoepidemiological methods** Including theoretical aspects and practical studies of various methods with the help of case studies. Drug utilization review, case reports, case series, surveys of drug use, cross–sectional studies, cohort studies, case control studies, case –cohort studies, meta – analysis, spontaneous reporting, prescription event monitoring and record linkage system.	**10 hours**
Unit-5:	**Sources of data for pharmacoepidemiological studies:** Adhoc data sources and Automated data systems	**10 hours**
Unit-6:	**Selected special applications of Pharmacoepidemiology:** Studies of vaccine safety, Hospital pharmacoepidemiology, Pharmacoepidemiology and risk management, Drug induced birth defects	**10 hours**
Unit-7:	**Pharmacoeconomics** **1. Definition, history, needs of pharmacoeconomic evaluations** Role in formulary management decision **1.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	**10 hours**

Unit-8:	**Applications of Pharmacoeconomic** Software and case studies	**10 hours**
Text Books:	1. *G Parthasarathi et al, A Textbook of clinical pharmacy practice – Essential concepts and skills., 1st Edn. Orient longman publications,2004.* 2. *Remington's – The Science and Practice of Pharmacy, Vol I & II, AR Gennaro etal, Mack Publishing company, 20th Edn, 2004.*	
Reference Books:	1. *Joseph T Dipiro, Pharmacotherapy – A Pathophysiologic Approach, 5th Edn. Published by McGraw – Hill medical publication,2002.* 2. *Leon Shargel, Comprehensive Pharmacy Review: 5th Edn. Published by Lippincot Williams & Wilkins2004.* 3. *Scott L Traub, Basic skills in interpreting lab data: 2nd Edn. Published by American Society of Health System Pharmacist1996.* 4. *Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.* **Latest editions of all the suggested books are recommended.*	

Course Code: PDR 503	**Pharm.D: Fifth Year** **CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING (THEORY)**	**L-2** **T-1** **P-0** **C-6**
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Understanding the concept of clinical pharmacokinetics.	
CO2.	Computing dosage regimen using pharmacokinetic data.	
CO3.	Interpreting drug interactions and monitoring individual drug therapy.	
CO4.	Practicing different approaches for dosage adjustment in patients with different pathophysiologic conditions.	
Course Content:		
Unit-1:	**Introduction to Clinical Pharmacokinetics**	**10 hours**
Unit-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.	**10 hours**
Unit-3:	**Pharmacokinetics of Drug Interactions**: a. Pharmacokinetic drug interactions b. Inhibition and Induction of Drug metabolism c. Inhibition of Biliary Excretion.	**10 hours**
Unit-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.	**10 hours**
Unit-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.	**10 hours**
Unit-6:	**Population Pharmacokinetics.** a. Introduction to Bayesian Theory. b. Adaptive method or Dosing with feedback. c. Analysis of Population pharmacokinetic Data.	**10 hours**

Unit-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	**10 hours**
Text Books:	1. *Eds Leon Shargel et al, Applied Biopharmaceutics &Pharmacokinetics,Prentice Hall International, Inc. 1999* 2. *Malcom Rowland & Thomas Tozer. Clinical Pharmacokinetics – Concepts and Applications. 3rd Edn.* 3. *Trevor M Speight, Nicholas HG et al, Avery's Drug Treatment:4th Edn. Adis International Ltd.1997.*	
Reference Books:	1. *Joseph T Dipiro, Pharmacotherapy, A Pathophysiologic Approach, 5th Edn. Appleton & Lange2002.* 2. *Bertram G Katzung, Basic and Clinical Pharmacology. 9th Edn. Lange Publications,2004.* 3. *Eric T Herfindal, Textbook of therapeutics, drug and disease management:7th Edn. Williams & Wilkins Publications,2000* 4. *Wolfgang A. Ritschel, Gregory L. Kearns. Hand Book of Basic Pharmacokinetics. 5th Edn.* ** Latest editions of all the suggested books are recommended.*	

Course Code: PDR 551	Pharm.D: Fifth Year CLERKSHIP	L-0 T-0 S-1 C-1
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Familiarizing with various clinical aspects by interacting with patients and healthcare professionals.	
CO2.	Developing pharmaceutical care skills during clerkship.	
Course contents		**6 Months**

Objective: The basic objective of this course is to get familiar with consultation on various clinical expects by interaction with patients involving principles of pharmacotheapeutics, clinical pharmacokinetics, toxicological and hospital pharmacy.

Guidelines:

The duration of clerkship will be six months.

Every student will be trained in drug information, adverse drug reaction monitoring (ADR) and management identifying various types of interaction cases and such other drug related problems.

1. Students will have to spend half a day in the first hour attending ward rounds on daily basis as a part of clerkship.
2. After finishing the round they shall go through case sheets (indoor & outdoor patients) and try to find out concurrent drug related problems.
3. Evaluation scheme:

(i) The performance in clerkship phase shall be evaluated by internal and external examiners.

(ii) Students shall be evaluated individually.

Internal Evaluation

1. A committee of four senior teachers i.e. the teacher preceptors will evaluate the performance of individual student.
2. Four seminars presented by students shall be evaluated for 30 marks each and the average of best two shall be forwarded to the university with marks of other Courses.
3. **Internal evaluation shall be done on the following items:** **Marks**

a) Write up of the seminar	(7.5)
b) Presentation of work	(7.5)
c) Communication skills	(7.5)
d) Question and answer skills	(7.5)
Total	**(30marks)**

External Evaluation

1. The end year examination of clerkship programme will comprise of evaluation of students by the external (appointed) examiner.
2. **External evaluation of clerkship at the end year examination 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)**

Course Code: PDR 552	Pharm.D: Fifth Year PROJECT WORK	L-0 T-0 P-20 C-20
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Developing research questions and methodology.	
CO2.	Developing data collection, analysis, reporting skills in the area of community, hospital and clinical pharmacy.	
Course contents		**6 Months**

Objective: The basic objective of this course is to present the findings of project and to develop data collection, analysis & reporting and interpretation skills.

Guidelines

1. The duration of Project work shall be of six months.

2. 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 at the end of the year. External and the internal examiners shall do the assessment of the project work.

3. Project work shall comprise of objectives of the work, methodology, results, discussions and conclusions.

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

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

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

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

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

(iii) 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.

Evaluation of the project work: The following methodology shall be adopted for evaluating the project work—

1. Project work shall be evaluated by internal and external examiners.
2. Students may be evaluated in groups for four students.

Internal Evaluation:

1. A group of four senior teachers including preceptors and Head of the departments, will evaluate the performance of each student.
2. The average of marks given by teacher preceptors will be computed as

internal assessment.

3. Three seminars presented by students shall be evaluated for thirty marks each and the average of best two shall be forwarded to the university with marks of other Courses.
4. **Internal evaluation shall be done 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)**

External Evaluation:

1. The End year evaluation of project work will be done by the duly appointed external examiner.
2. It will be accomplished for total marks of seventy (70).
3. **The project work at the end year, shall be evaluated 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)**

INTERNSHIP

1) **SPECIFIC OBJECTIVES:**

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

II. to manage and use resources of the health care system, in cooperation with patients, prescribers, other health care providers, and administrative and supportive personnel, to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and to improve therapeutic outcomes of medication use.

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

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

V. to develop leadership qualities to function effectively as a member of the health care team organised to deliver the health and family welfare services in existing socio-economic, political and cultural environment.

VI. to communicate effectively with patients and the community.

2) **OTHER DETAILS:**

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

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

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