MANIPAL
ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

Academic Programs Handbook

Revised Regulations 2014

Programs: Doctor of Pharmacy (PharmD) and

Doctor of Pharmacy – Post Baccalaureate (PharmD – PB)

Manipal College of Pharmaceutical Sciences

Manipal Academy of Higher Education

Manipal-576 104, Karnataka, India

MANIPAL
ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

July 1, 2023

Academic Programs : Revised Regulations 2014 – Approval

The PharmD and PharmD PB programs of Manipal Academy of Higher Education being offered at Manipal College of Pharmaceutical Sciences under the title "Academic Programs : Revised Regulations 2014" have been duly approved by the Academic Council of Manipal Academy of Higher Education.

REGISTRAR

MANIPAL ACADEMY OF HIGHER EDUCATION * INSTITUTION OF EMINENCE DEEMED TO BE UNIVERSITY * MANIPAL - 576 104 *

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भारत का राजपत्र
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No. 19] NEW DELHI, SATURDAY, MAY 10—MAY 16, 2008 (VAISAKHA 20, 1930)

इस भाग में भिन्न पृष्ठ संख्या दी जाती है जिससे कि यह अलग संकलन के रूप में रखा जा सके।
(Separate paging is given to this Part in order that it may be filed as a separate compilation)

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[PART III—SECTION 4]
[सांविधिक निकायों द्वारा जारी की गई विविध अधिसूचनाएं जिसमें कि आदेश, विज्ञापन और सूचनाएं सम्मिलित हैं]
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भारतीय रिज़र्व बैंक

मुंबई-400001, दिनांक 9 अप्रैल 2008

सदर्भ : बैंपविवि. सं. आईबीडी.-14241/23.13.048/2007-08--भारतीय रिज़र्व बैंक अधिनियम, 1934 (1934 का 2) की धारा 42 की उप-धारा (6) के खण्ड (ग) के अनुसरण में भारतीय रिज़र्व बैंक इसके द्वारा निदेश देता है कि उक्त अधिनियम की दूसरी अनुसूची में निम्नलिखित परिवर्तन किये जाएं :--

''अरब बांगलादेश बैंक लिमिटेड'' शब्दों के स्थान पर ''एबी बैंक लिमिटेड'' शब्द होंगे।

आनन्द सिन्हा
कार्यपालक निदेशक

1—59 GI/2008 (1335)

[PUBLISHED IN THE GAZETTE OF INDIA, No.19, PART III, SECTION 4]

Ministry of Health and Family Welfare
(Pharmacy Council of India)

New Delhi, 10th May, 2008.

Pharm.D. Regulations 2008

Regulations framed under section 10 of the Pharmacy Act, 1948 (8 of 1948).

(As approved by the Government of India, Ministry of Health vide, letter No.V.13013/1/2007-PMS, dated the 13th March, 2008 and notified by the Pharmacy Council of India).

No.14-126/2007-PCI.— In exercise of the powers conferred by section 10 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government, hereby makes the following regulations, namely:-

1

General Academic Regulations Governing PharmD and PharmD-PB Programs based on Credit System

General Academic Regulations Governing PharmD and PharmD (PB) Programs based on Credit System

(Applicable to students admitted in 2014-15 academic year onwards)

1. Titles of Academic Programs

a. **PharmD**: Doctor of Pharmacy, a six-year practice-oriented degree program.
b. **PharmD (PB)**: A three-year Doctor of Pharmacy (Post-Baccalaureate), after BPharm degree.

The maximum duration a student can take for complying with the degree requirement is twice the duration of the academic program from the date of first registration for his/her first year of the program.

2. Statutory Bodies

The programs are approved by the following statutory bodies viz., AICTE and PCI.

3. Credits Required for the Award of Degree

a. PharmD: 266
b. PharmD (PB): 126

4. Admission Procedure and Eligibility

Eligible students are admitted on the basis of the rank obtained in the All India Manipal Entrance Test (MET) conducted by Manipal Academy of Higher Education (MAHE) for the programs concerned. However, a few students are also admitted based on the reserved seat meant for NRI/Foreign students as per the university's policy.

5. Eligibility Criteria

PharmD: A pass in 10 + 2 or an equivalent examination with Physics, Chemistry, English as compulsory subjects along with Mathematics or Biology as optional subjects/Diploma in Pharmacy or any other equivalent qualification recognized by the Pharmacy Council of India
PharmD (PB): A pass in BPharm degree examination from an institution recognized by the Pharmacy Council of India/All India Council for Technical Education.

6. Educational Process of the Programs in General

6.1. Education Program: The programs are conducted on an annual system with continuous comprehensive evaluation system. Each academic year of the program is loaded with a minimum number of course-credits to be earned by a student. A course (subject) is defined in terms of certain number of contact hours through lectures and/ or labs. (Refer Tables under the respective program).

6.1.1. Course Code: The courses offered are given codes based on the following descriptions.

3-letter code: Indicates the department offering the course for PharmD/PharmD (PB)
3-digit code: The first digit indicates the program year and the second two digits indicate the course for PharmD/PharmD (PB) programs. However, in case of PharmD and PharmD (PB), single-digit code preceded by a period (.) is adopted for the course. The last letter-code (T/L/P/E/S/D/R) for a course indicates nature of the course such as the Theory/ Lab/ Project/ Extra and Co-curricular Activities/ Seminar/ Dissertation/ Residency respectively.

The following codes are used for different departments.

PCH	Pharmaceutical Chemistry		PPR	Pharmacy Practice
PHA	Pharmacology		PRM	Pharmaceutical Regulatory Affairs & Management
PCE	Pharmaceutics		PQA	Pharmaceutical Quality Assurance
PCO	Pharmacognosy		PBT	Pharmaceutical Biotechnology

6.2. Credit Based Course Work: Course work of each academic year of a program is expressed in terms of a specified number of credits allotted to an academic year. Each course viz., theory or practical, is given a value in terms of certain number of credits. The number of contact hours per week determines the credits. By and large each contact theory hour of a course per week in an annual system is equated with 2 credits for PharmD/PharmD (PB) programs. On the other hand, 2 credits are assigned to a lab having three-hour contact per week. A student successfully completes the course work of a particular annual year of the program only when the student earns all the credits allotted to that annual year. A student earns the full credits allotted to a course (subject) only if the student secures a minimum grade 'E' and above for the performance in that particular course. Promotion of a student to the next higher academic part of the program is based on the candidate's ability in securing a prescribed minimum number of credits as stated in each specific program.

6.3. Evaluation Process: The academic performance of a student is evaluated at two levels, internally by the course instructors concerned and at the university level as per the Manipal Academy of Higher Education procedure laid for the conduct of the university examination.

6.3.1 Internal Assessment:

Theory: The students' performance in theory of each course is assessed through three written sessional-examinations conducted during an academic year as per the calendar of events of the MCOPS. The average of two best, out of three performances of a student in theory course-tests is taken into account to grant the internal assessment award as per the marks break up shown in the tables of the respective programs.

Lab: The performance of a student in the practical of each course is evaluated on two parameters viz., 1. Daily assessment (on the student's regularity to the lab, preparedness, psychomotor skills and maintenance of the lab records etc.) and 2. Two-practical tests conducted in an academic year. The sum of the average of daily assessment and the average of two practical tests comprises the score meant for granting the internal assessment award to a student in a lab course. The breakup of maximum marks allotted to each of the components is specified in the tables of the respective programs.

Improvement-Internal-Assessment-Tests: Students who have poor internal assessment awards are given opportunity to improve their scores only in the theory courses of the program. However, this facility is offered to those students who have written the university (main/make-up) examination of a theory course but could not pass the course. These tests are conducted in March/June of every year.

6.3.2. University Examinations: University examinations are conducted for an eligible student twice in an academic year, namely, the main examination in May/June and the make-up examination in July/August.

Eligibility for the university examinations: A minimum of 80% attendance is prerequisite for a student to appear for the University examination of a course (subject)

Attendance: The students of PharmD and PharmD (PB), who have put in a minimum attendance of 80% and above, in each course of the programs are eligible to appear for the university examinations. A student, who registers for all the courses of the program and yet fails to put in the minimum required percentage of attendance, gets a DT (Detention status) letter grade in the course in which the student is not permitted to take the university examination. The students with DT grade, in theory courses of the programs, are allowed to improve the attendance status in case the classes are conducted between the gap of the end of main and the commencement of the make-up examinations. However, if the students are not able to improve the status from DT to the eligibility, such students will have to repeat the course/s in the next possible academic year. On the other hand, the students with the DT grade in the laboratory courses of the programs have no other option except repeating the laboratory courses in the subsequent academic year only.

Minimum for a Pass in a Course: The maximum marks allotted to a course of PharmD and PharmD (PB) are 100. A student, who appears in the university examination of a course (theory or lab courses) of a program, shall be declared to have passed the course only when the student secures at least 50%, of maximum marks of a course, in the aggregate of university and internal assessment awards put together.

6.3.3. Grading System: The marks so obtained, in the university examination and the internal assessment, in a course are added together and a 10-point grading system is used to award the student with an appropriate performance letter grade for his/her performance in the course.

Letter Grading System: The letter grades and grade points that are used to a assess the students' performance in a particular course of the program are given below

Ten-point Grading System – PharmD/PharmD (PB) Pharmacy Courses		
Marks Range	**Letter Grade**	**Grade Points**
90% and above	A+	10
80% - 89%	A	09
70% - 79%	B	08
60% - 69%	C	07
55% - 59%	D	06
50% - 54%	E	05
Less than 50%	F/I/DT/NE	00
F: Fails; I: Incomplete; DT: Detained; NE: Not Eligible		

Note the following:

1. Internal assessment marks and university examination marks put together are taken into account for the letter grading system in each course separately.
2. Appropriate letter grades, from E to A+, are awarded, in each theory and lab courses, to only such candidate who has passed the course in first attempt.
3. A candidate who is eligible and registers for the university examination but fails to appear in the university examination or fails in the course gets a grade 'F', indicating failure.
4. A student who is eligible and registers for the university examination but fails to appear in the university examination due to valid reasons will get a grade 'I', indicating incomplete. However, it needs prior approval of the HOI and the Registrar Evaluation, MAHE.
5. The grade DT is given to a candidate who fails to put in the minimum required attendance for appearing the university examination for a course.

6. NE grade is allotted to the students who fail to secure the minimum required internal assessment award in any of the courses of the programs.
7. A student who earns a grade 'E' or above in a course is declared to have successfully completed the course and earns the credits assigned to that particular course. A course successfully completed cannot be repeated for the purpose of improving the grade.
8. Final evaluation of the performance of a student in each course (theory and lab separately) will be carried out on a 10-point grading system corresponding to the marks obtained in that course. Eventually each letter grade of the course is converted into a specific grade point associated with the letter grade as given in the table above.

6.3.4. Grade Point Average (GPA): The overall performance of a student is indicated by two indices: The Grade Point Average (GPA) and the Cumulative Grade Point Average (CGPA). The GPA is arrived by the following procedure. In the first step each course letter grade is converted into the grade point as shown in the table above. The grade points are weighted with the number of the credits allotted to the course by multiplying the grade points earned by the student with the credits assigned to a course to obtain the Weighted-Grade-Points.

The Grade Point Average (GPA) is then calculated as per the following formula:

$$\text{GPA} = \frac{\text{Total Weighted Grade Points earned by the candidate in an academic year}}{\text{Total number of credits allotted for an academic year}}$$

6.3.5. Cumulative Grade Point Average (CGPA): The weighted average of GPA's of all years that the student has completed at any point of time is the cumulative grade point average (CGPA) at that point of time.

CGPA up to any year will be calculated only for those students who have passed all the courses up to that year. Generally, CGPA is calculated after the successful completion of the entire program.

$$\text{CGPA} = \frac{\Sigma\ (\text{GPA of each year} \times \text{Corresponding number of credits})}{\text{Total credits of the courses}}$$

Example:

GPA Calculation

As an example, if the following grades were received by a student in a year:

Course Code	Course Title	Credits	Letter Grade	Grade Points	Weighted Grade Points Earned
PHA 1.1T	Human Anatomy and Physiology	8	A+	10	80
PHA 1.1L	Human Anatomy and Physiology Lab	2	B	08	16
PCE 1.2T	Pharmaceutics	6	B	08	48
PCE 1.2L	Pharmaceutics Lab	2	B	08	16
PBT 1.3T	Medicinal Biochemistry	8	C	07	56
PBT 1.3L	Medicinal Biochemistry Lab	2	C	07	14
PCH 1.4T	Pharmaceutical Organic Chemistry	8	E	05	40
PCH 1.4L	Pharmaceutical Organic Chemistry Lab	2	C	07	14
PCH 1.5T	Pharmaceutical Inorganic Chemistry	6	A	09	54
PCH 1.5L	Pharmaceutical Inorganic Chemistry Lab	2	A	09	18
	Credits Earned	46			

$$\text{GPA} = \frac{80 + 16 + 48 + 16 + 56 + 14 + 40 + 14 + 54 + 18}{46} = 7.74$$

CGPA Calculation As an example, if the following GPA were received by a student in PharmD program		
BPharm Program	**Credits Earned**	**GPA**
First year	46	7.74
Second year	52	8.65
Third year	52	9.00
Fourth year	50	9.80
Fifth year	42	8.50
Sixth year	24	9.12
$\text{CGPA} = \frac{[(7.74 \times 46) + (8.65 \times 52) + (9.00 \times 52) + (9.80 \times 50) + (8.50 \times 42) + (9.12 \times 24)]}{266} = 8.79$		

6.3.6. Conversion of GPA/CGPA into Percentage: The performance of students who are pursuing pharmacy programs in Manipal College of Pharmaceutical Sciences, MAHE, Manipal is awarded on a 10-point credit based system.

In this system the top band of students who scored more than 90% marks are placed at A+ which is equivalent to 10 grade point (Maximum). Thus, 10 GPA or CGPA is equivalent to 100%. Accordingly 1 GPA or CGPA is equivalent to 10%.

Based on this, the following formula is applied to convert GPA or CGPA to an appropriate percentage:

Percentage secured by the candidate = GPA or CGPA × 10

6.3.7. Make-up (Supplementary) University Examinations: This exam is conducted in July/ August of every academic year after completion of the main university examination process in May/ June of the academic year. The purpose of this exam is to help the students who have got F/I grades in the main university examination conducted for the courses offered during the academic year. However, the candidates with DT and NE grades will also be allowed to take this examination provided they meet the eligibility criteria laid for the candidates to appear in the university examinations of the courses of the programs

Important to Note: The students who once failed (F-grade) or have had NE (Not Eligible) grades in any course, a maximum of C-grade will only be awarded in subsequent university examinations, irrespective of their high performances. However, those who miss regular examinations due to valid reasons (I-grade candidates) will be allowed to retain whatever the grades they secure in the make-up examinations. The candidates with DT (Detained) grades, who acquire the eligibility for make-up examination, could only be awarded a maximum C-grade in the make-up examination in place of A+ grade. In case a candidate with DT grade reregisters for the course to repeat the entire education process in the subsequent academic year, after paying the required course fee, the DT status in that particular course is removed and he is allowed to retain the grades that he secures in the main university examination.

After the results are declared, grade cards will be issued to each student, which will contain the list of courses for that year and the grades obtained by the student.

6.3.8. Promotion to the next Higher Classes: A student is promoted to the next higher class when the student passes all the courses of the previous year of the program and earns the credits assigned to that academic year of the program. However, there is a provision for restricted carry over as described under each specific program.

6.3.9. Requirement for Graduation:

A student completes the requirements for the graduation only when the student has

1. Fulfilled the minimum requirements of the programs
2. Earned the number of credits specified for the programs
3. Paid all the dues to the institutions
4. No cases of disciplinary action pending are against the student.

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2

Structure and Contents of the Programs

Doctor of Pharmacy (PharmD)

Doctor of Pharmacy - Post Baccalaureate (PharmD (PB))

Structure and Contents of the Programs

Doctor of Pharmacy (PharmD)

Objectives of the Program:

1. Prepare students for a career in pharmacy profession
2. To equip the students with the basic knowledge to provide pharmaceutical care to patients (patient counseling on rational drug use)
3. To work with physicians and provide drug information.

1.1. Title of the Program: Doctor of Pharmacy (PharmD) with 266 credits

1.2. Duration of the Program: Six Years

1.3. Medium of Instruction: English

1.4. Course Curriculum: Annual system, viz., the First, Second, Third, Fourth, Fifth and Sixth Year PharmD program. The course work structure of the program is shown in the Tables 1.1 – 1.6.

Table 1.1. First Year PharmD Degree Program Course Work Structure

Year	Course Code	Course Title	Hours per Week	Hours of Tutorial	Credits Assigned	Total Marks
First Year PharmD	PHA 1.1T	Human Anatomy and Physiology	3	1	8	100
	PHA 1.1L	Human Anatomy and Physiology Lab	3	--	2	100
	PCE 1.2T	Pharmaceutics	2	1	6	100
	PCE 1.2L	Pharmaceutics Lab	3	--	2	100
	PBT 1.3T	Medicinal Biochemistry	3	1	8	100
	PBT 1.3L	Medicinal Biochemistry Lab	3	--	2	100
	PCH 1.4T	Pharmaceutical Organic Chemistry	3	1	8	100
	PCH 1.4L	Pharmaceutical Organic Chemistry Lab	3	--	2	100
	PCH 1.5T	Pharmaceutical Inorganic Chemistry	2	1	6	100
	PCH 1.5L	Pharmaceutical Inorganic Chemistry Lab	3	--	2	100
	MAT 1.6T/ PCO 1.6T	Remedial Mathematics/ Remedial Biology	3	1	Not Allotted	100 [a]
	PCO 1.6L	Remedial Biology Lab	3	--	Not Allotted	100 [a]
		Total	**34**	**6**	**46**	**1000**

*** Additional courses of study:** A student will have to take the following additional courses, such as **Remedial Mathematics, Remedial Biology or both,** in case the student has not taken either Mathematics, Biology or both subjects in the qualifying examination prescribed for PharmD admission.
Exemption: If a student has already taken the above subjects in the qualifying examination, they are exempted from studying these courses at PharmD program.
Note: Exemption is given to these two subjects. All other courses prescribed under the course work of PharmD program are mandatory for every student.
[a] College level examination.

Table 1.2. Second Year PharmD Degree Program Course Work Structure						
Year	**Course Code**	**Course Title**	**Hours per Week**	**Hours of Tutorial**	**Credits Assigned**	**Total Marks**
Second Year PharmD	PPR 2.1T	Pathophysiology	3	1	8	100
	PBT 2.2T	Pharmaceutical Microbiology	3	1	8	100
	PBT 2.2L	Pharmaceutical Microbiology Lab	3	--	2	100
	PCO 2.3T	Pharmacognosy and Phytopharmaceuticals	3	1	8	100
	PCO 2.3L	Pharmacognosy and Phytopharmaceuticals Lab	3	--	2	100
	PHA 2.4T	Pharmacology-1	3	1	8	100
	PPR 2.5T	Community Pharmacy	2	1	6	100
	PPR 2.6T	Pharmacotherapeutics-1	3	1	8	100
	PPR 2.6L	Pharmacotherapeutics-1 Lab	3	--	2	100
		Total	**26**	**6**	**52**	**900**

Table 1.3. Third Year PharmD Degree Program Course Work Structure						
Year	**Course Code**	**Course Title**	**Hours per Week**	**Hours of Tutorial**	**Credits Assigned**	**Total Marks**
Third Year PharmD	PHA 3.1T	Pharmacology-2	3	1	8	100
	PHA 3.1L	Pharmacology-2 Lab	3	--	2	100
	PQA 3.2T	Pharmaceutical Analysis	3	1	8	100
	PQA 3.2L	Pharmaceutical Analysis Lab	3	--	2	100
	PPR 3.3T	Pharmacotherapeutics-2	3	1	8	100
	PPR 3.3L	Pharmacotherapeutics-2 Lab	3	--	2	100
	PRM 3.4T	Pharmaceutical Jurisprudence	2	--	4	100
	PCH 3.5T	Medicinal Chemistry	3	1	8	100
	PCH 3.5L	Medicinal Chemistry Lab	3	--	2	100
	PCE 3.6T	Pharmaceutical Formulations	2	1	6	100
	PCE 3.6L	Pharmaceutical Formulations Lab	3	--	2	100
		Total	**31**	**5**	**52**	**1100**

Table 1.4. Fourth Year PharmD Degree Program Course Work Structure						
Year	**Course Code**	**Course Title**	**Hours per Week**	**Hours of Tutorial**	**Credits Assigned**	**Total Marks**
Fourth Year PharmD	PPR 4.1T	Pharmacotherapeutics-3	3	1	8	100
	PPR 4.1L	Pharmacotherapeutics-3 Lab	3	--	2	100
	PPR 4.2T	Hospital Pharmacy	2	1	6	100
	PPR 4.2L	Hospital Pharmacy Lab	3	--	2	100
	PPR 4.3T	Clinical Pharmacy	3	1	8	100
	PPR 4.3L	Clinical Pharmacy Lab	3	--	2	100
	PPR 4.4T	Biostatistics and Research Methodology	2	1	6	100
	PPR 4.5T	Biopharmaceutics and Pharmacokinetics	3	1	8	100
	PPR 4.5L	Biopharmaceutics and Pharmacokinetics Lab	3	--	2	100
	PPR 4.6T	Clinical Toxicology	2	1	6	100
		Total	**27**	**6**	**50**	**1000**

Table 1.5. Fifth Year PharmD Degree Program Course Work Structure							
Year	**Course Code**	**Course Title**	**Hours per Week**	**No. of Hours of Hospital posting**	**No. of Hours of Seminar**	**Credits Assigned**	**Total Marks**
Fifth Year PharmD	PPR 5.1T	Clinical Research	3	-	1	8	100
	PPR 5.2T	Pharmacoepidemiology and Pharmacoeconomics	3	-	1	8	100
	PPR 5.3T	Clinical Pharmacokinetics and Pharmacotherapeutic Drug Monitoring	2	-	1	6	100
	PPR 5.4L	Clerkship (Attending ward rounds (3 hrs.) on daily basis)	18	-	1	8	100
	PPR 5.5P	Project Work (Six months)	-	20	-	12	100
		Total	**26**	**20**	**4**	**42**	**500**

Table 1.6. Sixth Year PharmD Degree Program Course Work Structure							
Year	**Course Code**	**Course Title**	**Internship**				**Credits Assigned**
Sixth Year PharmD	PPR 6.1R	Internship or residency training (Including postings in speciality units. Student should independently provide the clinical pharmacy services to the allotted wards.	6 months in General Medicine Dept.	2 months in Speciality Dept-1	2 months in Speciality Dept-2	2 months in Speciality Dept-3	24

PharmD Program	**Total Hours per Week**	**Total Credits Assigned**	**Total Marks**
	191 + Internship	**266**	**4500**

1.5. Examination Scheme: The PharmD program evaluation scheme is shown in the Table 2.

Table 2. PharmD Degree Program Evaluation Scheme							
Evaluation Scheme – Theory and Lab							
Maximum Marks for Theory				**Maximum Marks for Lab/Clerkship**			
Internal Assessment Award (30)		**University Examination** (C)	**Total**	**Internal Assessment Award (30)**		**University Examination**	**Total**
Written Examination	Assignments/ Surprise Tests			Daily Assessment	Tests		
A	B	C	A+B+C	A	B	C	A+B+C
25	**05**	**70**	**100**	**10**	**20**	**70**	**100**
Evaluation Scheme – Project Work							
Thesis Report		**Viva Voce**		**Total**			
A		B		C			
70		**30**		**100**			

1.5.1. Internal Assessment:

Theory Tests (A): There shall be 3 periodical tests of two hour duration for 50 marks each in the theory courses. The marks scored out of 50 is computed for 25 marks for each sessional. The average of the best two shall be taken for the compilation of the internal assessment marks.

Question Paper Pattern – PharmD Sessional Examinations

Manipal College of Pharmaceutical Sciences
Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy Duration: 2 hr. Max. Marks: 50

Instructions: Answer ALL questions.

Section A: Long Answer Questions (2 × 10 marks = 20 marks)
Section B. Short Answer Questions (4 × 5 marks = 20 marks)
Section C. Give Reasons for the Following (5 × 2 marks = 10 marks)

Assignments/Surprise Tests (B): Marks for Assignments/Surprise tests in a theory course of a program, subject to a maximum of five marks, are awarded to a student depending on the student's performance in these exercises at the end of the academic year.

Compilation of Internal Assessment of a Theory Course: A + B = 30 marks.

1.5.2. Lab and Clerkship:

Daily Assessment (A): 10 marks of the internal assessment shall be allotted for the student's preparedness, regularity, attendance, laboratory records, practical performed and such other criteria.

Tests (B): 20 marks shall be allotted for lab tests in each lab course. At least two tests have to be conducted and the average of the two shall be taken for the compilation of the internal assessment award in the lab course.

The scheme of the conduct of the Internal Lab Test is described in the respective course syllabus as per the PCI specifications.

Question Paper Pattern – PharmD Sessional Examinations

Manipal College of Pharmaceutical Sciences
Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 3 hr. | Max. Marks: 20

Instructions: Answer ALL questions.

Lab sessional examination shall be conducted as per the scheme given in the detailed lab course contents.

The Lab/clerkship internal awards compilation = A + B = 30 marks.

1.6. University Examinations: The university examination will be held at the end of each academic year, ordinarily in May/ June and a make-up examination will also be held in July/ August.

The theory examination is conducted for the duration of three hours for a maximum of 70 marks as per the model paper shown below.

Question Paper Pattern – PharmD University Examinations

Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 3 hr. | Max. Marks: 70

Instructions: Answer ALL questions.

Section A: Long Answer Questions (3 × 10 marks = 30 marks)
Section B. Short Answer Questions (6 × 5 marks = 30 marks)
Section C. Give Reasons for the Following (5 × 2 marks = 10 marks)

The practical examination is conducted for the duration four hours for a maximum of 70 marks as per the scheme shown in the syllabus of respective course.

Question Paper Pattern – PharmD University Examinations

Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 4 hr. | Max. Marks: 70

Instructions: Answer ALL questions.

University practical examination shall be conducted as per the scheme given in the detailed lab course contents.

1.7. Project Work: A PharmD candidate has to perform a project work during the fifth year of PharmD program. Accordingly the student shall submit a thesis on the project work. The thesis is evaluated for 70 marks and viva voice shall be conducted for 30 marks.

1.8. Promotion: A student is promoted to the next higher class when the student passes all the courses of previous year in the university examination. In case a student secures eligibility for

promotion to higher classes after the make-up examination, the student is allowed to the next higher classes along with the regular batch commencing from July/ August.

However, there is a provision for restricted carry over as mentioned below.

1.9. Restricted Carry Over: For the restricted carry over, Remedial Mathematics/ Remedial Biology course will not be included. However the students, who have failed in these courses, will have to pass these courses before their final year results are declared.

a) For obtaining the promotion to next higher class, the student should earn minimum required cumulative credits. A student can earn credits of a course when the student obtains minimum grade of 'E' and above on a 10-point grading system in each theory and lab courses separately.

   Minimum required credits year-wise and cumulative credits to be earned at the end of an academic year for promotion to next academic year are shown in the table given below.

Restricted Carry Over Criteria – PharmD Program

Program Year	Total Credits	Cumulative Credits	Minimum Credits to be Earned	Cumulative Credits to be Earned at the end of an Academic Year for Promotion for next Higher Class
First Year PharmD	46	46	26	26
Second Year PharmD	52	98	32	78 (46 credits of first year + 32 credits of second year)
Third Year PharmD	52	150	32	130 (46 credits of first year + 52 credits of second year + 30 credits of third year)
Fourth Year PharmD	50	200	30	180 (46 credits of first year + 52 credits of second year + 52 credits of third year + 30 credits of fourth year)
Fifth Year PharmD	42	242	34	234 (46 credits of first year + 52 credits of second year + 52 credits of third year + 50 credits of fourth year + 34 credits of fifth year)

b) No student shall be admitted to the third year unless the student passes all the courses of the first year.
c) No student shall be admitted to the fourth year unless the student passes all the courses of the second year
d) No student shall be admitted to the fifth year unless the student passes all the courses of the third year
e) No student shall be admitted to the sixth year unless the student passes all the courses of the Fourth year

1.10. Assessment of Internship: A PharmD student shall carry out internship as per the objectives laid in the internship course description. The internship is allotted 24 credits. The performance of a student during the internship is assessed as per the scheme given below.

Table 3. PharmD Degree Program Evaluation Scheme – 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 eligible for it.

Satisfactory completion of internship shall be determined on the basis of the following attributes.

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 (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues)	Score: 0-5
5. Initiative, participation in discussions, research aptitude	Score: 0-5

A score of less than 3 in any one of the attributes will represent unsatisfactory completion of internship.

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

Grading system		
Scores Range	**Letter Grade**	**Grade Points**
22 – 25	A+	10
18 – 21	A	09
15 – 17	B	08
Less than 15	F/I/DT/NE	00
F: Fails; I: Incomplete; DT: Detained; NE: Not Eligible		

1.11. Award of Degree: The degree shall be awarded to a student only when a student has successfully completed the six-year PharmD program by earning a total of 266 credits and has been certified by the Head of the Institution as having undergone the internship satisfactorily. The award of degree with honours is based on the CGPA given below:

Honours	CGPA
First Class with Distinction	7.50 and above
First	6.00 and above but less than 7.50
Second	5.00 and above but less than 6.00

****

Structure and Contents of the Programs

Doctor of Pharmacy Post-Baccalaureate (PharmD (PB))

Objectives of the Program:

1. Prepare students for a career in pharmacy profession
2. To equip the students with the basic knowledge to provide pharmaceutical care to patients (patient counseling on rational drug use)
3. To work with physicians and provide drug information.

1.1. Title of the Program: Doctor of Pharmacy Post-Baccalaureate (PharmD (PB)) with 126 credits.

1.2. Duration of the Program: Three years.

1.3. Medium of Instruction: English.

1.4. Course Curriculum: Annual system, viz., the First, Second, Third year PharmD (PB) program. The course work structure of the program is shown in the Tables 1.1 – 1.3.

Table 1.1. First Year PharmD (PB) Degree Program Course Work Structure

Year	Course Code	Course Title	Hours per Week	Hours of Tutorial	Credits Assigned	Total Marks
First Year PharmD (PB)	PPR 4.1T	Pharmacotherapeutics-3	3	1	8	100
	PPR 4.1L	Pharmacotherapeutics-3 Lab	3	--	2	100
	PPR 4.2T	Hospital Pharmacy	2	1	6	100
	PPR 4.2L	Hospital Pharmacy Lab	3	--	2	100
	PPR 4.3T	Clinical Pharmacy	3	1	8	100
	PPR 4.3L	Clinical Pharmacy Lab	3	--	2	100
	PPR 4.4T	Biostatistics and Research Methodology	2	1	6	100
	PPR 4.5T	Biopharmaceutics and Pharmacokinetics	3	1	8	100
	PPR 4.5L	Biopharmaceutics and Pharmacokinetics Lab	3	--	2	100
	PPR 4.6T	Clinical Toxicology	2	1	6	100
	PPR 4.7T	Pharmacotherapeutics-1 and 2	3	1	8	100
	PPR 4.7L	Pharmacotherapeutics-1 and 2 Lab	3	--	2	100
		Total	**33**	**7**	**60**	**1200**

Table 1.2. Second Year PharmD (PB) Degree Program Course Work Structure							
Year	**Course Code**	**Course Title**	**Hours per Week**	**No. of Hours of Hospital posting**	**No. of Hours of Seminar**	**Credits Assigned**	**Total Marks**
Second Year PharmD (PB)	PPR 5.1T	Clinical Research	3	-	1	8	100
	PPR 5.2T	Pharmacoepidemiology and Pharmacoeconomics	3	-	1	8	100
	PPR 5.3T	Clinical Pharmacokinetics and Pharmacotherapeutic Drug Monitoring	2	-	1	6	100
	PPR 5.4L	Clerkship (Attending ward rounds (3 hrs.) on daily basis)	18	-	1	8	100
	PPR 5.5P	Project Work (Six months)	-	20	-	12	100
		Total	**26**	**20**	**4**	**42**	**500**

Table 1.3. Third Year PharmD (PB) Degree Program Course Work Structure							
Year	**Course Code**	**Course Title**	**Internship**			**Credits Assigned**	
Third Year PharmD (PB)	PPR 6.1R	Internship or residency training (Including postings in speciality units. Student should independently provide the clinical pharmacy services to the allotted wards.	6 months in General Medicine Dept.	2 months in Speciality Dept-1	2 months in Speciality Dept-2	2 months in Speciality Dept-3	24

PharmD (PB) Program	**Total Hours per Week**	**Total Credits Assigned**	**Total Marks**
	90 + Internship	**126**	**1700**

1.5. Examination Scheme: The PharmD (PB) program evaluation scheme is shown in the Table 2.

Table 2. PharmD (PB) Degree Program Evaluation Scheme							
Evaluation Scheme – Theory and Lab							
Maximum Marks for Theory				**Maximum Marks for Lab/Clerkship**			
Internal Assessment Award (30)		**University Examination** (C)	**Total**	**Internal Assessment Award (30)**		**University Examination**	**Total**
Written Examination	Assignments/ Surprise Tests			Daily Assessment	Tests		
A	B	C	A+B+C	A	B	C	A+B+C
25	**05**	**70**	**100**	**10**	**20**	**70**	**100**
Evaluation Scheme – Project Work							
Thesis Report		**Viva Voce**			**Total**		
A		B			C		
70		**30**			**100**		

1.5.1. Internal Assessment:

Theory Tests (A): There shall be 3 periodical tests of two hour duration for 50 marks each in the theory courses. The marks scored out of 50 is computed for 25 marks for each sessional. The average of the best two shall be taken for the compilation of the internal assessment marks.

Question Paper Pattern – PharmD (PB) Sessional Examinations

Manipal College of Pharmaceutical Sciences
Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 2 hr. | Max. Marks: 50

Instructions: Answer ALL questions.

Section A: Long Answer Questions (2 × 10 marks = 20 marks)
Section B. Short Answer Questions (4 × 5 marks = 20 marks)
Section C. Give Reasons for the Following (5 × 2 marks = 10 marks)

Assignments/Surprise Tests (B): Marks for Assignments/Surprise tests in a theory course of a program, subject to a maximum of five marks, are awarded to a student depending on the student's performance in these exercises at the end of the academic year.

Compilation of Internal Assessment of a Theory Course: A + B = 30 marks.

1.5.2. Lab and Clerkship:

Daily Assessment (A): 10 marks of the internal assessment shall be allotted for the student's preparedness, regularity, attendance, laboratory records, practical performed and such other criteria.

Tests (B): 20 marks shall be allotted for lab tests in each Lab course. At least two tests have to be conducted and the average of the two shall be taken for the compilation of the internal assessment award in the lab course.

The scheme of the conduct of the Internal Lab Test is described in the respective course syllabus as per the PCI specifications.

Question Paper Pattern – PharmD (PB) Sessional Examinations

Manipal College of Pharmaceutical Sciences
Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 3 hr. | Max. Marks: 20

Instructions: Answer ALL questions.

Lab sessional examination shall be conducted as per the scheme given in the detailed lab course contents.

The Lab/clerkship internal awards compilation = A + B = 30 marks.

1.6. University Examinations: The university examination will be held at the end of each academic year, ordinarily in May/ June and a make-up examination will also be held in July/ August.

The theory examination is conducted for three hours duration for a maximum of 70 marks as per the model paper shown below.

Question Paper Pattern – PharmD (PB) University Examinations

Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 3 hr. | Max. Marks: 70

Instructions: Answer ALL questions.

Section A: Long Answer Questions (3 × 10 marks = 30 marks)
Section B. Short Answer Questions (6 × 5 marks = 30 marks)
Section C. Give Reasons for the Following (5 × 2 marks = 10 marks)

The practical examination is conducted for four hours duration for a maximum of 70 marks as per the scheme shown in the syllabus of respective courses

Question Paper Pattern – PharmD (PB) University Examinations

Manipal Academy of Higher Education, Manipal

Course Code. Course Title

Date: dd-mm-yyyy | Duration: 4 hr. | Max. Marks: 70

Instructions: Answer ALL questions.

University practical examination shall be conducted as per the scheme given in the detailed lab course contents.

1.7. Project Work: A PharmD (PB) candidate has to perform a project work during the second year of PharmD (PB) program. Accordingly the student shall submit a thesis on the project work. The thesis is evaluated for 70 marks and viva voice shall be conducted for 30 marks.

1.8. Promotion: A student is promoted to the next higher class after passing all the courses of previous year in the university examination. In case a student secures eligibility for promotion to higher classes after the make-up examination, the student is allowed to the next higher classes along with the regular batch commencing from July/ August.

However, there is a provision for restricted carry over as mentioned below.

1.9. Restricted Carry Over:

b) For obtaining the promotion to next higher class, the student should earn minimum required cumulative credits. A student can earn credits of a course after obtaining minimum grade of 'E' and above on a 10-point grading system in each theory and lab courses separately.

   Minimum required credits year-wise and cumulative credits to be earned at the end of an academic year for promotion to next academic year are shown in the table given below.

Restricted Carry Over Criteria – PharmD (PB) Program				
Program Year	**Total Credits**	**Cumulative Credits**	**Minimum Credits to be Earned**	**Cumulative Credits to be Earned at the end of an Academic Year for Promotion for next Higher Class**
First Year PharmD (PB)	60	60	40	40
Second Year PharmD (PB)	**42**	**102**	**34**	94 (60 credits of first year + 34 credits of second year)

b) No student shall be admitted to the third year unless the student passes all the courses of the first year

1.10. Assessment of Internship: A PharmD (PB) student carry out internship as per the objectives laid in the internship course description. The internship is allotted 24 credits. The performance of a student during the internship is assessed as per the scheme given in the Table 3.

Table 3. PharmD (PB) Degree Program Evaluation Scheme – 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 eligible for it.

Satisfactory completion of internship shall be determined on the basis of the following attributes.

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 (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues)	Score: 0-5
5. Initiative, participation in discussions, research aptitude	Score: 0-5

A score of less than 3 in any one of the attributes will represent unsatisfactory completion of internship.

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

Grading system		
Scores Range	**Letter Grade**	**Grade Points**
22 – 25	A+	10
18 – 21	A	09
15 – 17	B	08
Less than 15	F/I/DT/NE	00
F: Fails; I: Incomplete; DT: Detained; NE: Not Eligible		

1.11. Award of Degree: The degree shall be awarded to a student only when a student has successfully completed the three-year PharmD (PB) program by earning a total of 126 credits and has been certified by the Head of the Institution as having undergone the internship satisfactorily. The award of degree with honours is based on the CGPA given below:

Honours	CGPA
First Class with Distinction	7.50 and above
First	6.00 and above but less than 7.50
Second	5.00 and above but less than 6.00

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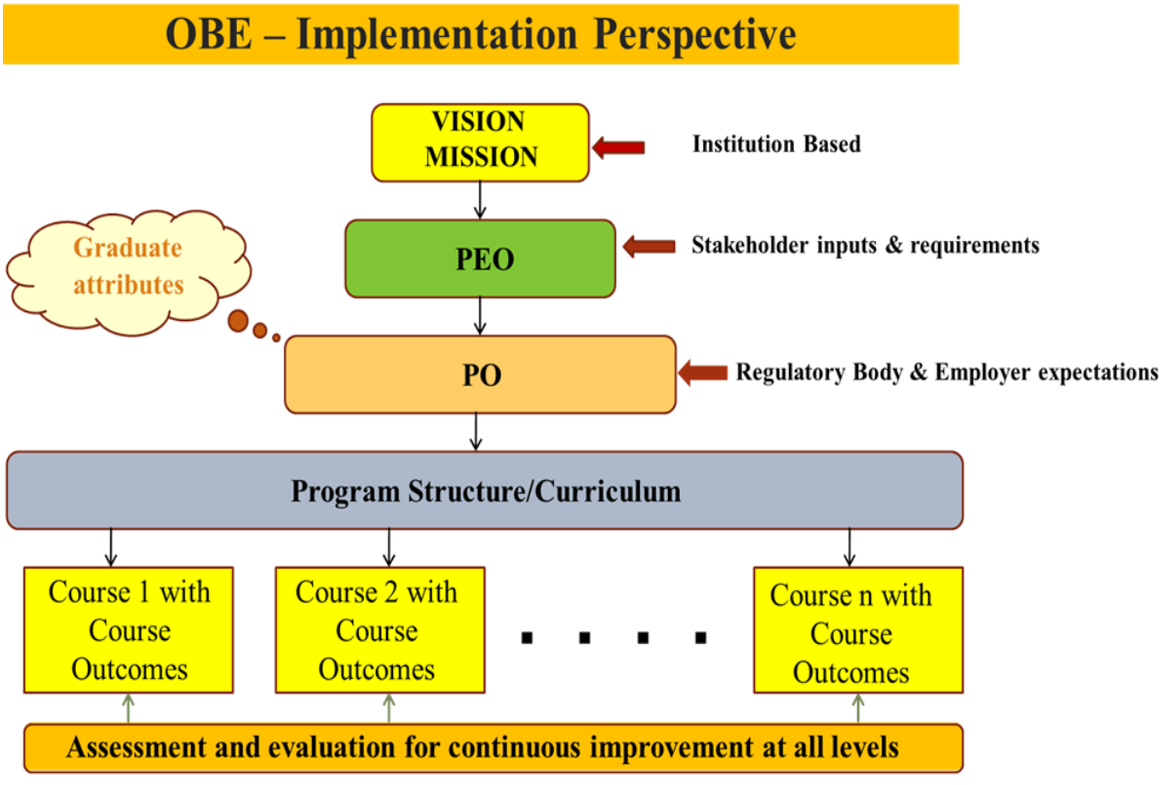
NOTES

3

OBE Framework
Vision, Mission, Quality Policy
Program Educational Objectives
Program Outcomes

Outcome Based Education (OBE) Framework



MCOPS Vision Mission

Vision:

“Excellence in Pharmaceutical Education and Research”

Mission:

“Marching with the Times”

Quality Policy

- **MCOPS is committed towards providing value-based pharmaceutical education to meet industry, hospital and community needs through continuous improvement of infrastructure and facility for learning, practice and research.**

- **MCOPS shall provide an environment conducive to the development of staff and students.**

PharmD and PharmD-PB Program Educational Objectives

Manipal College of Pharmaceutical Sciences endeavors to nurture an attitude conducive to self-learning and lifelong learning that would:

- Impart comprehensive pharmaceutical education leading to PharmD/PharmD-PB degree with integrated professional knowledge and skills, with research competencies to work in all the domains of pharmacy profession.

- Equip the students with comprehensive knowledge and skills to deliver pharmaceutical care in all the practice settings.

- Cultivate innovative thinking in clinical oriented services and nurture the ability to adapt according to evolving paradigms in health care and research.

- Foster the best in-class experiential hands-on training and advanced pharmacy practice services.

- Empower and sensitize pharmacists to serve the society in health care and guide the next generation clinical pharmacists.

PharmD and PharmD-PB Program Outcomes (POs)

The graduate student at the end of the PharmD/PharmD-PB program will be able to face the challenges of the profession of pharmacy in the constituent disciplines namely, Pharmacy Practice (Community and Hospital), Pharmaceutical Industry, Academia and Research as described below:

PO number	Attribute	Competency
PO1	**Domain knowledge**	Demonstrate the understanding of the fundamental principles in pharmaceutical sciences and practice and to apply the acquired knowledge for providing preliminary solutions in areas of clinical pharmacy practice and pharmaceutical care.
PO 2	**Problem analysis**	Demonstrate knowledge and skills that translate into problem solving abilities related to the day to day professional needs of the healthcare system by serving hospital & community pharmacy and pharmaceutical industry.
PO 3	**Design/develop solutions**	Apply principles of pharmacy for developing the solutions in patient care and in clinical drug development.
PO 4	**Conduct investigations of complex problems**	Apply competency and skills in clinical research, pharmaco-epidemiology, pharmacoeconomics and outcome research for pharmaceutical care.
PO 5	**Modern tool usage**	Utilize Utilize knowledge and skills acquired in information and digital technology in the areas of drug information, statistical data analysis, pharmacokinetic pharmacodynamic modeling, bioinformatics and meta-analysis.

PO number	Attribute	Competency
PO 6	**Business and society**	Create awareness in the society about the effective and safe use of medicines and remain as a responsible provider of drug information.
PO 7	**Environment and sustainability**	Understand the impact of the business solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**	Cultivate a sense of fair play, gender-neutral attitudes, respect for all races, nations, religions, cultures, languages, traditions, sensitivity to professional ethical codes of conduct, social values, environmental awareness and respect for democratic institutions.
PO 9	**Individual/ team work**	Be able to engage diverse stakeholders in a collaborative manner.
PO 10	**Communication**	Demonstrate effective communication skills with decorum through spoken and written manner in professional, scientific and societal settings employing conventional or digital media.
PO 11	**Project management and finance**	Demonstrate knowledge and understanding of the project and financial management principles and apply these to evaluate existing and new projects for effective decision making.
PO 12	**Life-long learning**	Cultivate a temperament that would enable individuals to work towards self-driven performancegoals, entrepreneurial ventures and overall leadership to tackle future challenges through continuing education towards professional development.

4

Doctor of Pharmacy (PharmD)

Courses, Course Outcome (COs), Course Content and Assessment Plan

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PHA 1.1T**
COURSE TITLE	**HUMAN ANATOMY AND PHYSIOLOGY(Theory)**

SYNOPSIS	**COs**
This course is designed to impart fundamental knowledge of the structure and functions of the human body. It also helps to understand the mechanisms of homeostasis of the human body. Since the medicines are meant for the ailment of human diseases and sometime betterment of human body, this course will enhance the understanding of the consequences after consuming the medication or applying for the medicines on the body.	Upon completion of this course, the student should be able to: 1. Identify the tissues and organs of the human body. 2. Describe the homeostatic mechanisms and their imbalances. 3. Describe the gross anatomical, histological structure and functions of systems and organs of the human body.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn the fundamentals of body organization such as cellular level, tissue level and organ level organization and its regulation mechanism known as homeostasis	Unit I (4 Hrs)	8	5			3
2	Students will learn about nervous system, which includes the brain, spinal cord and the whole regulation body by the nervous system over the whole body. This module also includes the integration of the sensory system in the body. Students will also learn about bones, joints and full skeletal system in the body	Unit II (18 Hrs)	35	20			15

3	Students will learn about blood, its formation, blood clotting mechanisms, the heart and blood vessels. Further, they study the regulation of heartbeat and blood pressure, lymphatic system and immunity	Unit III (14 Hrs)	27		15		12
4	Students will learn about the respiratory system and its regulations. Students will also learn about different muscles and their physiological functions. Further, they learn about the sports physiology.	Unit IV (8 Hrs)	15		10		5
5	Students will learn about the digestive system, accessory glands such as salivary glands, liver, pancreas and gastric glands and secretions for digestion of food. Students will also learn about the urine formation and regulation of body fluids by the kidneys.	Unit V (12 Hrs)	23			15	8
6	Students will learn about the endocrine organs or hormones and their function and regulations	Unit VI (10 Hrs)	20			10	10
7	Students will learn about the male and female reproductive system, where they study the pregnancy and the methods to prevent pregnancy	Unit VII (09 Hrs)	17				17
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I:

Introduction to human body (4 hours)

Definitions of anatomy and physiology, level of structural organization of body, homeostasis and its control, body's anatomical positions, planes, sections and body cavities; Cell: Structure, components and their functions; Elementary tissues: Epithelial, connective, muscular and nervous tissues-their subtypes and characteristics

Unit II:

Nervous system, special senses, bones and joints (18 hours) a) The organisation of the nervous system

b) Gross anatomy and functions of the cerebrum, cerebellum and midbrain

c) Functional aspects of thalamus, hypothalamus and basal ganglia
d) Spinal cord: Gross structure and reflexes
e) Cranial nerves: Names and their functions
f) ANS: Anatomy and functions of sympathetic and parasympathetic systems
g) Sense organs (gross anatomy and functions): a) Eye, b) Ear, c) Tongue and Nose, d) Skin h: Bone: Structure, composition and functions of the skeleton j: Joints: Classification of joints, types of movements of joints and definitions of joint disorders

Unit III: Cardiovascular and lymphatic system (14 hours)

a) Blood: Composition and functions of blood; Haemopoiesis; Blood groups; Clotting mechanism; platelets and definitions for disorders of coagulation
b) Heart and circulation: Functional anatomy; blood vessels, and circulation (Pulmonary, coronary and systemic circulation
c) Electrocardiogram (ECG); cardiac cycle and heart sounds; blood pressure, its maintenance and regulation
d) Definition of cardiovascular disorders

Hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure, cardiac arrhythmias

e. Lymphatic system: Composition, formation and circulation of lymph; spleen, the role of lymphatics in immunity; definitions for disorders of lymphatic systems.

Unit IV:

Respiratory system, muscles and sports physiology(8 hours) a) Anatomy of respiratory organs and functions
b) Physiology of respiration and its regulation; gas exchange and transportations
c) Respiratory volumes and capacities, the definition of hypoxia, asphyxia, dybarism
e) Oxygen therapy and resuscitation.
f) Muscular system: Histology, classification, anatomical and physiological differences of skeletal, cardiac and smooth muscles; Physiology of muscle contraction
g) Sports physiology: a) Muscles in exercise, the effect of athletic training on muscles and muscle performance. b) Respiration in exercise, CVS functions in exercise, body heat in exercise, body fluids and salts during exercise. c) Drugs used by athletes and doping

Unit V:

Digestive and urinary system (12 hours)

a) Digestive system: Functional anatomy;) digestion and absorption; Definitions of GIT disorders
b) Urinary System: Gross anatomy and physiological functions of the urinary system;) Physiology of urine formation; Renin-Angiotensin-Aldosterone System (RAAS), Acid-Base Balance by the kidney; Glomerular filtration rate, Clearance tests and micturition reflex

Unit VI:

Endocrine system (10 hours)

Histology, important hormones and their functions of a) Pituitary gland, b) Adrenal gland, c) Thyroid and Parathyroid glands, d) Pancreas and gonads

Unit VII

Reproductive system (9 hours)

a) Functional anatomy of the male and female reproductive system
b) Sex hormones; spermatogenesis and oogenesis; physiology of menstruation; Genetic basis of sex determination
c) Pregnancy and parturition; Contraceptive methods and devices

First Year PharmD Degree Program	
COURSE CODE	**PHA 1.1L**
COURSE TITLE	**HUMAN ANATOMY AND PHYSIOLOGY LAB**

SYNOPSIS	COs
This course is designed to gain hands-on knowledge on the gross structure and microscopic structure of the human body. This course helps them to understand fundamental parameters related to human body, and blood parameters that are commonly used in clinics.	Upon completion of this course the student shall be able to 1. Identify the body tissues and organs of the different systems of the human body 2. Perform the haematological tests and also record blood pressure, heart rate, pulse and respiratory volumes; 3. Interpret the mechanisms of contraception and conceptions

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCE 1.2T**
COURSE TITLE	**PHARMACEUTICS (Theory)**

SYNOPSIS	COs
The course deals with the fundamental knowledge on the art and science of formulating different dosage forms/formulations. It enables the students to work efficiently in applied field of pharmacy with basic knowledge of dosage forms, calculations, incompatibilities and surgical dressings.	Upon completion of this course students should be able to: 1. Know the history of profession of pharmacy 2. Understand the professional way of handling the prescriptions 3. Comprehend the different pharmaceutical calculation involved in formulation and dispensing of pharmaceutical dosage forms 4. Understand the formulation aspects of various dosage forms. 5. Know the principles involved in formulation of different dosage forms, their incompatibilities, and surgical dressings. 6. Demonstrate the importance of good stable and effective formulations with their evaluations

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Learners will be able to know the definition, classification of various dosage forms. Will understand handling and dispensing of prescription, posology with a history of profession of pharmacy and pharma industry, pharmacopoeias, and its development.	Unit I (8 Hrs)	24	12			12
2	It will help learners to understand the pharmaceutical calculation for the development of dosage forms like percentage, allegation etc.,	Unit II (6 Hrs)	17	9			8
3	It will help learners to know the preparation of various powders and granules.	Unit III (6 Hrs)	18	4	3		11
4	Learners will be able to understand the formulation of various monophasic and biphasic dosage forms, will be able to differentiate them.	Unit IV (10 Hrs)	29		14		15
5	It will help learners to understand the preparation and evaluation of suppositories and pessaries.	Unit V (5 Hrs)	14		8		6
6	Learners will be able to understand the extraction procedures and method of preparation of Galenicals.	Unit VI (5 Hrs)	14			8	6
7	Learners will be able to perform various pharmaceutical calculations, understand different types of dressings and dressing material, various incompatibilities, and their preventive measures	Unit VII (10 Hrs)	29			17	12
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I:

a. Introduction to dosage forms - classification and definitions
b. Prescription: definition, parts and handling
c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief. Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.

Unit II: Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

Unit III: Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules

Unit IV Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.
Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation

Unit V: Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation

Unit VI Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts

Unit VII Pharmaceutical calculations. Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages. Incompatibilities: Introduction, classification and methods to overcome the incompatibilities

First Year PharmD Degree Program	
COURSE CODE	**PCE 1.2L**
COURSE TITLE	**PHARMACEUTICS LAB**

SYNOPSIS	**COs**
This course is designed to acquire hands on experience in formulating different dosage forms.	Upon completion of this course the student should be able to: 1. Know the formulation aspects of different dosage forms 2. Know and appreciate the principle and procedure involved in the preparation of dosage forms 3. Know how to pack, label and dispense the dosage forms

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PBT 1.3T**
COURSE TITLE	**MEDICINAL BIOCHEMISTRY (Theory)**

SYNOPSIS	**COs**
Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control of treatment, and prevention of diseases.	Upon completion of this course the student should be able to : 1. Study the basic aspects of Biochemistry and its clinical relevance 2. Understand the catalytic activity of enzymes and the importance of isoenzymes in the diagnosis of disease 3. Know the metabolic process of biomolecules in health and illness (Metabolic disorders) 4. Understand the genetic organization of the mammalian genome, protein synthesis, replication, mutation, and repair mechanisms 5. Know the biochemical principles of organ function tests of the kidney, liver, and endocrine gland 6. Study of qualitative analysis and know the principle involved in the determination of biomolecules in body fluids

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will study the basic structural and functional aspects of the cell, including energy rich compounds and ATP generation. Students will understand the role of clinical chemistry laboratory.	Unit I (7 Hrs)	14	5	2		07
2	Students will learn about classification of enzymes, factor affecting enzyme activity, mechanism of enzyme action, enzyme inhibition and applications. Students will understand the therapeutic and diagnostic applications of isoenzymes, and biochemical role and deficiency diseases of coenzymes.	Unit II (7 Hrs)	14	7			7

3	Students will study various metabolic pathways of carbohydrates, their hormonal regulation, metabolic disorders and diagnostic tests.	Unit III (12 Hrs)	23	13			10
4	Students will learn various metabolic pathways of lipids, their hormonal regulation and related disorders. Students will study about the roles and detection of Lipoproteins	Unit IV (12 Hrs)	23		13		10
5	Students will understand various metabolic aspects of proteins and amino acids and associated disorders	Unit V (10 Hrs)	20			7	13
6	Students will study about nucleobases, nucleotides and nucleic acid metabolism Students will understand mutations and repair mechanisms	Unit VI (12 Hrs)	23		6	7	10
7	Students will study the tests to assess functions of organs such as liver and kidney. Students will learn the role of electrolytes, its regulation and determination. Students will understand the principle, procedure and significance of immunochemical techniques such as ELISA and RIA	Unit VII (15 Hrs)	28		4	11	13
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT I **7Hrs**

Introduction to biochemistry: The basic structural and functional aspects of the cell, including energy rich compounds, biological oxidation and ATP generation.

Introduction to clinical chemistry: the role of clinical chemistry laboratory.

UNIT II **7 Hrs**

Enzymes: Classification, factor affecting enzyme activity, mechanism of enzyme action, enzyme inhibition and applications. Diagnostic applications of isoenzymes, and biochemical role and deficiency diseases of coenzymes.

UNIT III **12 Hrs**

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.

UNIT IV **12 Hrs**

Lipid metabolism: □-oxidation, ketogenesis and ketolysis, biosynthesis of fatty acids, lipids, metabolism of cholesterol. Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).

Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.

UNIT V **10 Hrs**

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 disorders of amino acids.

UNIT VI **12 Hrs**

Nucleic acid metabolism: Metabolism of purine and pyrimidine nucleotides, DNA replication, Protein synthesis, Genetic code, inhibition of protein synthesis; mutation and repair mechanism.

UNIT VII **15 Hrs**

Liver function tests: various functions of liver and tests to assess them.

Kidney function tests: Role of kidney, laboratory tests for normal functions

Electrolytes: Body water, compartments, water balance, and electrolyte distribution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.

Immunochemical techniques: Determination of hormone and protein levels in serum for endocrine diseases and infectious diseases. Principle, procedure and significance of immunochemical techniques such as ELISA and RIA.

First Year PharmD Degree Program	
COURSE CODE	**PBT 1.3L**
COURSE TITLE	**MEDICINAL BIOCHEMISTRY LAB**

SYNOPSIS	**COs**
Medicinal Biochemistry lab course is designed to enable the students to learn how to determine various biochemical parameters by qualitative and quantitative methods. The students will learn to process the samples suitably and experimental results shall help them to interpret the health and disease state.	Upon completion of this course the student will be able to: 1. Perform qualitative and quantitative analysis of various biochemical parameters present in blood and urine and to interpret the clinical relevance based on observation. 2. Carry out experiments to study the factors affecting enzyme activity. 3. Be well versed with preparation of standard buffer solutions and its pH measurements. 4. Understand various lipid profile tests and methods to determine important electrolytes.

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCH 1.4T**
COURSE TITLE	**PHARMACEUTICAL ORGANIC CHEMISTRY (Theory)**

SYNOPSIS	**COs**
This course deals with the fundamental concepts like classification, nomenclature and the properties of organic compounds. Study of types of reactions, with mechanisms, of aliphatic and aromatic compounds. The syllabus also includes study of few named reactions, and discussion of monograph of some official organic compounds.	**Upon completion of this course the student should be able to:** 1. Understand the fundamentals of organic chemistry 2. Identify and name any given sample of organic compound 3. Aware of their physical and chemical properties 4. Understand why and how a chemical reaction occurs 5. Qualitative and quantitative analysis of organic compounds

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn nomenclature, physical properties and free radical chain reactions.	Unit I (11 Hrs)	21	12			9
2	Students will learn and understand the reactions like substitution and elimination with examples.	Unit II (11 Hrs)	21	13			8
3	Students will learn and understand the reactions like dehydration of alcohols, electrophilic and free radical addition, free radical halogenation of alkenes	Unit III (12 Hrs)	23		13		10
4	Students will learn Theory of resonance, electrophilic aromatic substitution reactions with examples	Unit IV (10 Hrs)	20		12		08
5	Students will learn the nucleophilic addition reactions and named reactions	Unit V (12 Hrs)	23			13	10

6	Students will learn the Hoffman rearrangement, nucleophilic aromatic substitution reactions	Unit VI (10 Hrs)	20			12	08
7	Students will learn the monograph of official compounds and oxidation and reduction reactions.	Unit VII (09 Hrs)	17				17
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit-I

Structure and physical properties, nomenclature of organic compounds free radical addition mechanism

Unit-II

Study of alicyclic compounds, Nucleophilic aliphatic substitution reactions and elimination reactions,

Unit-III

Dehydration of alcohols (by elimination reactions), Electrophilic and free radical addition, free radical halogenation of alkenes

Unit-IV

Theory of resonance, Electrophilic aromatic substitution and nucleophilic aromatic substitution reactions.

Unit-V

Nucleophilic addition reaction, various named reactions with reaction mechanism

Unit-VI

Learn the Hoffman rearrangement, nucleophilic aromatic substitution reactions

Unit-VII

Monograph of official compounds, oxidation and reduction reactions

First Year PharmD Degree Program	
COURSE CODE	**PCH 1.4L**
COURSE TITLE	**PHARMACEUTICAL ORGANIC CHEMISTRY LAB**

SYNOPSIS	COs
This course deals with the practical/laboratory skills about the nature and handling of different class of organic compounds. The students will be involving in the synthesis of simple organic compounds of pharmaceutical importance. The students also will develop the skills in identifying any given organic sample by performing various chemical tests.	**Upon completion of this course the student should be able to:** 1. Develop the practical skills in handling and approaches to prepare any organic compound. 2. Students also learn the techniques to identify the unknown organic sample by following systematic qualitative analysis. 3. Students will understand the concepts of shapes (stereochemistry) of different organic compounds

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCH-1.5T**
COURSE TITLE	**PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)**

SYNOPSIS	COs
This course deals with fundamentals of volumetric analysis and basic knowledge of monograph of inorganic drugs and pharmaceuticals.	Upon completion of this course the student should be able to: 1. Understand the significance and to learn the various volumetric analysis methods available for inorganic pharmaceuticals. 2. Know the Preparation, purity, storage, and applications of inorganic pharmaceuticals. 3. Appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn about sources and types of impurities, principles of limit test, fundamentals of different volumetric method of analysis, errors in analysis, concentration expression terms, standard solutions. Will acquire the theoretical and practical skills to perform neutralization titrations.	Unit I (09 Hrs)	25	13			12

2	Students will learn the methods of preparation, assay, storage conditions and medicinal uses of inorganic compounds used as acidifiers, antacids, cathartics and an antimicrobials.	Unit II (08Hrs)	24	12			12
3	Students will acquire the theoretical and practical skills to perform non aqueous titrations and precipitation titrations.	Unit III (06 Hrs)	18		10		08
4	Students will learn the physiological role of electrolytes, physiological acid base balance, electrolyte replacement therapy, electrolyte combination therapy. Students will learn the methods of preparation, assay and medicinal uses of electrolytes. Learn about physiological role of essential and trace elements required in body. Students will learn about preparation assay and uses of medicinal gases and inorganic dental products	Unit IV (10 Hrs)	29		15		14
5	Students will understand theory of indicators and the principle and applications of redox titrations, complexometric titrations and gravimetric analysis.	Unit V (09 Hrs)	25			13	12
6	Students will learn the methods of preparation, assay, medicinal uses of inorganic compounds used as expectorants, respiratory stimulant, antidotes, sedative, sclerosing agents, pharmaceutical aids. Understand the basics of radioactivity and applications of radioactive substances.	Unit VI (08 Hrs)	24			12	12
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **9 Hrs**

Limit test: Definition, importance, general procedure for limit tests for chlorides, sulphates, iron, arsenic, lead and heavy metals. (3hrs)

Errors: Errors in quantitative analysis, of errors, concept of accuracy and precision, treatment of analytical results. (1hr)

Volumetric analysis: Principle of volumetric analysis, different methods of analysis, different methods for expressing concentrations of solutions, primary and secondary standards. (1hr)

Acid base titrations: Acid- base concepts, relative strength of acids and bases, law of mass action, common ion effect, ionic product of water, Henderson-Hasselbalch equation, solutions, theory of indicators, neutralization curves, choice of indicators, mixed and universal indicators. (4hrs)

Unit II **8 Hrs**

Acidifiers: Dilute hydrochloric acid, sodium phosphate, Ammonium chloride. (1Hr)

Antacids: Classification, qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity. (3Hrs)

Cathartics: Magnesium hydroxide, magnesium sulphate, magnesium carbonate and sodium phosphate***.*** *(1Hr)*

Antimicrobials: Hydrogen Peroxide, potassium permanganate, chlorinated lime, Iodine, boric acid, silver nitrate, selenium sulphide.(3Hrs)

Unit III **6 Hrs**

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

Precipitation titrations: Introduction, types of precipitation titrations, end point detection.

Unit IV *10 Hrs*

Medicinal gases: Preparation and uses of the following: Oxygen, carbon dioxide, helium, nitrogen and nitrous oxide *(2Hrs)*

Electrolytes replenisher: Electrolytes used for replacement therapy

Electrolytes used in the acid-base therapy
Electrolyte combination therapy: (3Hrs)

Essential trace elements: Definition, Physiological role of Iron, copper, zinc, chromium, manganese, molybdenum, selenium, sulphur and Iodine. (3Hrs)

Dental products: Anti-caries Agents: Role of as anti-caries agents, Dentifrices: (2Hrs)

Unit V **9 Hrs**

Theory of indicators *(*1Hr*)*

Redox: Concepts of oxidation–reduction reactions, redox reactions , theory of redox titrations , redox indicators, iodometry and iodimetry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride. (3Hrs)

Complexometric: Introduction, principle, types of titrations, endpoint detection. (2Hrs)

Gravimetry: Basic concepts, Precipitation techniques, coprecipitation, post–precipitation, various steps involved in gravimetric analysis, pharmaceutical applications. (3Hrs)

Unit VI **8Hrs**

Pharmaceutical aids: (3Hrs)

Miscellaneous compounds:

Sedative:

Antidotes:

Respiratory stimulant: (3Hrs)

Radiopharmaceuticals: Introduction, measurement of radioactivity, clinical applications and dosage, hazards and precautions. (2Hrs)

First Year PharmD Degree Program	
COURSE CODE	**PCH 1.5L**
COURSE TITLE	**PHARMACEUTICAL INORGANIC CHEMISTRY LAB**

SYNOPSIS	**COs**
The course deals with expression of various concentrations and preparations, preparation of Inorganic compounds and application of Pharmacopeial purity and identity tests for real life samples and proper handling of laboratory equipments and glassware.	Upon completion of this course the student should be able to: 1. Prepare inorganic compounds and carry out pharmacopoeial tests. 2. Select an optimum analytical technique for a given sample. 3. Convert the observations to meaningful results and drawing the inferences. 4. Compare various methods of analysis and their outcomes.

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**MAT 1.6T**
COURSE TITLE	**REMEDIAL MATHEMATICS (Theory)**

SYNOPSIS	COs
This is an introductory course in mathematics. This subjects deals with the introduction to matrices, determinants, trigonometry, analytical geometry, differential calculus, integral calculus, differential equations, laplace transform.	Upon completion of the course the student shall be able to : 1. Know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications; 2. Solve the problems of different types by applying theory; and 3. Appreciate the important applications of mathematics in pharmacy.

First Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCO 1.6T**
COURSE TITLE	**REMEDIAL BIOLOGY (Theory)**

SYNOPSIS	COs
This is an introductory course in Biology, which gives detailed study of natural sources such as plant and animal origin. This subject has been introduces to the pharmacy course in order to make the student aware of various naturally occurring drugs and its history, sources, classification, distribution and the characters of the plants and animals. This subject gives basic foundation to Pharmacognosy.	Upon completion of this course the student should be able to: 1. Know the plant kingdom and its classification, general organization of plant, morphology of its various parts/ modifications and pollination process. 2. Understand the physiology and taxonomical characters of the plant. 3. Gain the Knowledge on Fungi, Yeast, Penicillin and Bacteria 4. Understand the animal cell/ tissues, characters, uses of Pisces, Reptiles, Aves, mammals and poisonous animals 5. Gain the knowledge on frog physiology

First Year PharmD Degree Program	
COURSE CODE	**PCO 1.6L**
COURSE TITLE	**REMEDIAL BIOLOGY LAB**

SYNOPSIS	COs
This is an introductory course in Biology, which gives a hands on experience of natural sources such as plant and animal origin. This subject has been introducing to the pharmacy course in order to make the student aware of various naturally occurring drugs, microscope handling techniques, morphological and histological characters of crude drugs and its inclusions. This subject gives basic foundation to Pharmacognosy Lab.	Upon completion of this course the student should be able to: 1. Gain the knowledge on handling microscope, preparation of permanent slides and simple physiological experiments. 2. Understand cell wall constituents, cell inclusions and different parts of the plants and its modifications 3. Get hands on experience on various parts of plant histology 4. Gain knowledge on identification of animals and study of frog

Second Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 2.1T**
COURSE TITLE	**PATHOPHYSIOLOGY (Theory)**

SYNOPSIS	COs
This course is designed to impart a thorough knowledge on pathology of various conditions with reference to its pharmacotherapy applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subject of pharmacy.	The student shall be able to: 1. Describe the etiology and pathogenesis of the selected disease states 2. Name the signs and symptoms of the diseases 3. Mention the complications of the diseases 4. Basic principles involved in cell injury, inflammation and immunity 5. Most recent updates on pathogenesis of the diseases

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52% of marks of assessment)			University Examination (48% of marks of assessment)
				S1	S2	S3	
1	Student will understand basic principles of cell injury and adaptation	Unit I (6 Hrs)	12	07			05
2	Student will understand basic concept of inflammation including inflammatory mediators and mechanism of wound healing	Unit II (8 Hrs)	16	09			07
3	Student will learn diseases of immunity including hypersensitivity, autoimmunity, immune deficiency disorders	Unit III (10 Hrs)	19		11		08
4	Student will understand etiology and pathogenesis of cancer including benign and malignant tumors	Unit IV (6 Hrs)	12		07		05
5	Student will learn about shock, biological effects of radiations; and environmental and nutritional diseases	Unit V (8 Hrs)	15			08	07

6	Student will learn the pathophysiology of neurodegenerative, psychiatry, cardiovascular, endocrine, gastrointestinal, hepatic, renal and pulmonary diseases	Unit VI (28 Hrs)	54	09	07	17	21
7	Student will learn about infectious diseases including sexually transmitted diseases, urinary tract infections, pneumonia, typhoid, leprosy, malaria tuberculosis, , dysentery and hepatitis	Unit VII (9 Hrs)	17				17
Total marks of ssessment			**145**	**25**	**25**	**25**	**70**

Unit I **6 Hrs**

1. Basic principles of cell injury and adaptation:

a) Causes, Pathogenesis and morphology of cell injury

b) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen storage diseases

Unit II **8 Hrs**

2. Inflammation:

a) Pathogenesis of acute inflammation, chemical mediators in inflammation, types of chronic inflammation

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

Unit III **10 Hrs**

3. Diseases of immunity:

a) Introduction to Tand B cells

b) MHC proteins or transplantation antigens

c) Immune tolerance

- Hypersensitivity

Hypersensitivity type I, II, III, IV, biological significance, allergy due to food, chemicals and drugs

Autoimmunity

Criteria for autoimmunity, classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft.

Acquired immune deficiency syndrome (AIDS)

Amylodosis

Unit IV **6 Hrs**

4. Cancer

Differences between benign and malignant tumors, histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.

Unit V **8 Hrs**

5. Types of shock, mechanisms, stages and management

6. Biological effects of radiation

7. Environmental and nutritional diseases

i) Air pollution and smoking- SO_2, NO, NO_2, and CO ii) Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation

Unit VI **28 Hrs**

8. Pathophysiology of common diseases:

a. Parkinsonism
b. Schizophrenia
c. Depression and mania
d. Hypertension,
e. Stroke (ischaemic and hemorrhage)
f. Angina, CCF, atherosclerosis, myocardial infarction
g. Diabetes mellitus
h. Peptic ulcer and inflammatory bowel diseases
i. Cirrhosis and alcoholic liver diseases
j. Acute and chronic renal failure
k. Asthma and chronic obstructive airway diseases

Unit VII **9 Hrs**

9. Infectious diseases

Sexually transmitted diseases (HIV, Syphilis, Gonorrhea), urinary tract infections, pneumonia, typhoid, tuberculosis, leprosy, malaria, dysentery (bacterial and amoebic), hepatitis-infective hepatitis.

Second Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PBT 2.2 T**
COURSE TITLE	**PHARMACEUTICAL MICROBIOLOGY (Theory)**
SCOPE/SUMMARY	**COs**
This course deals with various aspects of microorganisms, classification, morphology, laboratory cultivation identification and maintenance. It also discusses with sterilization of pharmaceutical products, equipment, media etc. The course further discusses the immunological preparations, diseases its transmission, diagnosis, control and immunological tests.	Upon completion of the subject student shall be able to – 1. Know the anatomy, identification, growth factors and sterilization of microorganisms; 2. Know the mode of transmission of disease causing microorganism, symptoms of disease, and treatment aspect; 3. Do estimation of RNA and DNA and there by identifying the source; 4. Do cultivation and identification of the microorganisms in the laboratory; 5. Do identification of diseases by performing the diagnostic tests; and 6. Appreciate the behavior of motility and behavioral characteristics of microorganisms.

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				25	25	25	
1	Student will know the biology of microscopic organisms, understand classification of microbes, various methods for classification and relationship among them	Unit I (5 Hrs)	7	4			3
2	Student will learn about growth, cultivation and nutritional requirements of microbes. Student will particularly study different media required for the growth of aerobic and anaerobic bacteria & fungi. Student will learn about maintenance of laboratory cultures	Unit II (15 Hrs)	30	11			19
3	Student will understand various physical and chemical methods of sterilization and be able to compare their merits and demerits. Student will learn various sterilization techniques employed for pharmaceutical products and to study of various indicators employed for sterility testing and validation.	Unit III (15 Hrs)	30	10	5		15
4	Student will study about chemical control of microorganisms using disinfectants and antiseptics Student will understand various factors influencing anti-microbial chemical agents Student will study various methods employed for evaluation of bacteriostatic, bactericidal and virucidal activities of various chemical agents	Unit IV (10 Hrs)	20		10	-	10

	Student will learn about evaluation of preservatives in pharmaceutical preparations.						
5	Student will study basic principles of Immunology and understand about various molecules that stimulate immune response. Student will study the structure and formation of antibodies, antigen-antibody interactions and various factors influencing antigen-antibody complex Student will study the differences between bacterial exotoxins and endotoxins Student will understand the role of toxoids in inducing immune responses	Unit V (15 Hrs)	30		10	10	10
6	Student will study various infectious diseases viz., Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis, Gonorrhea and HIV Student will understand various tests viz., Schick's Test, Elisa test, Western Blot test, Southern Blot, PCR, Widal, QBC, Mantaux, Peripheral smear to diagnose various diseases. Student will understand biology of malaria	Unit VI (10 Hrs)	20			10	10
7	Student will understand principles of various methods employed to analyze the compounds or substances that have an impact on microorganisms and understand the results of various microbiological assays Student will study the preparation and standardization of vaccines and sera	Unit VI (5 Hrs)	8			5	3
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **5 Hrs**

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

Unit II **15 Hrs**

Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures.

Unit III **15 Hrs**

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

Unit IV **10 Hrs**

Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agent's factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations.

Unit V **15 Hrs**

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.

Unit VI **10 Hrs**

Diagnostic tests: Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite.

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

Unit VII **5 Hrs**

Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B_2 and B_{12}.

Second Year PharmD Degree Program	
COURSE CODE	**PBT 2.2L**
COURSE TITLE	**PHARMACEUTICAL MICROBIOLOGY LAB**

SYNOPSIS	COs
Pharmaceutical Microbiology lab course is designed to make the students to learn the ways and means of culturing, staining and identification methods of microorganisms – tools to evaluate the sterility testing of a Pharmaceutical product. To learn various microbiological assays, which helps in determination of the simplest anti-biotic suitable for patient recovery. Learn to perform diagnostic tests for widal and malarial parasite.	Upon completion of this course the student will be able to: 1. Practice aseptic techniques and work in microbiology laboratory 2. Culture, stain, and identify the microorganisms. 3. Perform the microbiological assays of antibiotics. 4. Do sterility testing for Pharmaceutical products. 5. Perform diagnostic tests for widal and malarial parasite.

Second Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCO 2.3T**
COURSE TITLE	**PHARMACOGNOSY & PHYTOPHARMACEUTICALS (Theory)**

SYNOPSIS	COs
This subject has been introduced for the pharmacy course in order to make the student aware of medicinal uses of various naturally occurring drugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.	Upon completion of this course the student should be able to: 1. Understand the scope of Pharmacognosy, identification, basic principles of cultivation, collection and storage of crude drugs including adulteration. 2. Know the source, active constituents and uses of crude drugs 3. Appreciate the applications of primary and secondary metabolites of the plant. 4. Gain knowledge on natural pesticides in overcoming the various complication and health hazards of synthetic pesticides 5. Understand importance of surgical fibers and dressing.

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn the history, scope and development of Pharmacognosy, classification of crude drugs**.** Student will study about cell wall constituents and cell inclusions.	Unit I (10 Hrs)	20	12			08
2	Student will learn about anatomical and powder microscopical study of crude drugs.	Unit II (12Hrs)	23	13			10
3	Student will learn about cultivation, collection, processing and storage of crude drugs**.** Student will learn about different methods of adulteration of crude drugs.	Unit III (10 Hrs)	20		12		08
4	Student will learn in detail about methods of cultivation of crude drugs. Study of Natural Pesticides.	Unit IV (12 Hrs)	22		13		09
5	Student will learn about cell constituents**,** definition, sources, method of extraction, chemistry, methods of analysis of lipids, oils.	Unit V (10 Hrs)	20			12	08
6	Student will study in detail about carbohydrates containing drugs.	Unit VI (12 Hrs)	22			13	09
7	Student will study in detail about definition, classification, chemistry and method of analysis of proteins. Also study about plant fibers used in surgical dressings and related products.	Unit VII (09 Hrs)	18				18
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT I: **10 Hrs**

Introduction. Definition, history, scope and development of Pharmacognosy. Classification of crude drugs**.** Study of cell wall constituents and cell inclusions.

UNIT II: **12 Hrs**

Anatomical and powder microscopical study of crude drugs.

UNIT III: **10 Hrs**

Cultivation, collection, processing and storage of crude drugs**.** Different methods of adulteration of crude drugs.

UNIT IV: **12 Hrs**

Detailed methods of cultivation of crude drugs. Study of Natural Pesticides.

UNIT V: **10 Hrs**

Detailed study of various cell constituents**.** Definition, sources, method of extraction, chemistry and method of analysis of lipids. Detailed study of oils.

UNIT VI: **12 Hrs**

Detailed study of carbohydrates containing drugs.

UNIT VII: **9 Hrs**

Definition, classification, chemistry and method of analysis of proteins. Study of plant fibers used in surgical dressings and related products.

Second Year PharmD Degree Program	
COURSE CODE	**PCO 2.3L**
COURSE TITLE	**PHARMACOGNOSY & PHYTOPHARMACEUTICALS LAB**

SYNOPSIS	**COs**
This subject has been included in the pharmacy course in order give the students hands on training on identification of crude drugs by morphology, microscopy, chemical tests and quantitative analysis.	Upon completion of this course the student should be able to: 1. Identify crude drugs studied in the theory for their morphological and anatomical characters. 2. Perform chemical tests for identification of unorganized drugs and analysis of lipids.

Second Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PHA 2.4T**
COURSE TITLE	**PHARMACOLOGY-I (Theory)**

SYNOPSIS	COs
This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, hormones and renal system will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.	Upon completion of this course the student should be able to: 1. Apply and appreciate the pharmacokinetic and Pharmacodynamic principles of Drug actions. 2. Demonstrate knowledge to understand the pharmacological actions of drugs effecting ANS, CVS, CNS, Respiratory, Endocrine system and Autocoids 3. Correlate and apply the knowledge theoretically 4. Apply the learnt drug knowledge to clinical situations

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn the historical perspectives and scope of pharmacology as well as sources of drugs, route of administration and Pharmacokinetic principles of drug action.	Unit I (10 Hrs)	20	12			08
2	Students will learn the pharmacodynamic principles of drug action including general principles of adverse drug reactions and drug interactions and an outline of drug discovery and development process. Students will learn the classification, mechanism of action, pharmacokinetics, pharmacodynamics, and therapeutic uses of parasympathetic drugs and parasympatholytic drugs.	Unit II (12Hrs)	23	13			10

3	Students will learn about sympathomimetics, sympatholytic drugs used in myasthenia gravis, glaucoma, skeletal muscle relaxants, antihypertensive and antianginal drugs.	Unit III (10 Hrs)	20		12		08
4	Students will learn about hemodynamic and electrophysiology of heart, pharmacological principles of drugs affecting congestive heart failure, antiarrhythmic and anti-hyperlipidemic drugs also drugs that modulate respiratory system	Unit IV (12 Hrs)	22		13		09
5	Students will learn the about the general pharmacological principles of hormones. Also, will understand the classification and application of pharmacological principles of drugs modulating endocrine system.	Unit V (11 Hrs)	24			12	12
6	Learners Will understand the drugs acting on the central nervous systems such as anesthetics and pre-anesthetic medication. Also, understand the pharmacology of alcohol, sedatives-hypnotics, antiepileptics, psychotropic drugs, analgesics and anti-inflammatory CNS stimulants and cognitive enhancers.	Unit VI (15 Hrs)	29			13	16
7	Students will learn the physiological and pathological roles of local hormones and drugs modulating it.	Unit VII (05 Hrs)	7				7
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: General Pharmacology **10 Hrs**

a. Introduction, definitions and scope of pharmacology
b. Routes of administration of drugs
c. Pharmacokinetics (absorption, distribution, metabolism and excretion)

Unit II General Pharmacology and Pharmacology of drug acting on Cholinergic system **12 Hrs**

a. Pharmacodynamics
b. Factors modifying drug effects

c. Drug toxicity - Acute, sub- acute and chronic toxicity.
d. Pre-clinical evaluations
e. Drug interactions
f. Cholinergic drugs
g. Anticholinergic drugs

Unit III: Pharmacology of drugs acting on ANS and CVS **10 Hrs**

a. Adrenergic and antiadrenergic drugs
b. Neuromuscular blockers
c. Drugs used in myasthenia gravi
d. Antihypertensives
e. Anti-anginal drugs

Unit IV: Pharmacology of drugs acting on CVS and Respiratory system **12 hours**

a. Anti-arrhythmic drugs
b. Drugs used for therapy of Congestive Heart Failure
c. Drugs used for hyperlipidaemias
d. Bronchodilators
e. Mucolytics
f. Expectorants
g. Antitussives
h. Nasal Decongestants

Unit V: Pharmacology of Hormones and Hormone antagonists **10 Hrs**

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

Unit VI: Pharmacology of drugs acting on CNS **12 Hrs**

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

Unit VII: Pharmacology of autocoids and their antagonists **9 Hrs**

a. Histamines and Antihistaminics

b. 5-Hydroxytryptamine and its antagonists

c. Lipid derived autocoids and platelet activating factor

Second Year PharmD Degree Program **Courses, Course Outcome (COs), Course Content and Assessment Plan**	
COURSE CODE	**PPR 2.5 T**
COURSE TITLE	**Community Pharmacy (Theory)**

SYNOPSIS	**COs**
This course is designed to impart basic knowledge and skills that are required to practice the profession of pharmacy in the community settings.	On completion of the course, the student shall be able to – 1. Know pharmaceutical care service 2. Know the business and professional practice management skills in community pharmacies; 3. Understand the patient counselling & health screening services to public in community pharmacy 4. Respond to minor ailments and provide appropriate medication 5. Show empathy and sympathy to patients; and 6. Appreciate the concept of rational drug therapy

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52% of marks of assessment)			University Examination (48% of marks of assessment)
				S1	S2	S3	
1	Student will understand the concept of community pharmacy and requirements to set up a community pharmacy	Unit I (07 Hrs)	20	10			10
2	Student will understand the concept of prescription and its legality and recognize medication related problems. Student will learn the inventory control and pharmaceutical care process in community pharmacy	Unit II (08 Hrs)	23	12			11

3	Student will understand the process of patient counseling and preparation of patient information leaflets. Student will learn the concept of medication adherence and pharmacist role in health screening	Unit III (10 Hrs)	30	03	12		15
4	Student will understand the concept over-the-counter (OTC) medication, essential drugs, rational drug use and code of ethics	Unit IV (06 Hrs)	17		09		08
5	Student will comprehend the role pharmacist in health education learn the various communicable diseases.	Unit V (13 Hrs)	38		04	16	18
6	Student will understand the pathophysiology and common drug therapy when responding to symptoms of minor ailments.	Unit VI (06 Hrs)	17			09	08
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **07 Hrs**

Community pharmacy

Definition, scope, roles and responsibilities of community pharmacist.

1. Community pharmacy management

   Selection of site, space layout, and design

   a. Staff, materials- coding, stocking
   b. Legal requirements
   c. Maintenance of various registers
   d. Use of Computers: Business and healthcare software's

Unit II: **08 Hrs**

2. Prescriptions

   Parts of prescription, legality & identification of medication related problems like drug interactions.

3. Inventory control in community pharmacy

   Definition, various methods of inventory control.

   ABC, VED, EOQ, Lead time, safety stock.

4. Pharmaceutical care

Definition and principles of pharmaceutical care

Unit III **10 Hrs**

5. Patient counselling

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

6. Patient medication adherence

Definition, factors affecting medication adherence, role of pharmacist in improving the adherence

7. Health screening services

Definition, importance, methods for screening, blood pressure/ blood sugar/ lung function and cholesterol testing

Unit IV **06 Hrs**

8. Over-the-counter (OTC) medications

Definition, OTC medication list & counselling

9. Essential drugs concept and rational drug therapy.

Role of community pharmacist

10. Code of ethics for community pharmacist

Unit V **13 Hrs**

11. 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

Unit VI **06 Hrs**

12. Responding to symptoms of minor ailments

Relevant pathophysiology, common drug therapy to: pain, GI disturbances (nausea, vomiting, dyspepsia, diarrhea, constipation), pyrexia, ophthalmic symptoms and worms infestations.

Second Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 2.6T**
COURSE TITLE	**PHARMACOTHERAPEUTICS-I (Theory)**

SYNOPSIS	**COs**
This course is designed to impart knowledge and skills necessary for practice of clinical pharmacy and the promotion of rational use of medicines. Chapters cover mainly pharmacotherapy of major diseases with brief pathophysiology. This will enable the student to understand and practice evidence-based pharmacy for the disease management.	The student shall be able to understand: 1. Therapeutic approach to the management of cardiovascular, endocrine, respiratory and ophthalmic diseases 2. Treatment objectives for the individual patients and the diseases 3. Importance of developing individualized therapeutic plans 4. Prescribing guidelines for the special populations 5. Patient-specific parameters for selection, initiation and monitoring of drug therapies 6. Most recent updates in relevant treatment guidelines

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (*52 % of total marks of assessment)*			University Examination (*48 % of total marks of assessment)*
				S1	S2	S3	
1	Student will learn pharmacotherapy of major disease conditions affecting cardiovascular system and understand electrophysiology of heart and arrhythmias	Unit I (26 Hrs)	50	14	12		24
2	Student will understand various pulmonary function tests and learn pharmacotherapy of major diseases affecting respiratory system including drug induced pulmonary diseases	Unit II (14 Hrs)	27	11	03		13
3	Student will learn pharmacotherapy of major endocrine diseases such as diabetes and thyroid diseases	Unit III (8 Hrs)	16		10		06

4	Student will understand the concept of oral contraceptives and hormone replacement therapy and pharmacotherapy of osteoporosis	Unit IV (8 Hrs)	16			11	05
5	Student will understand the general prescribing guidelines for special population such as pediatrics, geriatrics, pregnant and lactating women	Unit V (5 Hrs)	10			07	03
6	Student will learn pharmacotherapy of ophthalmic diseases such as glaucoma and conjunctivitis	Unit VI (5 Hrs)	10			07	03
7	Student will understand the concept of rational drug use and essential drugs	Unit VII (9 Hrs)	16				16
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

(Etiopathogenesis and pharmacotherapy of diseases associated with following systems)

Unit I **28 Hrs**

Cardiovascular system: hypertension, congestive cardiac failure, angina pectoris, myocardial infarction, dyslipidemia, electrophysiology of heart and arrhythmias

Unit II **15 Hrs Respiratory system:** introduction to pulmonary function test, asthma, chronic obstructive airways disease,
drug induced pulmonary diseases

Unit III **18 Hrs**

Endocrine system: diabetes, thyroid diseases, oral contraceptives, hormone replacement therapy, osteoporosis

Unit IV **5 Hrs**

General prescribing guidelines for

a. Pediatric patients
b. Geriatric patients
c. Pregnancy and breast feeding

Unit V **5 Hrs**

Ophthalmology: Glaucoma, conjunctivitis (viral and bacterial)

Unit VI **4 Hrs**

Introduction to rational drug use (RDU): Definition, role of pharmacist in RDU, essential drug concept, rational drug formulations

Second Year PharmD Degree Program	
COURSE CODE	**PPR 2.6L**
COURSE TITLE	**PHARMACOTHERAPEUTICS-I Lab**
SYNOPSIS	**COs**
This course is designed to develop the skills necessary for the practice of clinical pharmacy. The course content involves team- and problem-based learning of therapeutic cases with presentations and discussion, which enable the candidate to develop self-learning and independent decision-making abilities	On completion of the course, the student shall be able to : 1. Develop individualized therapeutic plans for patients with cardiovascular, endocrine and respiratory diseases 2. Interpret patient-specific parameters for selection, initiation, and monitoring of drug therapies of individual cases 3. Apply core concept of case-based learning of pharmacotherapeutics with most recent evidencebased consensus guidelines for the management of the cases

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University Examination (*70 % of total marks of assessment)*
			S1	S2		
1	Student will learn the pharmacotherapy of cardiovascular diseases (CVD) through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor CVD cases with presentations and group discussions	Unit I (35Hrs)	18		10	70
2	Student will learn the pharmacotherapy of respiratory diseases through a case-based learning approach. Develop therapeutic skills via problembased learning of major and minor cases with presentations and group discussions	Unit II (15 Hrs)	2	6		

3	Student will learn the pharmacotherapy of endocrine diseases through a case-based learning approach. Develop therapeutic skills via problem based learning of major and minor cases with presentations and group discussions	Unit III (25 Hrs)		14		
Total Marks of assessment			**(Average of two sessional exams) 20**		**10**	**70**

Unit I

35Hrs

Major and minor case studies/presentations on

Cardiovascular system: Hypertension, Dyslipidaemias, Congestive cardiac failure, Angina pectoris, Myocardial infarction and Arrhythmia.

Unit II 15Hrs

Major and minor case studies/presentations on

Respiratory system: Asthma, Chronic obstructive airways disease and Drug induced pulmonary diseases.

Unit III 25Hrs

Major and minor case studies/presentations on

Endocrine system: Diabetes (Type 1 and Type 2), Thyroid diseases (Hyper and hypo) and Osteoporosis

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PHA 3.1T**
COURSE TITLE	**PHARMACOLOGY-II (Theory)**

SYNOPSIS	**COs**
This subject will provide an opportunity for the student to learn about drugs with respect to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, drugs acting on blood, renal, immune system and molecular pharmacology will be dealt. In addition, pharmacology of chemotherapeutic agents, vitamins, essential minerals and principles of toxicology will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.	Upon completion of this course the student should be able to: 1. Understand the pharmacological aspects of drugs falling under the below mentioned chapters 2. Appreciate the importance of pharmacology subjects as a basis of therapeutics. 3. Correlate and apply the knowledge in therapeutics management. 4. Apply molecular tools to understand drug action and other therapeutic areas.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Exam (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn the classification, mechanism of action of anticoagulants, thrombolytics, antiplatelet agents, haemopoietics and plasma expanders.	Unit I (10 Hrs)	20	8			12
2	Students will appreciate the classification, mechanism of action, pharmacokinetics and therapeutic uses of diuretics and antidiuretics	Unit II (5Hrs)	10	5			5

3	Students will learn mechanism of action, pharmacokinetics and therapeutic uses of various classes of anti-microbial agents in general	Unit III (18 Hrs)	36	12			19
4	Students will learn mechanism of action, pharmacokinetics and therapeutic uses of various classes of anti-microbial agents for specific chemotherapy	Unit III (12 Hrs)	24		15		9
4	Students will learn the pharmacological actions of immune-suppressants and stimulants	Unit IV (5 Hrs)	10		5		5
5	Students will comprehend the general principles of animal toxicology	Unit V (5 Hrs)	10		5		5
6	Learners will understand the structures and functions of components of a cell	Unit VI (10 Hrs)	20			12	08
7	Students will learn the genome structure, function and drugs affecting it	Unit VII (10 Hrs)	20			13	07
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: Pharmacology of drugs acting on blood and blood forming agents **10 Hrs**

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

Unit II: Pharmacology of drug acting on Renal system **5 Hrs**

a. Diuretics
b. Antidiuretics

Unit III Chemotherapy **30 Hrs**

a. Introduction
b. Sulfonamides and co-trimoxazole
c. Penicillins and Cephalosporins
d. Tetracyclines and Chloramphenicol
e. Macrolides, Aminoglycosides, Polyene and Polypeptide Antibiotics
f. Quinolones and Fluroquinolones
g. Anti-fungal antibiotics
h. Antiviral agents
i. Chemotherapy of tuberculosis and leprosy
j. Chemotherapy of malaria

k. Chemotherapy of protozoal infections (amoebiasis, giardiasis)
l. Pharmacology of anthelmintic drugs
m. Chemotherapy of Cancer (Neoplasms)

Unit IV: Immunopharmacology **5 Hrs**

a. Pharmacology of immune-suppressants and stimulants

Unit IV: Principles of animal toxicology **5 Hrs**

a. Acute toxicity
b. Sub- acute toxicity
c. Chronic toxicity

Unit VI: Dynamic cell: Structures and functions of components **10 Hrs**

a. Cell and macromolecules
b. Chromosome structure
c. DNA replication
d. Cell cycle
e. Cell signaling

Unit VII: The Gene: Genome structure and function **10 Hrs**

a. Gene structure
b. Gene expression
c. Transcription and transcription factors
d. Gene therapy and targeting
e. Recombinant technology

Third Year PharmD Degree Program	
COURSE CODE	**PHA 3.1L**
COURSE TITLE	**PHARMACOLOGY- II LAB**
SYNOPSIS	**COs**
This course is designed to impart basic knowledge on handling experimental animals, conducting bioassays and interpreting results from screening methods	Upon completion of this course the student shall be able to: • Understand the common laboratory animals used in experimental pharmacology, its handling and regulations governing them including physiological salt solutions, lab appliances employed in experiments • Gain knowledge about bioassays to determine the concentration of unknown samples provided and to appreciate the mechanism of drug action studied in theory • Understand theory, principle and methods involved in screening of different pharmacological activities and interpret results of simulated experiments

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	PQA3.2T
COURSE TITLE	PHARMACEUTICAL ANALYSIS (THEORY)

SYNOPSIS	**COs**
This course deals with the applications of instrumental methods for qualitative & quantitative analysis of drugs. The course is designed to impart a fundamental knowledge on the principle & instrumentation of spectroscopic, electrometric, chromatographic & other important analytical techniques. The course is also deals with quality control & quality assurance in pharmaceutical industry.	After completion of this course it is expected that students will be able to understand- 1. The concepts of quality assurance in pharmaceutical industry (Unit I). 2. Basic concepts of spectroscopy, instrumentation & applications of UV Visible spectroscopy (Unit IV). 3. Basics of separation science and advanced instrumentation in chromatography (Unit II). 4. Concepts of electrochemical methods of analysis and instrumentation of potentiometry, polarography and conductometry (Unit III). 5. Principle, instrumentation and applications of IR, fluorimetry and X-Ray diffraction (Unit V). 6. Principle, instrumentation and applications of NMR, ESR, AAS, AES & flame photometry (Unit VI). 7. Principle, instrumentation and applications of polarimetry, thermal methods of analysis, electrophoresis & mass spectrometry (Unit VII).

Course Content and Assessment Plan

Sl. No.	**Course Content**	**Syllabus (Chapters or Units with hours)**	**Total Marks of assessment**	**Distribution of marks of assessment**			
				Sessional exam (*30 % of total marks of assessment)*			**End Sem exam** (*70 % of total marks of assessment)*
				S1	S2	S3	
1	Students will learn the concepts of quality assurance in pharmaceutical industry such as GLP, QMS, Validation, regulatory guidelines of ICH & functions of QA & QC departments.	Unit I (12 Hrs)	23	13			10
2	Students will learn the fundamentals of spectroscopy such as theory, Beer-Lamberts law, principle, instrumentation & applications of UV Visible spectroscopic technique for quantitative & qualitative analysis of pharmaceuticals.	Unit IV (10 Hrs)	20	12			08

3	Students will learn the principle, instrumentation & applications of column chromatography, paper chromatography, HPLC & GC for quantitative & qualitative analysis of pharmaceuticals.	Unit II (12 Hrs)	22		13		09
4	Students will learn the principle, instrumentation & applications of electrochemistry such as potentiometry, polarography & conductometry for quantitative & qualitative analysis of pharmaceuticals.	Unit III (10 Hrs)	20		12		08
5	Students will learn the principle, instrumentation & applications of IR, fluorimetry and X-Ray diffraction for quantitative & qualitative analysis of pharmaceuticals.	Unit V (10 Hrs)	20			12	08
6	Students will learn the principle, instrumentation & applications of NMR, ESR, AAS, AES & flame photometry- for quantitative & qualitative analysis of pharmaceuticals.	Unit VI (12 Hrs)	22			13	09
7	Students will learn the principle, instrumentation & applications of polarimetry, thermal methods of analysis, electrophoresis & mass spectrometry.	Unit VII (9 Hrs)	18				18
		Total Marks of Assessment	145	25	25	25	70

Unit I: Quality Assurance: **12 Hrs**

a. Introduction, sources of quality variation, control of quality variation (2Hrs).
b. Concept of statistical quality control (2Hrs).
c. Validation: Calibration and qualification of equipment and validation of analytical methods.(2Hrs).
d. GLP, ISO 9000, 9001 and 14001 and auditing procedures (2Hrs).
e. Total quality management, quality review and documentation (2Hrs).
f. ICH- international conference for harmonization-guidelines (2Hrs).

Unit II: Chromatography: **12 Hrs**

a) Classification and principle of chromatography (1Hr).
b) Column Chromatography (1Hr).
c) TLC (1Hr).
d) Paper Chromatography (1Hr).
e) Ion-exchange chromatography (1Hr).
f) Gel filtration and affinity chromatography (1Hr).
g) HPTLC (1Hr).

h) Gas Chromatography (3Hrs).

i) HPLC (2Hrs).

Unit III: Electrometric Methods: **10Hrs**

a. Potentiometry (4Hrs).

b. Conductometry (2Hrs).

c. Polarography (3Hrs)

d. Amperometric Titrations (1Hr).

Unit IV: Spectroscopy: **10 Hrs**

a. Spectroscopy Theory (5Hrs).

b. UV-Visible Spectroscopy (5Hrs)

Unit V: Spectroscopy continued: **10 Hrs**

a. Infrared Spectroscopy (5Hrs).

b. Fluorimetry (3Hrs).

c. X-RAY Diffraction: (Basic concepts only) (2Hrs).

Unit VI: Spectroscopy continued: **12 Hrs**

a. NMR (Basic concept only) (4Hrs).

b. ESR (2h).

c. Atomic Absorption Spectrometry (2Hrs).

d. Atomic Emission Spectroscopy (2Hrs).

e. Flame Photometry (2Hrs).

Unit VII: Other Techniques: **9 Hrs**

a. Mass Spectrometry: (Introduction only) (3Hrs).

b. Polarimetry: (Introduction only) (2Hrs).

c. Thermal Analysis (2Hrs).

d. Electrophoresis (2Hrs).

Third Year PharmD Degree Program	
COURSE CODE	**PQA 3.2L**
COURSE TITLE	**PHARMACEUTICAL ANALYSIS LAB**

SYNOPSIS	**COs**
To understand the operations of advanced analytical instruments and to perform qualitative and quantitative analysis.	Upon completion of the course the student shall be able to: 1. Learn the operation of advanced instruments and documentation. 2. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 3.3T**
COURSE TITLE	**Pharmacotherapeutics – II (Theory)**

SYNOPSIS	**COs**
This course is designed to impart knowledge and skills necessary for practice of clinical pharmacy and the promotion of rational use of medicines. Chapters cover mainly pharmacotherapy of major diseases with brief pathophysiology. This will enable the student to understand and practice evidence-based pharmacy for the disease management.	Upon completion of the course, the student shall be able to understand: 1. Therapeutic approach to the management of infectious disease, renal disorders, musculoskeletal disorders, dermatology and cancer 2. Treatment objectives for the individual patients and the diseases 3. Importance of developing individualized therapeutic plans 4. Prescribing guidelines for the special populations 5. Patient-specific parameters for selection, initiation and monitoring of drug therapies 6. Most recent updates in relevant treatment guidelines

Course Outcome and its Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Students will learn guidelines for the rational use of antibiotics and surgical prophylaxis and pharmacotherapy of various infectious diseases such as malaria, UTI, HIV,TB, RTI and Protozoa infections	Unit I (12 Hrs)	23	13			10
2	Students will understand about various renal function tests and learn pharmacotherapy of major diseases affecting renal disorders and also drug induced renal disorder	Unit II (10Hrs)	20	12			08
3	Students will learn diagnosis, clinical manifestation and pharmacotherapy of various infectious diseases such as gastroenteritis, fungal and viral infections, endocarditis, septicemia, meningitis, gonarrhoea and syphilis	Unit III (12 Hrs)	22		13		09

4	Students will learn pharmacotherapy of major diseases affecting musculoskeletal disorders such as rheumatoid arthritis, osteoarthritis, gout, spondylitis and SLE	Unit IV (10 Hrs)	20		12		08
5	Students will learn and understand basic principles of cancer therapy and introduction to cancer chemotherapeutic agents	Unit V (12 Hrs)	22			13	09
6	Students will learn management of chemotherapy nausea and emesis chemotherapy of breast cancer, leukemia.	Unit VI (10 Hrs)	20			12	08
7	Students will learn pharmacotherapy of major diseases affecting dermatology such as psoriasis, scabies, eczema and impetigo	Unit VII (09 Hrs)	18				18
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Etiopathogenesis and pharmacotherapy of diseases associated with following systems:

UNIT I **12 Hrs**

Infectious disease: Guidelines for the rational use of antibiotics and surgical prophylaxis, malaria, urinary tract infections, HIV & opportunistic infections, protozoal infection, respiratory tract infections and tuberculosis.

UNIT II **10 Hrs**

Renal system Acute renal failure, chronic renal failure, renal dialysis and drug induced renal disorders.

UNIT III **12 Hrs**

Infectious disease: Gastroenteritis, fungal infections, viral infections, endocarditis, septicemia, meningitis, gonarrhoea and syphillis.

UNIT IV **10 Hrs**

Musculoskeletal disorders: Rheumatoid arthritis, osteoarthritis, gout, spondylitis and systemic lupus erythematosus.

UNIT V **12 Hrs**

Oncology: Basic principles of cancer therapy, general introduction to cancer chemotherapeutic agents,

UNIT IV **10 Hrs**

Management of chemotherapy nausea and emesis, chemotherapy of breast cancer, leukemia.

UNIT VII **9 Hrs**

Dermatology: Psoriasis, scabies, eczema and impetigo.

Third Year PharmD Degree Program	
COURSE CODE	**PPR 3.3L**
COURSE TITLE	**PHARMACOTHERAPEUTICS II Lab**
SYNOPSIS	**COs**
This course is designed to develop the skills necessary for the practice of clinical pharmacy. The course content involves team- and problem-based learning of therapeutic cases with presentations and discussion, which enable the candidate to develop selflearning and independent decisionmaking abilities	On completion of the course, the student shall be able to : 1. Develop individualized therapeutic plans for patients with Infectious disease, Renal disease diseases Musculoskeletal disorder, cancer and dermatological disorder 2. Interpret patient-specific parameters for selection, initiation, and monitoring of drug therapies of individual cases 3. Apply core concept of case-based learning of pharmacotherapeutics with most recent evidencebased consensus guidelines for the management of the cases 4. Learn skills for carrying out patient counselling and prescription audit

Course Content and Assessment Plan

Sl. No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University Examination (*70 % of total marks of assessment)*
			S1	S2		
1	Student will learn the pharmacotherapy of infectious & renal disease through a casebased learning approach. Develop therapeutic skills via problem-based learning of major and minor cases with presentations and group discussions. Learn how to provide patient counselling	Unit1 (40Hrs)	20		10	70

2	Student will learn the pharmacotherapy of cancer, musculoskeletal & dermatological diseases through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor cases with presentations and group discussions. Learn how to carryout prescription audit in the given prescriptions	Unit II (35Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I

1. Problem based learning-Case Study and SOAP Analysis for the following topic: Infectious disease, Renal disease
2. Patient Counselling

Unit II

3. Problem based learning-Case Study and SOAP analysis for the following topic Musculoskeletal disorder, cancer and dermatological disorder
4. Prescription audit

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PRM 3.4T**
COURSE TITLE	**PHARMACEUTICAL JURISPRUDENCE (Theory)**
SYNOPSIS	**COs**
This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India	Upon completion of this course the student shall be able to: 1. To understand the various concepts of the Pharmaceutical Legislation in India and about Code of pharmaceutical ethics. 2. To understand the various aspects of the Drug and Cosmetic Act and Rules. 3. To understand the provisions of the Pharmacy Act, Medicinal and Toilet Preparations Act and Narcotic and Psychotropic Substances Act. 4. To know the salient features of Drugs and Magic Remedies Act, Essential Commodities Act, DPCO and Prevention of Cruelty to animals Act. 5. To know about Patents and Designs.

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will gain knowledge about history of Pharmaceutical Legislations, Code of Pharmaceutical Ethics	Unit I (8 Hrs)	24	10			14
2	Student will analyze Drugs and Cosmetics Act	Unit II (16 Hrs)	45	15	10		20
3	Student will appreciate the importance of Education Regulations, provisions related to registration of pharmacists; learn about provisions of Medicinal and Toilet preparations Act; Narcotic Drugs and Psychotropic Substances Act	Unit III (12 Hrs)	36		10	05	21
4	Student will about learn advertisement regulations, understand drug policy and pricing of pharmaceutical products, regulations related to Prevention of Cruelty to Animals Act	Unit IV (10 Hrs)	30		05	15	10
5	Student will gain knowledge about Patents and Designs; learn the difference between prescription and non-prescription drugs	Unit V (4 Hrs)	10			05	05
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I:

1. Pharmaceutical Legislations – A brief review. 4 Hrs

2. Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics

drafted by PCI. 4 Hrs

Unit II:

3. Drugs and Cosmetics Act, 1940, and its rules 1945. 16 Hrs

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 And Cosmetics Provisions Relating to Indigenous Systems. Constitution and Functions of DTAB,DCC,CDL. Qualification and duties –Govt. analyst and Drugs Inspector.

Unit III

4. Pharmacy Act –1948. 4 Hrs

Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER.

5. Medicinal and Toilet Preparation Act –1955. 4 Hrs

Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.

6. Narcotic Drugs and Psychotropic Substances Act-1985 and Rules. 4 Hrs

Objectives, Legal Definitions, General Study, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and regulations, Schedules to the Act.

Unit IV

7. Study of Salient Features of Drugs and magic remedies Act and its rules. 2 Hrs
8. Study of essential Commodities Act Relevant to drugs price control Order. 2 Hrs
9. Drug Price Control Order & National Drug Policy (Current). 4 Hrs
10. Prevention of Cruelty to animals Act-1960. 2 Hrs

Unit V

11. Patents & design Act-1970. 2 Hrs
12. Brief study of prescription and Non-prescription Products. 2 Hrs

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCH 3.5T**
COURSE TITLE	**MEDICINAL CHEMISTRY (Theory)**

SYNOPSIS	**COs**
The course is framed to impart fundamental knowledge and insight on Modern concept of rational drug design including QSAR, prodrugs, combinatorial chemistry and computer aided drug design. The course emphasizes on learning structures along with their mechanism of action, therapeutic values, chemistry, SAR and synthesis of specific drugs.	Upon completion of this course the student should be able to: 1. Understand the Principle s of Modern concepts of rational drug design. 2. Understand the chemistry and mechanism of action of drugs along with their pharmacological activity 3. Know the SAR of different classes of drugs 4. Study the chemical synthesis of selected drugs

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will know the concept of QSAR, prodrugs, combinatorial chemistry, CADD and concept of antisense molecules	Unit I (5 Hrs)	10	06			04
2	Student will know the development, classification, MOA, Nomenclature, synthesis, uses, SAR of Local anti-infective agents, preservatives, antifungal agents, UT antiinfectives, anti-tubercular agents, anti-viral and anti AIDS drugs.	Unit II (15Hrs)	29	16			13
3	Student will know the development, classification, MOA, Nomenclature, synthesis, uses, SAR of Anti-protozoals, anthelmintics, sulphonamides & sulphones, anti-malarials and anti-biotics	Unit III (20Hrs)	38	03	17		18

4	Student will know the development, classification, MOA, Nomenclature, synthesis, uses, SAR of Antineoplastic agents and diagnostic agents	Unit IV (10 Hrs)	19		08	04	07
5	Student will know the development, classification, MOA, Nomenclature, synthesis, uses, SAR of Cardiovascular agents and diuretics	Unit V (15 Hrs)	29			17	12
6	Student will know the development, classification, MOA, Nomenclature, synthesis, uses, SAR of Hypoglycemics	Unit VI (5 Hrs)	10			02	08
7	Student will know the development, classification, MOA, Nomenclature, synthesis and uses of Thyroid & antithyroid drugs and steroidal hormones and adrenocortecoids	Unit VII (5 Hrs)	10			02	08
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: Modern concepts of rational drug design

Unit II: Local anti-infective agents, preservatives, antifungal agents, UT anti-infectives, anti-tubercular agents, anti-viral and anti AIDS drugs

Unit III: Anti-protozoals, anthelmintics, sulphonamides & sulphones, anti-malarials and anti-biotics

Unit IV: Antineoplastic agents and diagnostic agents

Unit V: Cardiovascular agents and diuretics

Unit VI: Hypoglycemics

Unit VII: Thyroid & antithyroid drugs and steroidal hormones and adrenocortecoids.

Third Year PharmD Degree Program	
COURSE CODE	**PCH 3.5L**
COURSE TITLE	**MEDICINAL CHEMISTRY LAB**

SYNOPSIS	COs
Medicinal Chemistry Practical course deals with the preparation and analysis of medicinally important compounds and intermediates. Besides, it also deals with the determination of physicochemical properties of medicinally important compounds.	Upon completion of this course, the student will be able to: 1. Analyze medicinally important compounds as per pharmacopoeia procedure. 2. Synthesize, purify and characterize medicinally important compounds and intermediates. 3. Evaluate important physicochemical properties and determine drug likeness of compounds.

Third Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PCE 3.6T**
COURSE TITLE	**PHARMACEUTICAL FORMLATIONS (Theory)**

SYNOPSIS	COs
The subject deals with the formulation and evaluation of various pharmaceutical dosage forms	Upon completion of this course students should be able to: 1. Understand the principle involved in the formulation, prepare and evaluate pharmaceutical dosage forms, tablets and capsules 2. Understand the principle involved in the formulation, prepare and evaluate liquid orals, parenterals, ophthalmic and semisolid preparations 3. Understand the concepts in the development of novel and controlled release drug delivery systems

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Learners will understand the principle involved in formulation of various pharmaceutical dosage forms	Unit I (2 Hrs)	6	4			2
2	This course will help the learners to know formulation of tablets and the various	Unit II (10 Hrs)	29	15			14

	quality control tests for their evaluation						
3	It will help the students to know formulation of capsules and the various quality control tests for their evaluation	Unit III (9 Hrs)	26	6	7		13
4	Learners will study the formulation and evaluation of liquid dosage forms like suspension, emulsions and solutions	Unit IV (6 Hrs)	18		10		8
5	It will help the learners to study the formulation and evaluation of sterile dosage forms like parenterals and ophthalmic preparations.	Unit V (8 Hrs)	23		8		15
6	Learners will be able to understand the formulation of semi-solid dosage forms.	Unit VI (7 Hrs)	20			12	8
7	Students will understand concepts and different types of controlled and novel drug delivery systems	Unit VII (8 Hrs)	23			13	10
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: Pharmaceutical dosage form: concept and classification

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

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

Unit IV: Liquid orals: Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations

Unit V: Parenterals: Introduction Containers used for Parenterals (including official tests) Formulation of large and small volume Parenterals Sterilization

Unit VI: **Ophthalmic preparations (Semi – Solids):** Introduction and classification Factors affecting absorption and anatomy of skin Packaging storage and labeling, Ointments Types of Ointment Base Preparation of ointment, Jellies Types of jellies Formulation of jellies Suppositories, Method of preparation, Types Packaging

Unit VII: Novel Drug Delivery systems: Definition and concept of Controlled and novel Drug delivery systems with available examples, viz. parentral, trans dermal, buccal, rectal, nasal, implants, ocular

Third Year PharmD Degree Program	
COURSE CODE	**PCE 3.6L**
COURSE TITLE	**PHARMACEUTICAL FORMULATIONS LAB**

SYNOPSIS	COs
Pharmaceutical formulations lab involves the preparation of several types of pharmaceutical dosage forms and cosmetic products. The dosage forms are routinely assessed for various quality control tests to ascertain the quality of the preparations. Hence, with this course, the students will be able to learn the methods of preparation and evaluation of different types of dosage forms. They will also study the preparation of some common cosmetic products.	Upon completion of this course the student will be able to: 1. Prepare different types of pharmaceutical dosage forms and carry out the various quality control tests. 2. Prepare commonly used cosmetic products.

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.1T**
COURSE TITLE	**Pharmacotherapeutics III (Theory)**

SYNOPSIS	COs
This course is designed to impart knowledge and skills necessary for practice of clinical pharmacy and the promotion of rational use of medicines. Chapters cover mainly pharmacotherapy of major diseases with brief pathophysiology. This will enable the student to understand and practice evidence-based pharmacy for the disease management.	On completion of the course, the student shall be able to understand: 1. Therapeutic approach to the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management 2. Treatment objectives for the individual patients and the diseases 3. Importance of developing individualized therapeutic plans 4. Prescribing guidelines for the special populations 5. Patient-specific parameters for selection, initiation and monitoring of drug therapies 6. Most recent updates in relevant treatment guidelines

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (*52 % of total marks of assessment)*			University Examination (*48 % of total marks of assessment)*
				S1	S2	S3	
1	Student will learn and understand the pathophysiology and pharmacotherapy of gastrointestinal diseases	Unit I (15 Hrs)	29	15			14
2	Student will learn and understand the pathophysiology and pharmacotherapy of hematological disorders	Unit II (10 Hrs)	19	10			09
3	Student will learn and understand the pathophysiology and pharmacotherapy of Neurological Disorders.	Unit III (15 Hrs)	29		15		14
4	Student will learn various aspects of EBM approaches including EBM sources and literature evaluation	Unit IV (10 Hrs)	19		10		09
5	Student will learn and understand the pathophysiology and pharmacotherapy of psychiatric disorders.	Unit V (15 Hrs)	29			15	14

6	Student will learn and understand the various pathway including neuralgia, headache and its pharmacotherapy	Unit VI (10 Hrs)	20			10	10
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Etiopathogenesis and pharmacotherapy of disease associated with the following system / disease

Unit I **15 Hrs**

1. Gastrointestinal system: peptic ulcer disease, gastro esophageal disease, bowel disease, liver disorders - alcoholic liver disease, viral hepatitis including jaundice, and drug induced liver disorders

Unit II **10 Hrs**

2. Haematological system: anaemias, venous thromboembolism, drug induced blood disorders.

UNIT III **15 Hrs**

3. Nervous system: epilepsy, parkinsonism, stroke, alzheimer's disease,

Unit IV **10Hrs**

4. Evidence Based Medicine

UNIT V **15 Hrs**

5. Psychiatry disorders: schizophrenia disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders

UNIT VI **10 Hrs**

6. Pain management including pain pathways, neuralgias, headaches

Fourth Year PharmD Degree Program	
COURSE CODE	**PPR 4.1L**
COURSE TITLE	**PHARMACOTHERAPEUTICS III Lab**
SYNOPSIS	**COs**
This course is designed to impart knowledge and skills in developing therapeutic plan and provide pharmaceutical care for different types of patients using SOAP format	On completion of the course, the student shall be able to: 1. Understand therapeutic approach for the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management 2. Identify the treatment goals for specific disease and able to develop the individualized therapeutic plans 3. To identify the patient-specific parameters for selection, initiation and monitoring of drug therapies 4. Provide the feedback regarding the drug related issues to the physicians

Course Content and Assessment Plan						
SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University Examination (70 *% of total marks of assessment)*
			S1	S2		
1	Student will learn the pharmacotherapy of Gastrointestinal and Hematological system through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor Gastrointestinal and Hematological system related cases with presentations and group discussions	Unit 1 (35Hrs)	20		10	70
2	Student will learn the pharmacotherapy of Psychiatry and Nervous system through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor Psychiatry and Nervous system related cases with presentations and group discussions	Unit II (40Hrs)		20		
Total Marks of assessment		**Average of two sessional exams 20**			**10**	**70**

Unit I

Major and Minor Case Presentation on

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

2 Haematological system: Anaemias, Venous thromboembolism, Drug induced blood disorders.

Unit II

Major and Minor Case Presentation on

1. Nervous system: Epilepsy, Parkinsonism, Stroke, Alzheimer's disease,

2. Psychiatry disorders: Schizophrenia disorders, Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.2T**
COURSE TITLE	**HOSPITAL PHARMACY (Theory)**

SYNOPSIS	**COs**
The changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.	On completion of the course, the student shall be able to: 1. Know various drug distribution methods 2. Know the professional practice management skills in hospital pharmacies 3. Provide unbiased drug information to the doctors 4. Know the manufacturing practices of various formulations in hospital set up 5. Appreciate the practice based research methods 6. Appreciate the stores management and inventory control

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn and understand the concepts, organization, functions of hospital and hospital pharmacy and budget preparation for hospital pharmacy	Unit I (10 Hrs)	29	15			14
2	Student will understand the concept of hospital drug police, which includes PTC, formulary, infection control committee and ethical committee, development of therapeutic guidelines and newsletter	Unit II (10 Hrs)	29	10	05		14
3	Student will learn the hospital pharmacy services- purchase and inventory control	Unit III (6 Hrs)	17		09		08
4	Student will understand the methods of drug distribution. distribution of narcotics and concept of central sterile supply room	Unit IV (7 Hrs)	20		11		09
5	Student will learn and understand various manufacturing pharmaceutical preparations	Unit V (11 Hrs)	33			17	16

6	Student will understand the continuing professional development programs education and training, radiopharmaceuticals and professional relations and practice of hospital pharmacists	Unit VI (6 Hrs)	17			08	09
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **10Hrs**

1. Hospital - its organization and functions
2. Hospital Pharmacy-organization and management
   a) Organizational structure-staff, infrastructure & work load statistics
   b) Management of materials and finance
   c) Roles & responsibilities of hospital pharmacist

3. The Budget – Preparation and implementation

Unit II: **10Hrs**

4. Hospital drug policy
   a) Pharmacy and Therapeutic committee (PTC)
   b) Hospital formulary
   c) Hospital committees
   - Infection committee
   -Research and ethical committee
   d) Developing therapeutic guidelines
   e)Hospital pharmacy communication - Newsletter

Unit III: **6 Hrs**

5. Hospital pharmacy services
   a) Procurement & warehousing of drugs and pharmaceuticals
   b) Inventory control
      Definition, various methods of inventory control
      ABC, VED, EOQ, Lead time, safety stock

Unit IV: **7 Hrs**

6 Hospital Pharmacy Services
   a) Drug distribution in the hospital

i) Individual prescription method ii) Floor stock method iii) Unit dose drug distribution method

   b) Distribution of narcotic and other controlled substances
   c) Central sterile supply services – role of pharmacist

Unit V: **11 Hrs**

7. Manufacture of pharmaceutical preparations
   a) Sterile formulations – large and small volume parenterals
   b) Manufacture of ointments, liquids, and creams
   c) Manufacturing of Tablets, granules, capsules, and powders
   d) Total parenteral nutrition

Unit VI: **8 Hrs**

7. Continuing professional development programs , Education and training
8. Radiopharmaceuticals – handling and packaging
9. Professional relations and practices of hospital pharmacist

Fourth Year PharmD Degree Program						
COURSE CODE	**PPR 4.2L**					
COURSE TITLE	**HOSPITAL PHARMACY LAB**					
SYNOPSIS		**COs**				
Hospital pharmacy lab deals with providing drug information, assessing drug-drug interactions in a given prescription and control the inventory in a drug store. Besides it also deals with manufacturing various formulations		On completion of the course, the student shall be able to : 1. Provide unbiased drug information to the physician 2. Assess the prescription for drug-drug interaction and its management 3.Know the manufacturing practice of various formulations in hospital setup 4. Appreciate the stores management & inventory control				
Course Content and Assessment Plan						
SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University Examination (*70 % of total marks of assessment)*
			S1	S2		
1	Student will earn how to provide Drug information queries and Assessment of drug interactions in the given prescriptions	Unit 1 (35Hrs)	20		10	70
2	Student will learn the concept of manufacture of various parenteral formulations & powders. And Understand the concept of Inventory control	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I

1. Drug information queries.
2. Assessment of drug interactions in the given prescriptions

Unit II

Manufacture of parenteral formulations, powders.

3. Inventory control

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.3T**
COURSE TITLE	**CLINICAL PHARMACY (Theory)**

SYNOPSIS	**COs**
This course is designed to impart the basic knowledge and skills that are required to practice clinical pharmacy Understanding clinical pharmacy concept will make students more equipped with the clinical competencies necessary to practice alongside with doctors, nurses and other health care professionals.	The student shall be able to 1. Monitor drug therapy of patient through medication chart review and clinical review; 2. Obtain medication history interview and counsel the patients; 3. Identify and resolve drug related problems 4. Detect, assess and monitor adverse drug reactions; 5. Interpret selected laboratory results (as monitoring parameter in therapeutics) of specific disease states; and 6. Retrieve, analyze, interpret and formulate drug or medicine information.

Course outcome and its Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn the scope of clinical pharmacy services and to understand the daily activities of clinical pharmacist	Unit I (14 Hrs)	27	13			14
2	Student will learn and understand drug and poison information center and to critically evaluate drug and biomedical literature and be able to apply to an article.	Unit II (14 Hrs)	27	12			15
3	Student will learn understand and learn the interpretation of various laboratory data for proper diagnosis	Unit III (14 Hrs)	27		14		13
4	Student will learn the interpretation skills on patient data analysis and review of cases studies	Unit IV (11 Hrs)	20		11		09

5	Student will learn understand the concept of Pharmaceutical care with the provision of communication skills, medication history interview and patient counseling and recognize and prevent medication errors	Unit V (12 Hrs)	24			13	11
6	Student will learn understand the fundamental concepts of pharmacovigilance and its activities	Unit VI (10 Hrs)	20			12	08
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

COURSE CONTENT

Unit I **14 Hrs**

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

Unit II **14 Hrs**

3. Drug and poison information
    a. Establishing a drug information center
    b. Introduction to drug information resources available
    c. Systematic approach in answering drug information queries
    d. Preparation of written and verbal reports
    e. Critical evaluation of drug information and literature
    f. Poison information – organization and information resources

4. Critical evaluation of biomedical literature

Unit III **14 Hrs**

5. Clinical laboratory tests used in the evaluation of disease 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

Unit IV **11 Hrs**

6. Patient data analysis

The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices. Assessment of cases.

Unit V **12 Hrs**

7. Pharmaceutical care concepts.
8. Communication skills including patient counselling techniques, medication history interview.
9. 9. Medication errors

Unit VI **10 Hrs**

10. 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

Fourth Year PharmD Degree Program	
COURSE CODE	**PPR 4.3L**
COURSE TITLE	**CLINICAL PHARMACY LAB**

SYNOPSIS	**COs**
This course is designed to help students to acquire the knowledge, skills and attitudes necessary to perform comprehensive clinical pharmacy service in team-based and direct patient care environments.	On completion of the course, the student shall be able to: 1. Provide drug information services to the health care professionals and patients. 2. Perform patient medication history interview and counseling as a part of pharmaceutical care. 3. Interpret the clinical laboratory investigational reports and its significance in disease management.

Course Content and Assessment Plan						
SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation *(10 % of total marks of assessment)*	University Examination (70 *% of total marks of assessment)*
			S1	S2		
1	Student will develop the skills needed to perform drug information and learn the skills to conduct patient medication history interview.	Unit 1 (35Hrs)	20		10	70
2	Student will acquire the skill for patient medication counselling and learn to utilize clinical laboratory data to monitor various disease states.	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I

1. Answering drug information questions (4 Nos)
2. Patient medication history interview (3 Nos)

Unit II

1. Patient medication counseling (4 Nos)
2. Case studies related to laboratory investigations (4 Nos)

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.4T**
COURSE TITLE	**BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)**
SYNOPSIS	**COs**
This course introduced to understand the students regarding concept of research methodology, how to write manuscript and understand the application of statistical analysis in data interpretation and presentation.	On completion of the course, the student shall be able to understand 1. Various study designs 2. Development of protocol and biomedical literature search 3. Understand the application of various statistical analysis in data analysis and interpretation 4. Writing research paper and presentation of results

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will understand the different types of data and its spread	Unit I (10 Hrs)	29	15			14
2	Student will understand the construction of different types of graphs and labelling of graphs	Unit II (6 Hrs)	17	10			7
3	Student will understand the basics of hypothesis testing and level of significance using Parametric and Non Parametric tests	Unit III (15 Hrs)	44		23		21
4	Student will understand the various epidemiological measures like Incidence and prevalence, relative risk, attributable risk	Unit IV (4 Hrs)	12		02		10
5	Student will understand the various clinical study designs, writing research methodology and report writing	Unit V (9 Hrs)	26			15	11
6	Student will understand the computers application in Hospital Pharmacy, Community Pharmacy, Drug Prescription and in Drug information	Unit VI (6 Hrs)	17			10	7
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT I **10 Hrs**

Basic Introduction to Statistics

a) Types of data distribution

b) Measures describing the central tendency distributions- average, median, mode

c) Measurement of the spread of data-range, variation of mean, standard deviation, variance, of variation, standard error of mean.

Unit II **6 Hrs**

Data Graphics-Data graphics Construction and labeling of graphs, histogram, pie charts, scatter plots, semilogarthimic plots

UNIT III **15 Hrs**

Basics of testing hypothesis

a) Null hypothesis, level of power of test, P value, and statistical estimation of intervals.
b) Level of significance (Parametric data)- student's t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)
c) Level of (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal- Wall is test (one way ANOVA)

d)Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation

e) Introduction to statistical software: SPSS, Epi Info, SAS

UNIT IV **4 Hrs**

Statistical methods in epidemiology

Incidence and prevalence, relative risk, attributable risk

UNIT V **9 Hrs**

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 an interval of width, power of a study
d) Report writing and presentation of data

UNIT VI **6Hrs**

Computer applications in pharmacy computer system in hospital pharmacy

Patterns of Computer use in Hospital Pharmacy - patient record database management, medication order entry - drug labels and list - intravenous solution and admixture, patient medication profiles, inventory control, management report & statistics. computer in community pharmacy computerizing the prescription dispensing process use of computers for pharmaceutical care in community pharmacy accounting and general ledger system

Drug information retrieval & storage

Introduction - advantages of computerized literature retrieval use of computerized retrieval.

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.5T**
COURSE TITLE	**BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)**

SYNOPSIS	**COs**
This course is designed to impart the understanding on the basics and applications of biopharmaceutics and clinical pharmacokinetics. Student will be equipped with in-depth knowledge and compartment models and other relevant concepts to apply in understanding dosage form related issues and their application in clinical situations.	The student shall be able to: 1. Understand basic concepts of absorption, distribution, metabolism and elimination 2. Have thorough understanding on pharmacokinetic and bioavailability studies 3. Understand compartment and non-compartment models 4. Appreciate the concepts of multiple dosage regimen 5. Understand the concepts of non-linear kinetics

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Learn the concepts of absorption and various factors affecting and also understand the basics of pharmacokinetics and mathematical models	Unit I (9 Hrs)	18	10			08
2	Learn and understand the concepts of drug distribution and elimination and various factors that influence these processes	Unit II (15 Hrs)	29	15			14
3	To learn and understand the concepts of compartment models, one compartment model for IV bolus and IV infusion and also understand non-linear pharmacokinetics	Unit III (14 Hrs)	27		14		13
4	Learn the concepts of two compartment models for IV bolus, infusion and oral administration	Unit IV (11 Hrs)	21		11		10

5	To understand the concepts of non-compartment, physiologic pharmacokinetic models and bio availability study designs and applications	Unit V (18 Hrs)	36			18	18
6	To understand the principles of Multiple dose administration for one and two compartment model for intravascular and extravascular administration of drugs	Unit VI (8 Hrs)	14			07	07
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **9 Hrs**

1. Absorption
2. Absorption from gastrointestinal tract
3. Introduction to pharmacokinetics
4. Mathematical & pharmacokinetic models

Unit II **15 Hrs**

5. Drug distribution
6. Drug elimination

Unit III **14 Hrs**

7. Compartment models
8. One compartment model for IV bolus and IV Infusion
9. Non-linear Pharmacokinetics

a. Introduction
b. Factors causing non-linearity.
c. Michaelis-menton method of estimating parameters

Unit IV **11 Hrs**

10. Multiple compartment models
11. Two compartment model for IV bolus, IV infusion and oral administration

Unit V **18 Hrs**

12. Non-compartmental Pharmacokinetics

a. Statistical moment theory.
b. MRT for various compartment models.
c. Physiological pharmacokinetic model

13. Bioavailability and Bioequivalence-Introduction, study protocols, methods of assessment

a. Introduction.
b. Bioavailability study protocol.
c. Methods of assessment of bioavailability

Unit VI **8 Hrs**

14. Multiple dosage regimens

e. Repetitive IV bolus and extravascular one compartment model

f. Repetitive administration two compartment models

<table>
<tr><th colspan="6">Fourth Year PharmD Degree Program</th></tr>
<tr><td>COURSE CODE</td><td colspan="5">PPR 4.5L</td></tr>
<tr><td>COURSE TITLE</td><td colspan="5">BIOPHARMACEUTICS AND PHARMACOKINETICS LAB</td></tr>
<tr><th colspan="3">SYNOPSIS</th><th colspan="3">COs</th></tr>
<tr><td colspan="3">This course is designed to impart knowledge and skills in developing pharmacokinetic models using mathematical models and software package</td><td colspan="3">On Completion of the course the student shall be able to:
1. Understand the concepts of absorption, distribution and Excretion
2. Apply the pharmacokinetic principles for dosage regimen design and bio-availability studies</td></tr>
<tr><th colspan="6">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="2">Sl No.</td><td rowspan="2">Course Content</td><td rowspan="2">Syllabus (chapters or Units with hours)</td><td colspan="3">Distribution of marks of assessment</td></tr>
<tr><td colspan="2">Sessional Examination (20 % of total marks of assessment)
S1 | S2</td><td>Continuous evaluation (10 % of total marks of assessment)</td><td>University Examination (70 % of total marks of assessment)</td></tr>
<tr><td>1</td><td>Student will learn how to calculate pharmacokinetic parameters using manual and pharmacokinetic software packages for relevant pharmacokinetic data to assess all relevant pharmacokinetic properties like absorption, distribution, metabolism and Elimination with data from relevant experiments</td><td>Unit 1 (35Hrs)</td><td>20</td><td></td><td rowspan="2">10</td><td rowspan="2">70</td></tr>
<tr><td>2</td><td>Student will assess pharmacokinetic parameters using manual and pharmacokinetic software packages for relevant PK problems and as well as bioavailability studies</td><td>Unit II (40Hrs)</td><td></td><td>20</td></tr>
<tr><td colspan="3">Total Marks of assessment</td><td colspan="2">Average of two sessional exams
20</td><td>10</td><td>70</td></tr>
</table>

UNIT I

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 protein bound drug and poorly protein bound drug.

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.

UNIT II

1. In vitro absorption studies.
2. Bio-equivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxazole, Trimethoprim, Aspirin etc., on animals and human volunteers.
3. Absorption studies in animal inverted intestine using various drugs.
4. Effect on contact time on the plasma protein binding of drugs.
5. Studying metabolic pathways for different drugs based on elimination kinetics data.
6. Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
7. Determination of renal clearance.

Fourth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.6T**
COURSE TITLE	**CLINICAL TOXICOLOGY (Theory)**
SYNOPSIS	**COs**
The course is designed to attain an in-depth knowledge in the area of clinical management of different poisoning cases and facilitating the students to involve in direct toxicological care including patient education, identification of toxins and toxidrome. Thereby, protect the local community from the various poisons.	The student shall be able to: 1. Learn general principles in the management of poisoning 2. Know clinical symptoms and management of acute poisoning 3. Learn clinical symptoms and management of chronic poisoning 4. Understand toxic effects and general management of snake bite 5. Learn plant, mushroom and food poisoning and envenomation 6. Understand substance abuse and treatment of dependence

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will understand the concept of general principles in the management of poisoning including supportive care, antidotes and toxicokinetics	Unit I (10 Hrs)	29	15			14
2	Student will learn clinical symptoms and management of acute poisoning with pesticides, depressants and antidepressants, alcohol, paracetamol, NSAIDs, hydrocarbons, caustics and radiation	Unit II (18 Hrs)	52	10	17		25
3	Student will learn clinical symptoms and management of chronic poisoning with heavy metals such as arsenic, lead, mercury, iron, copper	Unit III (5 Hrs)	15		08		07
4	Student will understand general management of snake bite including first aid, early manifestations, complications and antidotes	Unit IV (3 Hrs)	08			04	04
5	Student will learn plant poisoning, mycotoxins, food poisoning and envenomation with arthropod bites and stings	Unit V (4 Hrs)	12			06	06
6	Student will understand signs and symptoms of substance abuse and treatment of dependence	Unit VI (10 Hrs)	29			15	14
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I

10 Hrs

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications
3. Supportive care in clinical Toxicology
4. Gut Decontamination
5. Elimination Enhancement
6. Toxicokinetics

Unit II **18 Hrs**

7. Clinical symptoms and management of acute poisoning with the following agents –
   a) Pesticide poisoning: organophosphorous, compounds, carbamates, organochlorines, pyrethroids
   b) Opiates overdose
   c) Antidepressants
   d) Barbiturates and benzodiazepines
   e) Alcohol: ethanol, methanol
   f) Paracetamol and salicylates
   g) Non-steroidal drugs
   h) Hydrocarbons: Petroleum products and PEG
   i) Caustics: inorganic acids and alkali
   j) Radiation poisoning

Unit III **5 Hrs**

8. Clinical symptoms and management of chronic poisoning with the following agents -Heavy metals: arsenic, lead, mercury, iron, copper

Unit IV: **3 Hrs**

9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.

Unit V: **4 Hrs**

10. Plants poisoning and mushroom poisoning (Mycotoxins)
11. Food poisonings
12. Envenomation: Arthropod bites and stings

UNIT VI **10 Hrs**

13. Substance abuse: Signs and symptoms of substance abuse and treatment of dependence
    a) CNS stimulants: amphetamine
    b) Opioids
    c) CNS depressants
    d) Hallucinogens: LSD
    e) Cannabis group
    f) Tobacco

Fifth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 5.1T**
COURSE TITLE	**CLINICAL RESEARCH (Theory)**

SYNOPSIS	COs
In This course aims to provide the students an opportunity to learn drug development process especially the phases of clinical trials and also the ethical issues involved in the conduct of clinical research. Also, it aims to imparts knowledge and develop skills on conceptualizing, designing, conducting and managing clinical trials.	Upon completion of this course it is expected that students shall be able to: 1. Know the new drug development process. 2. Appreciate and conduct the clinical trials activities 3. Manage the trial coordination process 4. Understand the regulatory and ethical requirements. 5. Know safety monitoring and reporting in clinical trials

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn concepts of new drug discovery development process and phases of clinical trials and regulatory requirements for New drug	Unit I (13 Hrs)	27	14			13
2	Student will explore various objectives of Phase IV studies and regulations of generic drugs	Unit II (12 Hrs)	24	11			13
3	Student will demonstrate and be prepared to present a personal view founded on observing, understanding, documenting compiling, analyzing, organizing data and information in clinical research	Unit III (13 Hrs)	26		13		13
4	Student will convert information with judgement and sensitivity in the healthcare domain and in clinical practice.	Unit IV (12 Hrs)	23		12		11

5	Student will cultivate a sense of fair play, professional ethical codes of conduct.	Unit V (13 Hrs)	25			14	11
6	Student will learn concepts of drug regulatory environments in global level. Develop skills to devise clinical trial related documents.	Unit VI (12 Hrs)	20			11	09
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **13 Hrs**

1. Drug development process:

Introduction Various Approaches to drug discovery

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

2. Clinical development of drug:

1. Introduction to Clinical trials
2. Various phases of clinical trial.

Unit II: **12 Hrs**

3. Methods of post marketing surveillance
4. Abbreviated New Drug Application submission.

Unit III: **13 Hrs**

5. Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines
6. Challenges in the implementation of guidelines
7. 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

Unit IV: **12 Hrs**

8. Role and responsibilities of Regulatory authority

9. Composition, responsibilities, procedures of IRB / IEC

10. Data management and its components

11. Safety monitoring in clinical trials.

Unit V: **13 Hrs**

12. Ethical guidelines in Clinical Research

13. Informed consent Process

Unit VI: **12 Hrs**

14. Overview of regulatory environment in USA, Europe and India.

15. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)

Fifth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 5.2T**
COURSE TITLE	**PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (Theory)**
SYNOPSIS	**COs**
This course enables the students to understand various pharmacoepidemiological methods and their clinical applications. Also, it aims to impart knowledge on basic concepts, assumptions, terminology, and methods associated with pharmacoeconomics and health related outcomes, and when should be appropriate pharmacoeconomic model should be applied for a health care regimen.	Upon completion of this course the student should be able to: 1. Understand the various epidemiological methods and their applications. 2. Understand the fundamental principles of pharmacoeconomics. 3. Identify and determine relevant cost and consequences associated with pharmacy products and services. 4. Perform key pharmacoeconomics analysis methods. 5. Understand the pharmacoeconomic decision analysis methods and its applications. 6. Describe current pharmacoeconomic method and issues. 7. Understand the applications of pharmacoeconomics to various pharmacy settings

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn the definition, scope, applications, outcome measurements in pharmacoepidemiology	Unit I (10 Hrs)	19	10			09
2	Student will understand the concepts of risk in pharmacoepidemiology and learn the pharmacoepidemiological study methods	Unit II (15 Hrs)	29	15			14
3	Student will learn the application of pharmacoepidemiological study in the field of study review and pharmacovigilance safety managements.	Unit III (15 Hrs)	29		15		14
4	Student will learn the data sources available in pharmacoepidemiological studies	Unit IV (08 Hrs)	19		10		09
5	Student will learn basic of pharmacoeconomics, cost categorization and outcome measurements.	Unit V (10 Hrs)	20			10	10
6	Student will learn various types of pharmacoeconomic evaluations and its application.	Unit VI (20Hrs)	29			15	14
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT – I **10 Hrs**

1. **Introduction to Pharmacoepidemiology:** Definition, scope, need, aims & applications.
2. **Outcome measurement**: Outcome measures, drug use measures: monetary units, number of prescriptions, units of drug dispensed, defined daily doses, prescribed daily doses, diagnosis and therapy surveys, prevalence, incidence rate, medications adherence measurements.

UNIT – II **15 Hrs**

3. **Concept of risk:** Measurement of risk, attributable risk and relative risk, time- risk relationship and odds ratio

4. **Pharmacoepidemiological Methods:** Qualitative models: qualitative models: drug utilization review; quantitative models: case reports, case series, cross sectional studies, cohort and case control studies, calculation of odds' ratio,

UNIT – III **12 Hrs**

5. **Pharmacoepidemiological study review and pharmacovigilance safety management's**: meta-analysis models, drug effects study in populations: Spontaneous reporting, prescription event monitoring, post marketing surveillance, record linkage systems.

UNIT – IV **08 Hrs**

6. **Sources of data for Pharmacoepidemiological studies:** Ad Hoc data sources and automated data systems.

UNIT – V **10 Hrs**

7. **Introduction to Pharmacoeconomics:** Definition, history, needs of pharmacoeconomic evaluations.
8. **Cost categorization:** Direct costs, indirect costs, intangible costs.
9. **Outcomes and Measurements of Pharmacoeconomics:** Types of outcomes: Clinical outcome, economic outcomes, humanistic outcomes; quality adjusted life years, disability adjusted life years incremental cost effective ratio, average cost effective ratio, person-time, willingness to pay, time trade off and discounting.

UNIT – VI **20 Hrs**

10. **Pharmacoeconomic evaluations:** Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA), Cost Effective Analysis (CEA), Cost Utility Analysis (CUA). Software used in pharmacoeconomic analysis.
11. **Pharmacoeconomic** role in formulary management decisions.

Fifth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 5.3T**
COURSE TITLE	**CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING (Theory)**
SYNOPSIS	**COs**
To Understand the basic and applied concepts in clinical pharmacokinetics and appreciate the concepts of therapeutic drug monitoring. To understand application oriented dosage adjustment concepts and advanced concepts like population pharmacokinetics and pharmacokinetics	Upon completion of the course, the student shall be able to: 1. Design dosage regimen 2. Understand Pharmacokinetic drug interactions 3. Learn and apply the concepts of therapeutic drug monitoring 4. Appreciate the concepts of dosage adjustment in special populations 5. Understand the concepts of population pharmacokinetics 6. Learn the concepts of pharmacogenetics and its application in pharmacokinetics

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52% *of marks of assessment)*			University Examination (48% *of marks of assessment)*
				S1	S2	S3	
1	Student will understand clinical pharmacokinetics. Understand the concepts of therapeutic drug monitoring of various classes of drugs	Unit I (11 Hrs)	32	16			16
2	Student will understand Pharmacokinetic interactions and their mechanisms. Understand the mechanisms of inhibition and induction of drug metabolism	Unit II (7 Hrs)	21	9			12
3	Student will understand dosage adjustment in renal failure, hepatic failure and IV to oral conversion	Unit III (9 Hrs)	26		13		13
4	Student will understand dosage adjustment in elderly, paediatric and obese patients along with dose and dosing intervals. Understand the application of Bayesian theory	Unit IV (8 Hrs)	23		12		11
5	Student will understand population pharmacokinetics and genetic polymorphism of drug transports and targets	Unit V (8 Hrs)	23			13	10
6	Student will understand PKPD correlation, adaptive methods for dosing and nomograms & Tabulation for dosage regimen design	Unit VI (7 Hrs)	20			12	8
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **11 Hrs**

1. Introduction to Clinical pharmacokinetics.
2. Indications and Protocol for TDM
3. Individualization of Dosage Regimen
4. TDM of CVS & Seizure drugs
5. TDM of Psychiatric & Organ transplant drugs

Unit II: **7 Hrs**

6. Pharmacokinetic drug interactions
7. Inhibition of drug metabolism
8. Induction of drug metabolism
9. Inhibition of Biliary Excretion

UNIT III: **9 Hrs**

10. General approach for dosage adjustment in Renal disease and assessment of renal function
11. Extracorporeal removal of drugs
12. Dosage adjustment in Hepatic disease & uremic patients
13. Conversion from intravenous to oral dosing

UNIT IV: **8 Hrs**

14. Drug dosing in the elderly and pediatric patients
15. Drug dosing in obese patients
16. Determination of dose and dosing intervals
17. Introduction to Bayesian Theory

UNIT V: **8 Hrs**

18. Analysis of Population pharmacokinetic Data.
19. Genetic polymorphism in Drug metabolism.
20. Pharmacogenetics & PKPD considerations
21. Genetic Polymorphism in Drug Transport & Targets

UNIT VI: **7 Hrs**

22. Adaptive method or Dosing with feed-back.
23. PK/PD Correlation in drug therapy
24. Nomograms & Tabulation in dosage regimen

Fifth Year PharmD Degree Program	
COURSE CODE	**PPR 5.4L**
COURSE TITLE	**CLERKSHIP**

SYNOPSIS	**COs**
This course is designed to impart knowledge and skills in evaluating clinical cases and assess the pharmacotherapy and recommend appropriate dosage regimen	On Completion of the course the student shall be able to: 1. Understand the concepts of case assessment and pharmacotherapy 2. Apply pharmaceutical care plan considering the therapeutic and toxic monitoring plans

Course Content and Assessment Plan						
Sl No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional Examination (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University Examination (*70 % of total marks of assessment)*
			S1	S2		
1	Student will earn to assess the cases as per the SOAP format and other clinically relevant approaches and able to present. The assessment will be in the format of long and short cases considering the biochemical lab parameters and pathophysiological conditions	Unit1 (35Hrs)	20		10	70
2	Student will assess the cases in all disease areas and will be able to recommend necessary interventions. Student will be able to assess recommend management strategies for the disease in question.	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Fifth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 5.5P**
COURSE TITLE	**PROJECT WORK**

SYNOPSIS	COs
This course is designed to impart knowledge and skills in developing appropriate research protocol and execution of research work with ethical committee approval.	On completion of the course, the student shall be able to: 1. Undertake literature search, identify topics, design, plan, execute studies, document, compile, analyze and interpret data 2. Present the results of the project work as a written report, conference presentations and publications in peer reviewed journals.

Course Content and Assessment Plan				
Sl No.	Course Contents	Distribution of marks of assessment		
		Project evaluation(70 marks)		Viva voce (30% of total marks of assessment)
		Evaluation of project work: 65% of total marks of assessment	Publication of project work (5 *% of total marks of assessment)*	
1	Students will be taking up a research work in novel and appropriate areas relevant to the discipline to explore, innovate and contribute to scientific and professional body of knowledge and demonstrate skills and capabilities in literature search, identification of topics, design and plan of study, execution, documentation, compilation, analysis and interpretation. Students will present the results of the project work as a written report, conference presentations and publications in peer reviewed journals.	65	05	30
Total Marks of assessment		**100 marks**		

Topic Selection and Project execution

A group of students (2-4 students) will be choosing a topic on contemporary and advanced areas of the discipline in consultation with their respective dissertation guides. The topics will be connected to the planned dissertation work to be carried out in the 5th year/2nd year of Pharm D and Pharm D (PB) programme respectively. The group of students shall work on the project by consulting with their guides during all the stages of the dissertation from planning to the final presentation.

Guidelines to Prepare Project work report

COVER PAGE

- Title of the dissertation, name and affiliation of the student and registration number. Names and affiliation of guides

PAPER

- Use A4 (210 mm X 297 mm) bond plain white paper Margin 1” on all 4 sides.

CONTENT

- Title of the work
- Introduction/background

- Aims and objective
- Methodology
- Results
- Discussion
- Conclusion
- References

NUMBERING

- Every page in the report must be accounted for except the cover page.
- Page numbering Position: numbering should be at the bottom of page with right justified and continuous numbering from the introduction chapter. for the pages before this, use roman numerals.
- For sections, use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2,1.3, etc.
- For equations, use only Arabic numerals with single decimal. Equation numbers should be right justified using normal print. example (1.1)

TEXT

- Black print, Times New Roman
- Section headings (12 pts. and bold print and capitals), Subsection Headings (12 pts., bold print and leading capitals), regular text (12 pts. and normal print), special text (italics / superscript / subscript / special symbols etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.).
- Use 1.5 spacing between the lines. Use double spacing between paragraphs, and entirely justified.

TABLES

- Tables should follow immediately after they are referred to for the first time in the text.
- Each table has to be numbered (ex: Table 1, 2, 3 etc.).
- The table title should be centered with respect to the table and must be on the top of the Table.
- The titles must be in the same font as the regular text and should be single spaced.

FIGURES

- Figures should follow immediately after they are referred to for the first time in the text. Each figure has to be numbered (example figure 1, 2, etc.).
- The figure caption should be centered with respect to the figure and must be at the bottom of the figure.
- The titles must be in the same font as the regular text and should be single spaced.
- Graphs, photographs are also considered to be figure.

REFERENCE

- Vancouver or Harvard style of referencing

Submission

- The last page of the project work report must contain a copy of plagiarism report (one page only of less than 15% similarity index.
- Ethical committee approval letter must attach as appropriate
- All the students should submit the hard copy of the bound dissertation report in the required numbers (two copy) to the department office and follow all other regulations as stipulated from time to time.
- A copy of published article/ submitted manuscript/draft manuscript must be attached
- Submission of project report shall be done at least one month prior to the commencement of annual or supplementary examination

Project work evaluation

The performance of the student in the project work is assessed as per the scheme given below by the two examiners (guide with other expert staff) appointed by the department.

<table>
<tr><th colspan="4">Evaluation of project work and viva voce</th></tr>
<tr><th colspan="2">Evaluation of project work</th><th colspan="2">Evaluation of Presentation and Viva-voce</th></tr>
<tr><th>Contents</th><th>Marks</th><th>Contents</th><th>Marks</th></tr>
<tr><td>Objective(s) of the study</td><td>15</td><td rowspan="2">Presentation of work</td><td rowspan="2">10</td></tr>
<tr><td>Literature search</td><td>15</td></tr>
<tr><td>Methodology adopted</td><td>10</td><td rowspan="2">Communication skills</td><td rowspan="2">10</td></tr>
<tr><td>Results and discussions</td><td>10</td></tr>
<tr><td>Conclusions and outcomes</td><td>10</td><td rowspan="3">Answering skill</td><td rowspan="3">10</td></tr>
<tr><td>Bibliography</td><td>05</td></tr>
<tr><td>Publication of project work*</td><td>05</td></tr>
<tr><td>Total Marks</td><td>70</td><td>Total Marks</td><td>30</td></tr>
<tr><td>Total project work evaluation Marks</td><td colspan="3">100 Marks</td></tr>
</table>

Note: *Published and accepted for publication awards 5 marks. Manuscript under review 4 marks, manuscript submitted to journal 3 marks and for under preparation 2marks. Publication must be in Q1 to Q4 Journals and under the affiliation of the department.

Sixth Year PharmD Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 6.1 R**
COURSE TITLE	**INTERNSHIP**

SYNOPSIS	**COs**
Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy and healthcare and acquires skills under the supervision so that he or she may become capable of functioning independently.	(1) To provide patient care in cooperation with patients, prescribers, and other inter-professional health care teams based upon sound therapeutic principles and evidence-based data. (2) To manage and use the health care system's resources to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and improve therapeutic outcomes of medication use. (3) To promote health, wellness, and disease prevention in cooperation with patients, communities, at-risk populations, and other members of an interprofessional team of health care providers. (4) To demonstrate skills in monitoring the national health programs and schemes, oriented to provide preventive and promotive health care services to the community. (5) To develop leadership qualities to function effectively as a member of the health care team organized to deliver the health and family welfare services in the existing socio-economic, political, and cultural environment. (6) To communicate effectively with patients and the community.

Assessment Plan

SL No	Assessment Parameters	Scores		
		S1 *(6 months)*	S2 *(6 months)*	University Evaluation *(Average of S1, S2 assessments)*
1	Proficiency of knowledge required for each case management			
2	The competency in skills expected for providing clinical pharmacy services			
3	Responsibility, punctuality, work up of case, involvement in patient care			
4	Ability to work in a team (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues)			
5	Initiative, participation in discussions, research aptitude			
Total scores of assessment (average)		**5**	**5**	**5**

NOTES

5

Doctor of Pharmacy (PharmD)

Course Contents In-Detail (Syllabus)

PharmD: First Year Syllabus
PHA 1.1T: HUMAN ANATOMY AND PHYSIOLOGY

Theory: 3 Hrs. /Week

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

2. **Upon completion of the course, the student shall be able to:**
   a. describe the structure (gross and histology) and functions of various organs of the human body;
   b. describe the various homeostatic mechanisms and their imbalances of various systems;
   c. identify the various tissues and organs of the different systems of the human body;
   d. perform the hematological tests and also record blood pressure, heart rate, pulse and Respiratory volumes;
   e. appreciate coordinated working pattern of different organs of each system; and
   f. appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body

3. **Course materials:**

Text books

a. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
b. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference books

a. Guyton arthur, C. Physiology of human body. Publisher: Holtsaunders.
b. Chatterjee,C.C. Human physiology. Volume 1&11. Publisher: medical allied agency, Calcutta.
c. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H.
d. Gray's Anatomy. Publisher: Churchill Livingstone, London.

4. **Lecture wise program:**

Topics

1 Scope of anatomy and physiology, basic terminologies used in this subject (Description of the body as such planes and terminologies)
2 Structure of cell – its components and their functions.
3 Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues-their sub-types and characteristics
4 a) Osseous system - structure, composition and functions of the Skeleton. (done in practical classes - 6 hrs)
   b) Classification of joints, Types of movements of joints and disorders of joints (Definitions only)

5 Haemopoetic system
a) Composition and functions of blood
b) Haemopoesis and disorders of blood components (definition of disorder)
c) Blood groups
d) Clotting factors and mechanism
e) Platelets and disorders of coagulation

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

7 Cardiovascular system
a) Anatomy and functions of heart
b) Blood vessels and circulation (Pulmonary, coronary and systemic circulation)
c) Electrocardiogram (ECG)
d) Cardiac cycle and heart sounds
e) Blood pressure – its maintenance and regulation
f) Definition of the following disorders
Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias

8 Respiratory system
a) Anatomy of respiratory organs and functions
b) Mechanism / physiology of respiration and regulation of respiration

c) Transport of respiratory gases
d) Respiratory volumes and capacities, and Definition of: Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.

9 Digestive system
a) Anatomy and physiology of GIT
b) Anatomy and functions of accessory glands of GIT
c) Digestion and absorption
d) Disorders of GIT (definitions only)

10 Nervous system
a) Definition and classification of nervous system
b) Anatomy, physiology and functional areas of cerebrum
c) Anatomy and physiology of cerebellum
d) Anatomy and physiology of mid brain
e) Thalamus, hypothalamus and Basal Ganglia
f) Spinal card: Structure & reflexes – mono-poly-planter
g) Cranial nerves – names and functions
h) ANS – Anatomy & functions of sympathetic & parasympathetic N.S.

11 Urinary system
a) Anatomy and physiology of urinary system
b) Formation of urine
c) Renin Angiotensin system – Juxtaglomerular apparatus - acid base Balance
d) Clearance tests and micturition

12 Endocrine system
a) Pituitary gland
b) Adrenal gland
c) Thyroid and Parathyroid glands
d) Pancreas and gonads

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

14 Sense organs
a) Eye
b) Ear
c) Skin
d) Tongue & Nose

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

16 Sports physiology
a) Muscles in exercise, Effect of athletic training on muscles and muscle performance,
b) Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise,
c) Drugs and athletics

PharmD: First Year Syllabus
PHA 1.1L: HUMAN ANATOMY & PHYSIOLOGY LAB

Practical: 3 Hrs./Week

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

Course materials:

Text books

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

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

List of Experiments:

1. Study of tissues of human body
   (a) Epithelial tissue.
   (b) Muscular tissue.
2. Study of tissues of human body
   (a) Connective tissue.
   (b) Nervous tissue.
3. Study of appliances used in hematological experiments.
4. Determination of W.B.C. count of blood.
5. Determination of R.B.C. count of blood.
6. Determination of differential count of blood.
7. Determination of
   (a) Erythrocyte Sedimentation Rate.
   (b) Hemoglobin content of Blood.
   (c) Bleeding time & Clotting time.
8. Determination of
   (a) Blood Pressure.
   (b) Blood group.
9. Study of various systems with the help of charts, models & specimens
   (a) Skeleton system part I-axial skeleton.
   (b) Skeleton system part II- appendicular skeleton.
   (c) Cardiovascular system.
   (d) Respiratory system.

(e) Digestive system.
(f) Urinary system.
(g) Nervous system.
(h) Special senses.
(i) Reproductive system.

10. Study of different family planning appliances.
11. To perform pregnancy diagnosis test.
12. Study of appliances used in experimental physiology.
13. To record simple muscle curve using gastroenemius sciatic nerve preparation.
14. To record simple summation curve using gastroenemius sciatic nerve preparation.
15. To record simple effect of temperature using gastroenemius sciatic nerve preparation.
16. To record simple effect of load & after load using gastroenemius sciatic nerve preparation.
17. To record simple fatigue curve using gastroenemius sciatic nerve preparation.

Scheme of Practical Examination:

	Sessionals	Annual
Identification	04	10
Synopsis	04	10
Major Experiment	07	20
Minor Experiment	03	15
Viva	02	15
Max Marks	**20**	**70**

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

PharmD: First Year Syllabus
PCE 1.2T: PHARMACEUTICS

Theory: 2 Hrs. /Week

1. **Scope and objectives:** This course is designed to impart a fundamental knowledge on the art and science of formulating different dosage forms. It prepares the students for most basics of the applied field of pharmacy.
2. **Upon the completion of the course the student should be able to:**
   a. know the formulation aspects of different dosage forms;
   b. do different pharmaceutical caluculation involved in formulation;
   c. formulate different types of dosage forms; and
   d. appreciate the importance of good formulation for effectiveness.
3. **Course materials:**

Text books

a. Cooper and Gunns Dispensing for pharmacy students.
b. A text book Professional Pharmacy by N. K. Jain and S.N. Sharma.

Reference books

a. Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
b. Remington's Pharmaceutical Sciences.
c. Register of General Pharmacy by Cooper and Gunn.
d. General Pharmacy by M.L. Schroff.

4. **Lecture wise programme: Topics**

1 a. Introduction to dosage forms - classification and definitions
b. Prescription: definition, parts and handling
c. Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.

2 Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.

3 Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.

4 Weights and measures, Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.

5 Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.

6 Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.

7 Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.

8 Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.

9 Galenicals: Definition, equipment for different extraction processes like Infusion, Decoction, Maceration and Percolation, Methods of preparation of spirits, tinctures and extracts.

10 Pharmaceutical calculations.

11 Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.

12 Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.

PharmD: First Year Syllabus
PCE 1.2L: PHARMACEUTICS LAB

Practical: 3 Hrs./Week

List of Experiments:

1. Syrups

a. Simple Syrup I.P
b. Syrup of Ephedrine HCl NF
c. Syrup Vasaka IP
d. Syrup of Ferrous Phosphate IP
e. Orange Syrup

2. Elixir

a. Piperazine citrate elixir BP
b. Cascara elixir BPC
c. Paracetamol elixir BPC

3. Linctus

a. Simple Linctus BPC
b. Pediatric simple Linctus BPC

4. Solutions

a. Solution of cresol with soap IP
b. Strong solution of ferric chloride BPC
c. Aqueous Iodine Solution IP
d. Strong solution of Iodine IP
e. Strong solution of ammonium acetate IP

5. Liniments

a. Liniment of turpentine IP*
b. Liniment of camphor IP

6. Suspensions*

a. Calamine lotion
b. Magnesium Hydroxide mixture BP

7. Emulsions*

a. Cod liver oil emulsion
b. Liquid paraffin emulsion

8. Powders**

a. Eutectic powder
b. Explosive powder
c. Dusting powder
d. Insufflations

9. Suppositories**

a. Boric acid suppositories
b. Chloral suppositories

10. Incompatibilities

a. Mixtures with Physical
b. Chemical & Therapeutic incompatibilities

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

Scheme of Practical Examination:

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

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

PharmD: First Year Syllabus
PBT 1.3T: MEDICINAL BIOCHEMISTRY

Practical: 3 Hrs./Week

1. **Scope of the Subject:** Applied biochemistry deals with complete understanding of the molecular level of the chemical process associated with living cells. Clinical chemistry deals with the study of chemical aspects of human life in health and illness and the application of chemical laboratory methods to diagnosis, control, treatment and prevention of diseases.
2. **Objectives of the Subject (Know, do, appreciate):** The objective of the present course is providing biochemical facts and the principles to the students of pharmacy. Upon completion of the subject student shall be able to –
   a. understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases;
   b. know the metabolic process of biomolecules in health and illness (metabolic disorders);
   c. understand the genetic organization of mammalian genome; protein synthesis;
   replication; mutation and repair mechanism;
   d. know the biochemical principles of organ function tests of kidney, liver and endocrine gland;
   e. do the qualitative analysis and determination of biomolecules in the body fluids.

Text books (Theory)

a. Harpers review of Biochemistry - Martin
b. Text book of Biochemistry – D. Satyanarayana
c. Text book of Clinical Bhemistry- Alex kaplan & Laverve L. Szabo

Reference books (Theory)

a. Principles of Biochemistry -- Lehninger
b. Text book of Biochemistry -- Ramarao
c. Practical Biochemistry-David T. Plummer.
d. Practical Biochemistry-Pattabhiraman.

3. Lecture wise programme:

1 **Introduction to Biochemistry:** Cell and its biochemical organization, transport process across the cell membranes. Energy rich

compounds: ATP, Cyclic AMP and their biological significance.

2 **Enzymes:** Definition, Nomenclature, IUB classification, Factors affecting enzyme activity; Enzyme action & enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.

3 **Carbohydrate metabolism:** Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis & glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose & Galactose tolerance test with their significance; hormonal regulation of carbohydrate metabolism.

4 **Lipid metabolism:** Oxidation of saturated fatty acids (Beta-oxidation), Ketogenesis and ketolysis, biosynthesis of fatty acids, lipids metabolism of cholesterol. Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atherosclerosis, fatty liver, hypercholesterolemia).

5 **Biological oxidation:** Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture: regulation and inhibition). Uncouplers of ETC & Oxidative phosphorylation.

6 **Protein and amino acid metabolism:** Protein turn over, nitrogen balance, Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders, production of bile pigments; hyperbilirubinemia, porphyria, jaundice. Metabolic disorder of Amino acids.

7 **Nucleic acid metabolism:** Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism.

8 **Introduction to clinical chemistry:** Cell; composition & malfunction; Role of the clinical chemistry laboratory.

9 **The kidney function tests:** Role of kidney; Laboratory tests for normal function includes-

a) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.)

b) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid)

c) Urine concentration test d) Urinary tract calculi. (stones)

10 **Liver function tests:** Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation.

a) Test for hepatic dysfunction-Bile pigments metabolism.

b) Test for hepatic function Serum bilirubin, urine bilirubin, and urine urobilinogen.

c) Dye tests for excretory function.

d) Tests based upon abnormalities of serum proteins.

Selected enzyme tests.

11 **Lipid profile tests:** Lipoproteins - composition & functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.

12 **Immunochemical techniques:** Determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases.

Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA)

13 **Electrolytes:** Body water, compartments, water balance and electrolyte distrubution. Determination of sodium, calcium potassium, chlorides & bicarbonates in the body fluids.

PharmD: First Year Syllabus
PBT 1.3L: MEDICINAL BIOCHEMISTRY LAB

Practical: 3 Hrs./Week

Title of the Experiment:

1 Qualitative analysis of normal constituents of urine.*

2 Qualitative analysis of abnormal constituents of urine.*

3 Quantitative estimation of urine sugar by Benedict's reagent method.**

4 Quantitative estimation of urine chlorides by Volhard's method.**

5 Quantitative estimation of urine creatinine by Jaffe's method.**

6 Quantitative estimation of urine calcium by precipitation method.**

7 Quantitative estimation of serum cholesterol by Libermann Burchard's method.**

8 Preparation of Folin Wu filtrate from blood.*

9 Quantitative estimation of blood creatinine.**

10 Quantitative estimation of blood sugar Folin-Wu tube method.**

11 Estimation of SGOT in serum.**

12 Estimation of SGPT in serum.**

13 Estimation of Urea in Serum.**

14 Estimation of Proteins in Serum.**

15 Determination of serum bilirubin**

16 Determination of Glucose by means of Glucoseoxidase.**

17 Enzymatic hydrolysis of Glycogen/Starch by Amylases.**

18 Study of factors affecting Enzyme activity. (pH & Temp.)**

19 Preparation of standard buffer solutions and its pH measurements (any two)*

20 Experiment on lipid profile tests**

21 Determination of sodium, calcium and potassium in serum.**

** indicate major experiments & * indicate 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.

Scheme of Practical Examination:

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

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

PharmD: First Year Syllabus
PCH 1.4T: PHARMACEUTICAL ORGANIC CHEMISTRY

Theory: 3 Hrs. /Week

1. **Scope and objectives:** This course is designed to impart a very good knowledge about
   a. IUPAC/Common system of nomenclature of simple organic compounds belonging to different classes of organic compounds;
   b. Some important physical properties of organic compounds;
   c. Free radical/ nucleophilic [alkyl/ acyl/ aryl]/electrophilic substitution, free radical/ nucleophilic / electrophilic addition, elimination, oxidation and reduction reactions with mechanism, orientation of the reaction, order of reactivity, stability of compounds;
   d. Some named organic reactions with mechanisms;
   e. Methods of preparation, test for purity, principle involved in the assay, important medicinal uses of some important organic compounds.

2. Course materials:

Text books

   a. T.R.Morrison and R. Boyd - Organic chemistry,
   b. Bentley and Driver-Text book of Pharmaceutical chemistry
   c. I.L.Finer- Organic chemistry, the fundamentals of chemistry

Reference books

   a. Organic chemistry – J.M.Cram and D.J.Cram
   b. Organic chemistry- Brown
   c. Advanced organic chemistry- Jerry March, Wiley
   d. Organic chemistry- Cram and Hammered, Pine Hendrickson

3. Lecture wise programme:

Topics

1 Structures and Physical properties:
   a. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, solubility, non ionic solutes and ionic solutes, protic and aprotic solvents, ion pairs,
   b. Acids and bases, Lowry bronsted and Lewis theories
   c. Isomerism

2 Nomenclature of organic compound belonging to the following classes: Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides and Cycloalkanes.

3 Free radical chain reactions of alkanes: Mechanism, relative reactivity and stability

4 Alicyclic compounds: Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.

5 Nuclophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN^2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN^1 reaction, Ion dipole bonds, SN^2 versus SN^1 solvolysis, nucleophilic assistance by the solvents.

6 Dehydrohalogenation of alkyl halides: 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement, isotope effect, absence of hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohols ease of dehydration, acid catalysis, reversibility and orientation.

7 Electrophillic and free radicals addition: Reactions at carbon-carbon, double bond, electrophile,

hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff's rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radical additon, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free radical addition, additions of carbene to alkene, cyclo addition reactions.

8 Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.

9 Theory of resonance: Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyperconjugation, allyl cation as a resonance hybrid, nucleophillic substitution in allylic substrate, SN^1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyperconjugation, nucleophilic substitution in allylic substrate, SN^2 nucleophilic substituion in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4-addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.

10 Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent groups 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 benzenes resonance stabilization of benzyl radical.

11 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.

12 Mechanism of aldol condensation, claisen condensation, cannizzaro's reaction, crossed aldol condensation, crossed cannizzaro's reaction, benzoin condensation, perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.

13 Hoffman rearrangement: Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe-Schmitt reaction, Reimer tieman's reactions.

14 Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.

15 Oxidation reduction reactions.

16 Study of the following official compounds-preparation, test for purity, assay and medicinal uses of chlorbutol, dimercaprol, glyceryl trinitrate, urea, ethylene diamine dihyrate, vanillin, paraldehyde, ethylene chloride, lactic acid, tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.

PharmD: First Year Syllabus
PCH 1.4L: PHARMACEUTICAL ORGANIC CHEMISTRY LAB

Practical : 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. 9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde
9. m-phenylene diamine (Reduction of M-dinitrobenzene) /Aniline from nitrobenzene
10. Benzophenone oxime
11. Nitration of salicylic acid
12. Preparation of picric acid
13. Preparation of O-chlorobenzoic acid from O-chlorotolune
14. Preparation of cyclohexanone from cyclohexanol

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

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

III. Introduction to the use of stereo models:

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

Scheme of Practical Examination:

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

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

PharmD: First Year Syllabus
PCH 1.5T: PHARMACEUTICAL INORGANIC CHEMISTRY

Theory : 2 Hrs. /Week

1. **Scope and objectives:** This course mainly deals with fundamentals of Analytical chemistry and also the study of inorganic pharmaceuticals regarding their monographs and also the course deals with basic knowledge of analysis of various pharmaceuticals.
2. **Upon completion of the course student shall be able to:**
   a. understand the principles and procedures of analysis of drugs and also regarding the application of inorganic pharmaceuticals;
   b. know the analysis of the inorganic pharmaceuticals, their applications; and
   c. appreciate the importance of inorganic pharmaceuticals in preventing and curing the disease.
3. **Course materials:**

Text books

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

Reference books

a. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
b. Pharmaceutical Inorganic chemistry by Dr. B. G. Nagavi
c. Analytical chemistry principles by John H. Kennedy d. I.P.1985 and 1996, Govt. of India, Ministry of health

4. **Lecture wise programme:**

1. **Errors:**
   Errors in quantitative analysis, classification of errors, concept of accuracy and precision, treatment of analytical results.
2. **Volumetric analysis:**
   Principle of volumetric analysis, different methods of analysis, different methods for expressing concentrations of solutions, primary and secondary standards.
3. **Acid-base titrations**
   Acid- base concepts, relative strength of acids and bases, law of mass action, common ion effect, ionic product of water, Henderson-Hasselbalch equation, buffer solutions, theory of indicators, neutralization curves, choice of indicators, mixed and universal indicators.
4. **Redox titrations**
   Concepts of oxidation–reduction reactions, redox reactions, theory of redox titrations, redox indicators, iodometry and iodimetry, titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate, titanous chloride.
5. **Non aqueous titration**
   Theoretical basis, types of solvents, preparations and standardization of titrant solutions, titration of weak acid, weak bases. Indicators. Standardisation of perchloric acid, lithium and sodium methoxide, tetra butyl ammonium hydroxide.
6. **Precipitation titrations**
   Introduction, types of precipitation titrations, end point detection.
7. **Complexometric titrations**
   Introduction, principle, types of titrations, endpoint detection.
8. **Theory of Indicators**
9. **Gravimetry**
   Basic concepts, Precipitation techniques, co-precipitation, post–precipitation, various steps involved in gravimetric analysis, pharmaceutical applications.
10. **Limit tests**
    Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, lead and heavy metals.
11. **Medicinal Gases**
    Preparation and uses of the following: Oxygen, carbon dioxide, helium, nitrogen and nitrous oxide.

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

12. Acidifiers

Dilute hydrochloric acid, sodium phosphate, Ammonium chloride.

13. Antacids

Classification, Qualities of an ideal antacid, side effects, advantages, combination therapy, acid neutralizing capacity. Sodium bicarbonate, potassium citrate, aluminium hydroxide gel, dried aluminium hydroxide gel, Magnesium hydroxide, light and heavy magnesium trisilicate, light and heavy magnesium carbonate, calcium carbonate, magaldrate and bismuth carbonate.

14. Cathartics

Magnesium hydroxide, magnesium sulphate, magnesium carbonate and sodium phosphate.

15. Electrolyte replenisher

Electrolytes used for replacement therapy: Sodium chloride, potassium chloride, calcium chloride, calcium gluconate.

Electrolytes used in the acid-base therapy : Sodium acetate, potassium acetate, sodium bicarbonate, potassium bicarbonate, sodium citrate, sodium lactate, ammonium chloride.

Electrolyte combination therapy: Compound sodium chloride solution, sodium chloride injection and oral rehydration salt.

16. Essential Trace elements

Definition, Physiological role of Iron, copper, zinc, chromium, manganese, molybdenum, selenium, sulphur and Iodine.

17. Antimicrobials

Hydrogen Peroxide, potassium permanganate, chlorinated lime, Iodine, boric acid, silver nitrate, selenium sulphide.

18. Pharmaceutical Aids: Sodium bisulphite, sodium metabisulphite, bentonite, magnesium stearate, zinc stearate, aluminium sulphate, sodium carboxy methyl cellulose, purified water, water for injection and sterile water for injection.

19. Dental products

Anti-caries Agents: Role of fluorides as anti-caries agents, sodium fluoride.

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

20. Miscellaneous compounds.

Sclerosing agents: Hypertonic saline, sodium tetra decyl sulphate.

Expectorants: Potassium citrate and potassium iodide.

Sedative: Potassium bromide.

Antidotes: Sodium nitrite, sodium thiosulphate and charcoal

Respiratory stimulant: Ammonium carbonate.

21. Radiopharmaceuticals.

Introduction, measurement of radioactivity, clinical applications and dosage, hazards and precautions.

PharmD: First Year Syllabus
PCH 1.5L: PHARMACEUTICAL INORGANIC CHEMISTRY LAB

Practical : 3 Hrs./Week

1. Limit test (6 exercises)
- a. Limit test for chlorides
- b. Limit test for sulphates
- c. Limit test for iron
- d. Limit test for heavy metals
- e. Limit test for arsenic
- f. Modified limit tests for chlorides and sulphates

2. Assays (10 exercises)
- a. Ammonium chloride- Acid-base titration
- b. Ferrous sulphate- Cerimetry
- c. Copper sulpahte- Iodometry
- d. Calcilugluconate- Complexometry
- e. Hydrogen peroxide – Permanganometry
- f. Sodium benzoate – Nonaqueous titration
- g. Sodium chloride – Modified volhard's method
- h. Assay of KI – KIO3 titration
- i. Gravimetric estimation of barium as barium sulphate
- j. Sodium antimony gluconate or antimony potassium tartarate

3. Estimation of mixture (Any two exercises)
- a. Sodium hydroxide and sodium carbonate
- b. Boric acid and borax
- c. Oxalic acid and sodium oxalate

4. Test for identity (Any three exercises)
- a. Sodium bicorbonate
- b. Barium sulphate
- c. Ferrous sulphate
- d. Potassium chloride

5. Test for purity (Any two exercises)
- a. Swelling power in bentonite
- b. Acid neutralising capacity in aluminium hydroxide gel
- c. Ammonium salts in potash alum
- d. Adsorption power heavy Kaolin
- e. Presence of iodates in KI

6. Preparations (Any two exercises)

a. Boric acid
b. Potash alum
c. Calcium lactate
d. Magnesium suphate

Scheme of Practical Examination:

	Sessionals	Annual
Synopsis	05	15
Major Experiment	10	25
Minor Experiment1&2	03	15
Viva	02	15
Max Marks	**20**	**70**
Duration	**03 hrs**	**04 hrs**

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

PharmD: First Year Syllabus
MAT 1.6T/PCO 1.6T: REMEDIAL MATHEMATICS / BIOLOGY

Theory: 3 Hrs. /Week

REMEDIAL MATHEMATICS (MAT 1.6T):

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

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

a. know Trignometry, Analytical geometry, Matrices, Determinant, Integration, Differential equation, Laplace transform and their applications;
b. solve the problems of different types by applying theory; and
c. appreciate the important applications of mathematics in pharmacy.

3. Course materials:

Text books

a. Differential calculus by Shantinarayan
b. Text book of Mathematics for second year pre-university by Prof.B.M. Sreenivas

Reference books

a. Integral calculus by Shanthinarayan
b. Engineering mathematics by B.S.Grewal
c. Trigonometry Part-I by S.L. Loney

4. Lecture wise programme:

Topics

1 **Algebra:** Determinants, Matrices

2 **Trigonometry:** Sides and angles of a triangle, solution of triangles

3 **Analytical Geometry:** Points, straight line, circle, parabola

4 **Differential Calculus**: Limit of a function, Differential calculus, Differentiation of a sum, Product, Quotient Composite, Parametric, exponential, trigonometric and Logarithmic function. Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions of two variables

5 **Integral Calculus:** Definite integrals, integration by substitution and by parts, properties of definite integrals.

6 **Differential Equations:** Definition, order, degree, variable separable, homogeneous, Linear, heterogeneous, linear, differential equation with constant coefficient, simultaneous linear equation of second order.

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

BIOLOGY (PCO 1.6T) :

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

2. Course materials:

Text books

a. Text book of Biology by S.B.Gokhale
b. A Text book of Biology by Dr.Thulajappa and Dr. Seetaram.

Reference books

a. A Text book of Biology by B.V.Sreenivasa Naidu

b. A Text book of Biology by Naidu and Murthy

c. Botany for Degree students By A.C.Dutta.

d. Outlines of Zoology by M. E kambaranatha ayyer and T. N. Ananthakrishnan.

e. A manual for pharmaceutical biology practical by S. B. Gokhale and C.K.Kokate.

3. Lecture wise programme :

Topic

PART – A

01 Introduction

02 General organization of plant and plant cell and its inclusions

03 Plant tissues-Meristematic & Permanent

04 Plant kingdom and its classification

05 Morphology of plants

06 Root, stem, leaf and its modifications

07 Inflorescence, flower and Pollination

08 Morphology of fruits and seeds

09 Plant physiology

10 Plant Taxonomy: Study of different plant families with special reference to medicinal plants: Leguminosae, umbelliferae, solanaceae, lilliaceae, zinziberaceae, rubiaceae

11 Study of Fungi, Yeast, Penicillin and Bacteria

PART-B

01 Study of animal cell

02 Study animal tissues

03 Detailed study of frog

04 Study of Pisces, Reptiles, Aves

05 Genearal organization of mammals

06 Study of poisonous animals

PharmD: First Year Syllabus
PCO 1.6L: BIOLOGY LAB

Practical : 3 Hrs./Week

Title:

1. Introduction of biology experiments
2. Study of cell wall constituents and cell inclusions
3. Study of stem modifications
4. Study of root modifications
5. Study of leaf modifications
6. Identification of fruits and seeds
7. Preparation of permanent slides
8. T. S. of Senna, Cassia, Ephedra, Podophyllum.
9. Simple plant physiological experiments
10. Identification of animals
11. Detailed study of frog
12. Computer based tutorials

Scheme of Practical Examination:

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

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

PharmD: Second Year Syllabus
PPR 2.1T: PATHOPHYSIOLOGY

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic Pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge of its application in other subject of pharmacy.
2. **Objectives of the Subject:** Upon completion of the subject student shall be able to -
   a. describe the etiology and pathogenesis of the selected disease states;
   b. name the signs and symptoms of the diseases; and
   c. mention the complications of the diseases.

Text books (Theory)

a. Pathologic basis of disease by- Cotran, Kumar, Robbins

b. Text book of Pathology- Harsh Mohan

c. Text book of Pathology- Y.M. Bhinde

Reference books (Theory)

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

3. Detailed syllabus and lecture wise schedule :

1 Basic principles of cell injury and Adaptation

a) Causes, Pathogenesis and morphology of cell injury

b) Abnormalities in lipoproteinaemia, glycogen infiltration and glycogen infiltration and glycogen infiltration and glycogen storage diseases

2 Inflammation

a) Pathogenesis of acute inflammation, Chemical mediators in inflammation, Types of chronic inflammation

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

3 Diseases of Immunity

a) Introduction to T and B cells

b) MHC proteins or transplantation antigens

c) Immune tolerance

- Hypersensitivity

  Hypersensitivity type I, II, III, IV, Biological significance, Allergy due to food, chemicals and drugs

- Autoimmunity

  Criteria for autoimmunity, Classifications of autoimmune diseases in man, mechanism of autoimmunity, Transplantation and immunologic tolerance, allograft rejections, transplantation antigens, mechanism of rejection of allograft.

- Acquired immune deficiency syndrome (AIDS)

- Amylodosis

4 Cancer

Differences between benign and malignant tumors, Histological diagnosis of malignancy, invasions and metastasis, patterns of spread, disturbances of growth of cells, classification of tumors, general biology of tumors, spread of malignant tumors, etiology and pathogenesis of cancer.

5 Types of shock, mechanisms, stages and management

6 Biological effects of radiation

7 Environmental and nutritional diseases

i) Air pollution and smoking- SO_2, NO, NO_2, and CO

ii) Protein calorie malnutrition, vitamins, obesity, pathogenesis of starvation.

8 Pathophysiology of common diseases

a. Parkinsonism

b. Schizophrenia

c. Depression and mania

d. Hypertension,

e. Stroke (ischaemic and hemorrhage)

f. Angina, CCF, Atherosclerosis, Myocardial infarction

g. Diabetes Mellitus

h. Peptic ulcer and inflammatory bowel diseases

i. Cirrhosis and Alcoholic liver diseases

j. Acute and chronic renal failure

k. Asthma and chronic obstructive airway diseases

9 Infectious diseases

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

4. Assignments

Title of the Experiment

1 Chemical Mediators of inflammation

2 Drug Hypersensitivity

3 Cigarette smoking & its ill effects

4 Biological Effects of Radiation

5 Etiology and hazards of obesity

6 Complications of diabetes

7 Diagnosis of cancer

8 Disorders of vitamins

9 Methods in Pathology-Laboratory values of clinical significance

10 Pathophysiology of Dengue Hemorrhagic Fever (DHF)

Format of the assignment

1 Minimum & Maximum number of pages.

2. Reference(s) shall be included at the end.

3. Assignment can be a combined presentation at the end of the academic year

4. It shall be computer draft copy.

5. Name and signature of the student

6. Time allocated for presentation may be 8+2 Min.

PharmD: Second Year Syllabus
PBT 2.2T: PHARMACEUTICAL MICROBIOLOGY

Theory : 3 Hrs. /Week

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

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

2. **Objectives of the Subject :**

   Upon completion of the subject student shall be able to -

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

Text books (Theory)

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

Reference books (Theory)

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

3. **Detailed syllabus and lecture wise schedule :**

	Title of the topic
1	Introduction to the science of microbiology. Major divisions of microbial world and Relationship among them.
2	Different methods of classification of microbes and study of Bacteria, Fungi, virus, Rickettsiae, Spirochetes.
3	Nutritional requirements, growth and cultivation of bacteria and virus. Study of different important media required for the growth of aerobic and anaerobic bacteria & fungi. Differential media, enriched media and selective media, maintenance of lab cultures.
4	Different methods used in isolation and identification of bacteria with emphasis to different staining techniques and biochemical reactions. Counting of bacteria -Total and Viable counting techniques.
5	Detailed study of different methods of sterilization including their merits and demerits. Sterilization methods for all pharmaceutical products. Detailed study of sterility testing of different pharmaceutical preparations . Brief information on Validation.
6	Disinfectants- Study of disinfectants, antiseptics, fungicidal and virucidal agents. Factors affecting their activation and mechanism of action. Evaluation of bactericidal, bacteristatic, virucidal activities, evaluation of preservatives in pharmaceutical preparations.
7	Immunology- Immunity, Definition, Classification, General principles of natural immunity, Phagocytosis, acquired immunity (active and passive). Antigens, chemical nature of antigens structure and formation of Antibodies, Antigen-Antibody reactions. Bacterial exotoxins and endotoxins. Significance of toxoids in active immunity, Immunization programme, and importance of booster dose.
8	Diagnostic tests : Schick's Test, Elisa test, Western Blot test, Southern Blot PCR Widal, QBC, Mantaux Peripheral smear. Study of malarial parasite.
9	Microbial culture sensitivity Testing: Interpretation of results Principles and methods of different microbiological assays, microbiological assay of Penicillin, Streptomycin and vitamin B_2 and B_{12}. Standardisation of vaccines and sera.
10	Study of infectious diseases: Typhoid, Tuberculosis, Malaria, Cholera, Hepatitis, Meningitis, Syphilis & Gonorrhea and HIV.

PharmD: Second Year Syllabus
PBT 2.2L: PHARMACEUTICAL MICROBIOLOGY LAB

Practical : 3 Hrs./Week

Title of the Experiment:

1 Study of apparatus used in experimental microbiology*.
2 Sterilisation of glassware. Preparation of media and sterilisation.*
3 Staining techniques - Simple staining; Gram's staining ; Negative staining**
4 Study of motility characters*.
5 Enumeration of microorganisms (Total and Viable)*
6 Study of the methods of isolation of pure culture.*
7 Biochemical 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 turbidimetric method**
13 Determination of RWC.**
14 Diagnostic tests for some common diseases, Widal, malarial parasite.**

* Indicate minor experiment & ** indicate major experiment

Assignments:

1 Visit to some pathological laboratories & study the activities and equipment/instruments used and reporting the same.
2. Visit to milk dairies (Pasturization) and microbial laboratories(other sterization methods) & study the activities and equipment/instruments used and reporting the same.
3. Library assignments

a. Report of recent microbial techniques developed in diagnosing some common diseases.

b. Latest advancement developed in identifying, cultivating & handling of microorganisms.

Format of the assignment:

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

Scheme of Practical Examination:

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

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

PharmD: Second Year Syllabus
PCO 2.3T: PHARMACOGNOSY & PHYTOPHARMACEUTICALS

Theory : 3 Hrs. /Week

1. **Scope and objectives:** This subject has been introduced for the pharmacy course in order to make the student aware of medicinal uses of various naturally occurring drugs its history, sources, distribution, method of cultivation, active constituents, medicinal uses, identification tests, preservation methods, substitutes and adulterants.

2. **Upon completion of the course student shall be able to:**

   a. Understand the basic principles of cultivation, collection and storage of crude drugs;

   b. know the source, active constituents and uses of crude drugs

   c. appreciate the applications of primary and secondary metabolites of the plant.

3. **Course materials:**

Text books

a. Pharmacognosy by G.E. Trease & W.C.Evans.

b. Pharmacognosy by C.K.Kokate,Gokhale & A.C.Purohit.

Reference books

a. Pharmacognosy by Brady &Tyler.E.

b. Pharmacognosy by T.E.Wallis.

c. Pharmacognosy by C.S. Shah & Qadry.

d. Pharmacognosy by M.A. Iyengar.

4. **Lecture wise programme:**

Topics

1 Introduction.
2 Definition, history and scope of Pharmacognosy.

3 Classification of crude drugs.
4 Cultivation, collection, processing and storage of crude drugs.
5 Detailed method of cultivation of crude drugs.
6 Study of cell wall constituents and cell inclusions.
7 Anatomical and powder microscopical study of crude drugs.
8 Study of natural pesticides.
9 Detailed study of various cell constituents.
10 Carbohydrates and related products.
11 Detailed study of carbohydrates containing drugs.(11 drugs)
12 Definition, sources, method of extraction, chemistry and method of analysis of lipids.
13 Detailed study of oils.
14 Definition, classification, chemistry and method of analysis of proteins.
15 Study of plants fibers used in surgical dressings and related products.
16 Different methods of adulteration of crude drugs.

PharmD: Second Year Syllabus
PCO 2.3L: PHARMACOGNOSY & PHYTOPHARMACEUTICALS LAB

Practical : 3 Hrs./Week

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

List of experiments:

1 Introduction of Pharmacognosy laboratory and experiments.
2 Study of cell wall constituents and cell inclusions.
3 Macro, powder and microscopic study of Datura
4 Macro, powder and microscopic study of Senna.
5 Macro, powder and microscopic study of Cassia and Cinnamon.
6 Macro, powder and microscopic study of Cinchona.
7 Macro, powder and microscopic study of Ephedra.
8 Macro, powder and microscopic study of Quassia.
9 Macro, powder and microscopic study of Clove
10 Macro, powder and microscopic study of Fennel.
11 Macro, powder and microscopic study of Coriander.
12 Macro, powder and microscopic study of Isapgol.
13 Macro, powder and microscopic study of Nux vomica.
14 Macro, powder and microscopic study of Rauwolfia.
15 Macro, powder and microscopic study of Liquorice.
16 Macro, powder and microscopic study of Ginger.
17 Macro, powder and microscopic study of Podophyllum.
18 Determination of Iodine value.
19 Determination of saponification value and unsaponifiable matter.
20 Determination of ester value.
21 Determination of acid value.
22 Chemical tests for Acacia.
23 Chemical tests for Tragacanth.
24 Chemical tests for Agar.
25 Chemical tests for Starch.
26 Chemical tests for Lipids.(castor oil,sesame oil, shark liver oil,bees wax)
27 Chemical tests for Gelatin.

Scheme of Practical Examination:

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

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

PharmD: Second Year Syllabus
PHA 2.4T: PHARMACOLOGY - I

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, apart from general pharmacology, drugs acting on autonomic nervous system, cardiovascular system, central nervous system, will be taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.

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

   a. understand the pharmacological aspects of drugs falling under the above mentioned chapters;

   b. appreciate the importance of pharmacology subject as a basis of therapeutics; and

   c. correlate and apply the knowledge therapeutically.

   Text books (Theory) (Author, Title, Edition, Publication Place, Publisher, Year of Publication)

   a. Tripathi, K. D. Essentials of medical pharmacology. 4th Ed, 1999. Publisher: Jaypee, Delhi.

   b. Satoskar, R.S. and Bhadarkar, S.D. Pharmacology and pharmacotherapeutics. 16th edition (single volume), 1999. Publisher: Popular, Dubai.

   c. Rang, H.P. & Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books (Theory) (Author, Title, Edition, Publication Place, Publisher, Publication Year)

   a. 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.

   b. Craig, C.R.&Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown.Co

   c. Katzung, B.G. Basic and Clinical Pharmacology. Latest edition. Publisher: Prentice Hall, Int.

   d. Shargel and Leon. Applied Biopharmaceutics and pharmacokinetics. Latest edition. Publisher: Prentice Hall, London.

3. **Detailed syllabus and lecture wise schedule :**

Title of the topic

1. **General Pharmacology**

   a) Introduction, definitions and scope of Pharmacology

   b) Routes of administration of drugs

   c) Pharmacokinetics (absorption, distribution, metabolism and excretion)

   d) Pharmacodynamics

   e) Factors modifying drug effects

   f) Drug toxicity - Acute, sub-acute and chronic toxicity.

   g) Pre-clinical evaluations

   h) Drug interactions

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

2. **Pharmacology of drugs acting on ANS**

   a) Adrenergic and antiadrenergic drugs

   b) Cholinergic and anticholinergic drugs

   c) Neuromuscular blockers

   d) Mydriactics and miotics

   e) Drugs used in myasthenia gravis

   f) Drugs used in Parkinsonism

3. **Pharmacology of drugs acting on cardiovascular system**

   a) Antihypertensives

   b) Anti-anginal drugs

   c) Anti-arrhythmic drugs

   d) Drugs used for therapy of Congestive Heart Failure

   e) Drugs used for hyperlipidaemias

4. **Pharmacology of drugs acting on Central Nervous System**

   a) General anesthetics

   b) Sedatives and hypnotics

   c) Anticonvulsants

   d) Analgesic and anti-inflammatory agents

   e) Psychotropic drugs

   f) Alcohol and methyl alcohol

   g) CNS stimulants and cognition enhancers

   h) Pharmacology of local anaesthetics

5. **Pharmacology of Drugs acting on Respiratory tract**

   a) Bronchodilators

   b) Mucolytics

   c) Expectorants

   d) Antitussives

   e) NasalDecongestants

6. **Pharmacology of Hormones and Hormone antagonists**

   a) Thyroid and Antithyroid drugs

   b) Insulin, Insulin analogues and oral hypoglycemic agents

   c) Sex hormones and oral contraceptives

   d) Oxytocin and other stimulants and relaxants

7. **Pharmacology of autacoids and their antagonists**

   a) Histamines and Antihistaminics

   b) 5-Hydroxytryptamine and its antagonists

   c) Lipid derived autacoids and platelet activating factor

PharmD: Second Year Syllabus
PPR 2.5T: COMMUNITY PHARMACY

Theory : 2 Hrs. /Week

1. **Scope:** In the changing scenario of pharmacy practice in India, Community Pharmacists are expected to offer various pharmaceutical care services. In order to meet this demand, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling, health screening services for improved patient care in the community set up.
2. **Objectives:** Upon completion of the course, the student shall be able to -
   a. know pharmaceutical care services;
   b. know the business and professional practice management skills in community pharmacies;
   c. do patient counselling & provide health screening services to public in community pharmacy;
   d. respond to minor ailments and provide appropriate medication;
   e. show empathy and sympathy to patients; and
   f. appreciate the concept of Rational drug therapy.

Text Books:

a. Health Education and Community Pharmacy by N. S. Parmar.
b. WHO consultative group report.
c. Drug store & Business management by Mohammed Ali & Jyoti.

Reference books:

a. Handbook of pharmacy - health care.Edt. Robin J Harman. The Pharmaceutical press.
b. Comprehensive Pharmacy Review - Edt. Leon Shargel. Lippincott Williams & Wilkins.

Special requirements:

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

4. **Lecture wise programme :**

Topics

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

2 **Community Pharmacy Management**

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

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

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

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

6 **Patient counselling**

Definition, outcomes, various stages, barriers, Strategies to overcome barriers

Patient information leaflets- content, design, & layouts, advisory labels

7 **Patient medication adherence**

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

8 **Health screening services**

Definition, importance, methods for screening

Blood pressure/ blood sugar/ lung function

and Cholesterol testing

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

10 **Health Education**

WHO Definition of health, and health promotion, care for children, pregnant & breast feeding women, and geriatric patients.

Commonly occurring Communicable Diseases, causative agents, Clinical presentations and prevention of communicable diseases - Tuberculosis, Hepatitis, Typhoid, Amoebiasis, Malaria, Leprosy, Syphilis, Gonorrhea and AIDS Balance diet, and treatment & prevention of deficiency disorders Family planning - role of pharmacist

11 Responding to symptoms of minor ailments

Relevant pathophysiology, common drug therapy to, Pain, GI disturbances (Nausea, Vomiting, Dyspepsia, diarrhea, constipation), Pyrexia, Opthalmic symptoms, worms infestations.

12 Essential Drugs concept and Rational Drug Therapy

Role of community pharmacist

13 **Code of ethics for community pharmacists**

PharmD: Second Year Syllabus
PPR 2.6T: PHARMACOTHERAPEUTICS - I

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.
2. **Objectives:** At completion of this subject it is expected that students will be able to understand -
   a. the pathophysiology of selected disease states and the rationale for drug therapy;
   b. the therapeutic approach to management of these diseases;
   c. the controversies in drug therapy;
   d. the importance of preparation of individualised therapeutic plans based on diagnosis;
   e. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
   f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
   g. summarise the therapeutic approach to management of these diseases including reference to the latest available evidence;
   h. discuss the controversies in drug therapy;
   i. discuss the preparation of individualised therapeutic plans based on diagnosis; and
   j. identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text Books

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

Reference Books

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

3. **Detailed syllabus and lecture wise schedule :**

Etiopathogenesis and pharmacotherapy of diseases associated with following systems/ diseases

Title of the topic

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

2 **Respiratory system:** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases

3 **Endocrine system:** Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis

4 **General prescribing guidelines for**

a. Paediatric patients

b. Geriatric patients

c. Pregnancy and breast feeding

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

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

PharmD: Second Year Syllabus
PPR 2.6L: PHARMACOTHERAPEUTICS - I LAB

Practical : 3 Hrs./Week

Practicals :

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

Assignments :

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

Format of the assignment:

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

Scheme of Practical Examination:

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

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

PharmD: Third Year Syllabus
PHA 3.1T: PHARMACOLOGY - II

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This subject will provide an opportunity for the student to learn about the drug with regard to classification, pharmacodynamic and pharmacokinetic aspects, adverse effects, uses, dose, route of administration, precautions, contraindications and interaction with other drugs. In this subject, drugs acting on blood, renal, immune system and molecular pharmacology will be concentrated. In addition, pharmacology of chemotherapeutic agents, vitamins, essential minerals and principles of toxicology are also taught. In addition to theoretical knowledge, the basic practical knowledge relevant to therapeutics will be imparted.
2. **Objectives:** Upon completion of the subject student shall be able to:
   a. understand the pharmacological aspects of drugs falling under the above mentioned chapters,
   b. carry out the animal experiments confidently,
   c. appreciate the importance of Pharmacology subject as a basis of therapeutics, and
   d. correlate and apply the knowledge therapeutically.

Text books (Theory)

a. Tripathi, K. D. Essentials of medical Pharmacology. 4th edition, 1999. Publisher: Jaypee, Delhi.
b. Satoskar, R. S. and Bhadanrkar, S. D. Pharmacology and Pharmacotherapeutics. 17th edition (single volume), 1999. Publisher: Popular Prakashan, Mumbai.
c. Rang, H.P. and Dale, M.M. Pharmacology. 4th edition, 1999. Publisher: Churchill Living stone.

Reference books (Theory)

a. Goodman Gilman, A., Rall, T.W., Nies, A.I.S. and Taylor, P. Goodman and Gilman's The pharmacological Basis of therapeutics. 9th edition, 1996. Publisher: Mc Graw Hill, Pergamon press.
b. Craig, C.R. and Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown and company.
c. Katzung, B.G. Basic and clinical pharmacology. Latest edition. Publisher: Prentice Hall, International.

d. Gupta, P.K. and Salunkhe, D.K. Modern Toxicology. Volume I, II and III. Latest edition. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.

Text books (Practical)

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

Reference books (Practical) :

a. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.

b. Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.

c. Ghosh, M.N. Fundamentals of Experimental Pharmacology. Latest edition, Publisher: Scientific book agency, Kolkata.

d. Ian Kitchen. Textbook of in vitro practical Pharmacology. Latest edition, Publisher: Black well Scientific.

3. Detailed syllabus and lecture wise schedule:

Title of the topic

1. Pharmacology of Drugs acting on Blood and blood forming agents
   a) Anticoagulants
   b) Thrombolytics and antiplatelet agents
   c) Haemopoietics and plasma expanders
2. Pharmacology of drugs acting on Renal System
   a) Diuretics
   b) Antidiuretics
3. Chemotherapy
   a) Introduction
   b) Sulfonamides and co-trimoxazole
   c) Penicillins and Cephalosporins
   d) Tetracyclins and Chloramphenicol
   e) Macrolides, Aminoglycosides, Polyene & Polypeptide antibiotics
   f) Quinolines and Fluroquinolones
   g) Antifungal antibiotics
   h) Antiviral agents
   i) Chemotherapy of tuberculosis and leprosy
   j) Chemotherapy of Malaria
   k) Chemotherapy of protozoal infections (amoebiasis, Giardiasis)
   l) Pharmacology of Anthelmintic drugs
   m) Chemotherapy of cancer (Neoplasms)
4 Immunopharmacology

Pharmacology of immunosuppressants and stimulants

5. Principles of Animal toxicology: Acute, sub acute and chronic toxicity
6. The dynamic cell: The structures and functions of the components of the cell

a) Cell and macromolecules: Cellular classification, 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.

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, translocations, 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

Books:

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

2 Molecular Cell Biology By Lodish, H., Baltimore, D., Berk, A et al., 5th edition.

3 Molecular Biology by Turner, PC., McLennan, AG., Bates, AD and White MRH 2nd edition.

4 Genes VIII by Lewin, B., (2004)

5 Pharmaceutical Biotechnology, by Crommelin, DJA and Sindelar RD (1997)

6 Recombinant DNA by Watson, JD., Gilman, M., et al., (1996)

7 Biopharmaceutical: Biochemistry and Biotechnology by Walsh, G., (1998)

PharmD: Third Year Syllabus
PHA 3.1L: PHARMACOLOGY - II LAB

Practical : 3 Hrs./Week

List of Experiments:

1. Study of laboratory animals and their handling (a. Frogs, b. Mice, c. Rats, d. Guinea pigs, e. Rabbits).
2. Study of physiological salt solutions used in experimental pharmacology.
3. Study of laboratory appliances used in experimental pharmacology.
4. Study of use of anesthetics in laboratory animals.
5. To record the dose response curve of Ach using isolated ileum/rectus abdominis muscle preparation.
6. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by interpolation method.
7. To carry out bioassay of Ach using isolated ileum/rectus abdominis muscle preparation by three point method.
8. To record the dose response curve of Histamine using isolated guinea-pig ileum preparation.
9. Study of agonistic and antagonistic effects of drugs using isolated guinea-pig ileum preparation.
10. To carry out bioassay of Histamine using isolated guinea-pig ileum preparation by interpolation method.
11. To carry out bioassay of Histamine using guinea-pig ileum preparation by three point method.
12. To study the routes of administration of drugs in animals (Rats, Mice, Rabbits).
13. Study of theory, principle, procedure involved and interpretation of given results for the following experiments:
    a) Analgesic property of drug using analgesiometer.
    b) Antiinflammatory effect of drugs using rat-paw edema method.
    c) Anticonvulsant activity of drugs using maximal electroshock and pentylene tetrazole methods.
    d) Antidepressant activity of drugs using pole climbing apparatus and pentobarbitone induced sleeping time methods.
    e) Locomotor activity evaluation of drugs using actophotometer and rotarod.
    f) Cardiotonic activity of drugs using isolated frog heart and mammalian heart preparations.

Scheme of Practical Examination:

	Sessionals	Annual
Identification	02	10
Synopsis	04	10
Major Experiment (Bioassay)	08	30
Minor Experiment (Interpretation of given Graph or simulated experiment)	04	10
Viva	02	10
Max Marks	**20**	**70**
Duration	**03hrs**	**04hrs**

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

PharmD: Third Year Syllabus
PQA 3.2T: PHARMACEUTICAL ANALYSIS

Theory : 3 Hrs. /Week

1. Quality Assurance:

a. Introduction, sources of quality variation, control of quality variation.

b. Concept of statistical quality control.

c. Validation methods- quality of equipment, validation of equipment and validation of analytical instruments and calibration.

d. GLP, ISO 9000.

e. Total quality management, quality review and documentation.

f. ICH- international conference for harmonization-guidelines.

g. Regulatory control.

2. Chromatography:

Introduction, history, classification, separation techniques, choice of methods. The following techniques be discussed with relevant examples of pharmaceutical products involving principles and techniques of separation of drugs from excipients.

a. Column Chromatography: Adsorption column

chromatography, Operational technique, frontal analysis and elution analysis. Factors affecting column efficiency, applications and partition chromatography.

b. TLC: Introduction, principle, techniques, Rf value and applications.

c. PC: Introduction, principle, types of paper chromatography, preparation techniques, development techniques, applications.

d. Ion-exchange chromatography: Introduction, principles, types of ion exchange synthetic resins, physical properties, factors affecting ion exchange, methodology and applications.

e. HPLC: Introduction, theory, instrumentation, and applications.

f. HPTLC: Introduction, theory, instrumentation, and applications.

g. Gas Chromatography: Introduction, theory, instrumentation-carrier gases, types of columns, stationary phases in GLC & GSC. Detectors-Flame ionization detectors, electron capture detector, thermal conductivity detector. Typical gas chromatogram, derivatisation techniques, programmed temperature gas chromatography, applications.

h. Electrophoresis: Principles of separation, equipment for paper and gel electrophoresis, and application.

i. Gel filtration and affinity chromatography: Introduction, technique, applications.

3. Electrometric Methods:

Theoretical aspects, instrumentation, interpretation of data/spectra and analytical applications be discussed on the following topics.

a. Potentiometry: Electrical potential, electrochemical cell, reference electrodes, indicator electrodes, measurement of potential and pH, construction and working of electrodes, Potentiometric titrations, methods of detecting end point, Karl Fischer titration.

b. Conductometry: Introduction, conductivity cell, conductometric titrations and applications.

c. Polarography: Instrumentation, DME, residual current, diffusion current and limiting current, polarographic wave, Ilkovic's equation, Effect of oxygen on polarographic wave, Polarographic maxima and suppressors and applications.

d. Amperometric Titrations: Introduction, types of electrodes used, reference and indicator electrode, instrumentation, titration procedure, advantages and disadvantages of Amperometry over potentiometry. Pharma applications.

4. Spectroscopy:

Theoretical aspects, instrumentation, elements of interpretation of data/spectra and application of analytical techniques be discussed on:

a. Absorption Spectroscopy:

- Theory of electronic, atomic and molecular spectra. Fundamental laws of photometry, Beer-Lambert's Law, application and its deviation, limitation of Beer law, application of the law to single and multiple component analysis, measurement of equilibrium constant and rate constant by spectroscopy. Spectra of isolated chromophores, auxochromes, batho-chromic shift, hypsochromic shift, hyperchromic and hypochromic effect, effect of solvent on absorption spectra, molecular structure and infrared spectra.

  Instrumentation - Photometer, U.V.-Visible spectrophotometer - sources of U.V.-Visible radiations, collimating systems, monochromators, samples cells and following detectors-Photocell, Barrier layer cell, Phototube, Diode array, applications of U.V.-Visible spectroscopy in pharmacy and spectrophotometric titrations.

- Infrared Spectroscopy: Vibrational transitions, frequency - structure correlations, Infrared absorption bands, Instrumentation-IR spectro-meter - sources of IR, Collimating systems, monochromators, sample cells, sample handling in IR spectroscopy and detectors-Thermocouple, Golay Cells, Thermistor, Bolometer, Pyroelectric detector, Applications of IR in pharmacy.

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

b. Flame Photometry: Theory, nebulisation, flame and flame temperature, interferences, flame spectrometric techniques and instrumentation and pharmaceutical applications.

c. Atomic Absorption Spectrometry: Introduction, Theory, types of electrodes, instrumentation and applications.

d. Atomic Emission Spectroscopy: Spectroscopic sources, atomic emission spectrometers, photographic and photoelectric detection.

e. NMR & ESR (introduction only): Introduction, theoretical aspects and applications.

f. Mass Spectroscopy: (Introduction only) - Fragmentation, types of ions produced mass spectrum and applications.

g. Polarimetry: (Introduction only) - Introduction to optical rotatory dispersion, circular dichroism, polarimeter.

h. X-RAY Diffraction: (Introduction only) - Theory, reciprocal lattice concept, diffraction patterns and applications.

i. Thermal Analysis: Introduction, instrumentation, applications, and DSC and DTA.

PharmD: Third Year Syllabus
PQA 3.2L: PHARMACEUTICAL ANALYSIS LAB

Practical : 3 Hrs./Week

List of Experiments:

1. Separation and identification of Amino Acids by Paper Chromatography.
2. Separation and identification of Sulpha drugs by TLC technique.
3. Effect of pH and solvent on the UV spectrum of given compound.
4. Comparison of the UV spectrum of a compound with that of its derivatives.
5. Determination of dissociation constant of indicators using UV-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.

Reference Books:

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

Scheme of Practical Examination:

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

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

PharmD: Third Year Syllabus
PPR 3.3T: PHARMACOTHERAPEUTICS - II

Theory : 3 Hrs. /Week

1. **Scope of the Subject:** This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.
2. **Objectives of the Subject:** Upon completion of the subject student shall be able to -
   a. know the pathophysiology of selected disease states and the rationale for drug therapy
   b. know the therapeutic approach to management of these diseases;
   c. know the controversies in drug therapy;
   d. know the importance of preparation of individualised therapeutic plans based on diagnosis; and
   e. appreciate the needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text books (Theory)

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

Reference books (Theory)

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

3. **Detailed syllabus and lecture wise schedule :**

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

Title of the topic

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

PharmD: Third Year Syllabus
PPR 3.3L: PHARMACOTHERAPEUTICS – II LAB

Practical : 3 Hrs./Week

Practicals:

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

The student shall be trained to understand the principle and practice involved in selection of drug therapy including clinical discussion.

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

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

Format of the assignment:

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

Scheme of Practical Examination:

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

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

PharmD: Third Year Syllabus
PRM 3.4T: PHARMACEUTICAL JURISPRUDENCE

Theory: 2 Hrs. /Week

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

2. **Objectives of the Subject:** Upon completion of the subject student shall be able to (Know, do, and appreciate)
   a. practice the Professional ethics;
   b. understand the various concepts of the pharmaceutical legislation in India;
   c. know the various parameters in the Drug and Cosmetic Act and rules;
   d. know the Drug policy, DPCO, Patent and design act;
   e. understand the labeling requirements and packaging guidelines for drugs and cosmetics;
   f. be able to understand the concepts of Dangerous Drugs Act, Pharmacy Act and Excise duties Act; and
   g. other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.

Text books (Theory)

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

Reference books (Theory)

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

3. **Detailed syllabus and lecture wise schedule:**

Title of the topic

1. Pharmaceutical Legislations - A brief review.
2. Principle and Significance of professional ethics. Critical study of the code of pharmaceutical ethics drafted by PCI.
3. Drugs and Cosmetics Act, 1940, and its rules 1945. 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 And Cosmetics Provisions Relating to Indigenous Systems. Constitution and Functions of DTAB,DCC,CDL. Qualification and duties -Govt. analyst and Drugs Inspector.
4. Pharmacy Act -1948.
   Objectives Legal Definitions, General Study, Constitution and Functions of State & Central Council, Registration & Procedure, ER.
5. Medicinal and Toilet Preparation Act -1955.
   Objectives, Legal Definitions, Licensing, Bonded and Non Bonded Laboratory, Ware Housing, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietory Preparations.
6. Narcotic Drugs and Psychotropic substances Act-1985 and Rules. Objectives, Legal Definitions, General Study, Constitution and Functions of narcotic & Psychotropic

Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulations, Schedules to the Act.

7. Study of Salient Features of Drugs and Magic Remedies Act and its Rules.
8. Study of essential Commodities Act Relevant to Drugs Price Control Order.
9. Drug Price control Order & National Drug Policy (Current).
10. Prevention of Cruelty to Animals Act-1960.
11. Patents & Design Act-1970.
12. Brief study of prescription and Non-prescription Products.

4. Assignments:

Format of the assignment

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

6. Time allocated for presentation may be 8+2 Min

Case studies relating to

1. Drugs and Cosmetics Act and rules along with its amendments, Dangerous Drugs Act, Medicinal and Toilet preparation Act, New Drug Policy, Professional Ethics, Drugs (Price control) Order, Patent and Design Act.
2. Various prescription and non-prescription products.
3. Medical and surgical accessories.
4. Diagnostic aids and appliances available in the market.

PharmD: Third Year Syllabus
PCH 3.5T: MEDICINAL CHEMISTRY

Theory: 3 Hrs. /Week

1. Modern concept of rational drug design: A brief introduction to Quantitative Structure Activity Relationship (QSAR), Prodrug, Combinatorial Chemistry and Computer Aided Drug Design (CADD) and concept of antisense molecules.
2. A study of the development of the following classes of drugs including SAR, mechanism of action, synthesis of important compounds, chemical nomenclature, brand names of important marketed products and their side effects.

Anti-infective agents

a) Local anti-infective agents
b) Preservatives
c) Antifungal agents
d) Urinary tract anti-infectives
e) Antitubercular agents
f) Antiviral agents and Anti AIDS agents
g) Antiprotozoal agents
h) Anthelmentics
i) Antiscabies and Antipedicular agents

3. Sulphonamides and sulphones

4. Antimalarials

5. Antibiotics

6. Antineoplastic agents

7. Cardiovascular agents

a) Antihypertensive agents
b) Antianginal agents and vasodilators
c) Antiarrhythmic agents
d) Antihyperlipidemic agents
e) Coagulants and Anticoagulants
f) Endocrine

8. Hypoglycemic agents

9. Thyroid and Antithyroid agents

10. Diureties

11. Diagnostic agents

12. Steroidal Hormones and Adrenocorticoids

PharmD: Third Year Syllabus
PCH 3.5L: MEDICINAL CHEMISTRY LAB

Practical: 3 Hrs./Week

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 coefficient, dissociation constant and molar refractivity of compounds for QSAR analysis.

Reference Books:

a. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry, 12th Edition, Lippincott-Raven Publishers-New York, Philadelphia.
b. William.O.Foye, Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd., New Delhi.

c. Burgers, Medicinal Chemistry, M.E.,Welly Med.Chemistry M.E. Walffed Johnwilley and Sons, Wiley-interscience Publication, New York, Toranto.

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

e. Indian Pharmacopoeia 1985 and 1996. The Controller of Publications, Civil Lines, Delhi - 54.

f. Current Index of Medical Specialities (CIMS) and MIMS India, MIMS, A.E. Morgan Publications (I) Pvt. Ltd, New Delhi-19.

g. Organic Drug Synthesis-Ledniser Mitzsher Vol. I and II.

h. Pharmaceutical Chemistry drug Synthesis Vol. I and II by H. J. Roth and A. Kleemann.

i. The Science and Practice of Pharmacy Vol. 1 and 2, Remington, MACK Publishing Company, Easton, Pennsylvania.

PharmD: Third Year Syllabus
PCE 3.6T: PHARMACEUTICAL FORMULATIONS

Theory: 2 Hrs. /Week

1. **Scope of the Subject:** Scope and objectives of the course: Subject deals with the formulation and evaluation of various pharmaceutical dosage forms.
2. **Objectives of the Subject:** Upon completion of the subject student shall be able to (Know, do, appreciate) -
   a. understand the principle involved in formulation of various pharmaceutical dosage forms;
   b. prepare various pharmaceutical formulations;
   c. perform evaluation of pharmaceutical dosage forms; and
   d. Understand the concept of novel and controlled release drug delivery

Text books (Theory)

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

Reference books (Theory)

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

3. **Detailed syllabus and lecture wise schedule: Title of the topic**

1. **Pharmaceutical dosage forms** (concept and classification)
2. **Tablets:** Formulation of different types of tablets, tablet excipients, granulation techniques quality control and evaluation of tablets. Tablet coating, type of coating, quality control tests for coated tablet.
3. **Capsules:** Production and filling of hard gelatin capsules, Raw material for shell, finishing, quality control tests for capsules. Production and filling of soft gelatin capsules, quality control tests for soft gelatin capsules.
4. **Liquid orals:** Formulation and evaluation of suspensions, emulsions and solutions. Stability of these preparations
5. **Parenterals:** Introduction, containers used for parenterals (including official tests). Formulation of large and small volume parenterals, sterilization
6. **Ophthalmic preparations and Semisolids**: Introduction and classification, factors affecting absorption and anatomy of skin, packaging storage and labeling. Ointments - types of ointment bases, preparation of ointments. Jellies- Types of jellies, formulation of jellies. Suppositories - Method of preparation, Types of packaging
7. **Definition and concept of Controlled and Novel Drug Delivery Systems** with available examples, viz. parenteral, transdermal, buccal, rectal, nasal, implants and ocular

PharmD: Third Year Syllabus
PCE 3.6L: PHARMACEUTICAL FORMULATIONS LAB

Practical: 3 Hrs./Week

List of Experiments:

1. **Manufacture of Tablets**
   a. Ordinary compressed tablet-wet granulation
   b. Tablets prepared by direct compression.
   c. Soluble tablet.
   d. Chewable tablet.
2. **Formulation and filling of hard gelatin capsules**
3. **Manufacture of parenterals**
   a. Ascorbic acid injection
   b. Calcium gluconate injection
   c. Sodium chloride infusion.
   d. Dextrose and Sodium chloride injection/ infusion.
4. **Evaluation of Pharmaceutical formulations (QC tests)**
   a. Tablets
   b. Capsules

c. Injections

5. **Formulation of two liquid oral preparations and evaluation by assay**
   a. Solution: Paracetamol Syrup
   b. Antacid suspensions- Aluminum hydroxide gel
6. **Formulation of semisolids and evaluation by assay**
   a. Salicyclic acid and benzoic acid ointment
   b. Gel formulation Diclofenac gel
7. **Cosmetic preparations**
   a. Lipsticks
   b. Cold cream and vanishing cream
   c. Clear liquid shampoo
   d. Tooth paste and tooth powders.
8. **Tablet coating (demonstration)**

Scheme of Practical Examination:

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

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

PharmD: Fourth Year Syllabus
PPR 4.1T: PHARMACOTHERAPEUTICS - III

Theory : 3 Hrs. /Week

1. **Scope**: This course is designed to impart knowledge and skills necessary for contribution to quality use of medicines. Chapters dealt cover briefly pathophysiology and mostly therapeutics of various diseases. This will enable the student to understand the pathophysiology of common diseases and their management.
2. **Objectives:** At completion of this subject it is expected that students will be able to understand -
   a. the pathophysiology of selected disease states and the rationale for drug therapy;
   b. the therapeutic approach to management of these diseases;
   c. the controversies in drug therapy;
   d. the importance of preparation of individualised therapeutic plans based on diagnosis;
   e. needs to identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects);
   f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;
   g. to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;
   h. to discuss the controversies in drug therapy;
   i. to discuss the preparation of individualised therapeutic plans based on diagnosis; and
   j. identify the patient-specific parameters relevant in initiating drug therapy, and monitoring therapy (including alternatives, time-course of clinical and laboratory indices of therapeutic response and adverse effects).

Text Books

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

Reference Books

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

3. **Lecture wise programme** :

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

Title of the topic

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

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

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

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

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

6 **Evidence Based Medicine**

PharmD: Fourth Year Syllabus
PPR 4.1L: PHARMACOTHERAPEUTICS - III LAB

Practical: 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.

Assignments:

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

Format of the assignment:

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

Scheme of Practical Examination:

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

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

PharmD: Fourth Year Syllabus
PPR 4.2T: HOSPITAL PHARMACY

Theory: 2 Hrs. /Week

1. **Scope:** In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.
2. **Objectives:** Upon completion of the course, the student shall be able to -
   a. know various drug distribution methods;
   b. know the professional practice management skills in hospital pharmacies;
   c. provide unbiased drug information to the doctors;
   d. know the manufacturing practices of various formulations in hospital set up;
   e. appreciate the practice based research methods; and
   f. appreciate the stores management and inventory control.

Text books: (latest editions)

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

References:

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

3. **Lecture wise programme** :

Topics

1 **Hospital** - its Organisation and functions

2 **Hospital pharmacy**-Organisation and management
   a) Organizational structure-Staff, Infrastructure & work load statistics
   b) Management of materials and finance
   c) Roles & responsibilities of hospital pharmacist

3 **The Budget** - Preparation and implementation

4 **Hospital drug policy**
   a) Pharmacy and Therapeutic committee (PTC)
   b) Hospital formulary
   c) Hospital committees
   - Infection committee
   - Research and ethical committee
   d) developing therapeutic guidelines
   e) ospital pharmacy communication - Newsletter

5 **Hospital pharmacy services**
   a) Procurement & warehousing of drugs and Pharmaceuticals
   b) Inventory control
   Definition, various methods of Inventory Control

ABC, VED, EOQ, Lead time, safety stock

c) Drug distribution in the hospital
   i) Individual prescription method
   ii) Floor stock method
   iii) Unit dose drug distribution method

d) Distribution of Narcotic and other controlled substances

e) Central sterile supply services - Role of pharmacist

6 Manufacture of Pharmaceutical preparations

a) Sterile formulations - large and small volume parenterals

b) Manufacture of Ointments, Liquids, and creams

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

d) Total parenteral nutrition

7 Continuing professional development programs Education and training

8 Radio Pharmaceuticals - Handling and packaging

9 Professional Relations and practices of hospital pharmacist

PharmD: Fourth Year Syllabus
PPR 4.2L: HOSPITAL PHARMACY LAB

Practical: 3 Hrs./Week

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

List of Assignments:

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

Special requirements:

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

Scheme of Practical Examination:

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

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

PharmD: Fourth Year Syllabus
PPR 4.3T: CLINICAL PHARMACY

Theory: 3 Hrs. /Week

1. Objectives of the Subject:

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

a. monitor drug therapy of patient through medication chart review and clinical review;

b. obtain medication history interview and counsel the patients;

c. identify and resolve drug related problems;

d. detect, assess and monitor adverse drug reaction;

e. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states; and

f. retrieve, analyse, interpret and formulate drug or medicine information.

Text books (Theory)

a. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.

b. Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.

c. Biopharmaceutics and Applied Pharmacokinetics - Leon Shargel, Prentice Hall publication.

d. A text book of Clinical Pharmacy Practice;

Essential concepts and skills, Dr.G.Parthasarathi etal, Orient Orient Langram Pvt.Ltd. ISSBN8125026

References

a. Australian drug information -Procedure manual. The Society of Hospital Pharmacists of Australia.

b. Clinical Pharmacokinetics - Rowland and Tozer, Williams and Wilkins Publication.

c. Pharmaceutical statistics. Practical and clinical applications. Sanford Bolton, Marcel Dekker, Inc.

2. Detailed syllabus and lecture wise schedule:

Title of the topic

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

   The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.
4. Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results
   a. Haematological, Liver function, Renal function, thyroid function tests
   b. Tests associated with cardiac disorders
   c. Fluid and electrolyte balance
   d. Microbiological culture sensitivity tests
   e. Pulmonary Function Tests
5. Drug & Poison information
   a. Introduction to drug information resources available
   b. Systematic approach in answering DI queries
   c. Critical evaluation of drug information and literature
   d. Preparation of written and verbal reports
   e. Establishing a Drug Information Centre
   f. Poisons information- organization & information resources
6. 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.
7. Communication skills, including patient counselling techniques, medication history interview, presentation of cases.
8. Pharmaceutical care concepts
9. Critical evaluation of biomedical literature
10. Medication errors

PharmD: Fourth Year Syllabus
PPR 4.3L: CLINICAL PHARMACY LAB

Practical: 3 Hrs./Week

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

a. Answering drug information questions (4 Nos)

b. Patient medication counselling (4 Nos)

c. Case studies related to laboratory investigations (4 Nos)

d. Patient medication history interview (3 Nos)

Assignment:

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

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

Format of the assignment:

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

PharmD: Fourth Year Syllabus
PPR 4.4T: BIOSTATISTICS AND RESEARCH METHODOLOGY

Theory: 2 Hrs. /Week

1. Detailed syllabus and lecture wise schedule

1 Research Methodology

a) Types of clinical study designs:
Case studies, observational studies, interventional studies,

b) Designing the methodology

c) Sample size determination and Power of a study Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study

d) Report writing and presentation of data

2 Biostatistics

2.1 a) Introduction

b) Types of data distribution

c) Measures describing the central tendency distributions- average, median, mode

d) Measurement of the spread of data-range, variation of mean, standard deviation, variance, coefficient of variation, standard error of mean.

2.2 Data graphics

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

2.3 Basics of testing hypothesis

a) Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.

b) Level of significance (Parametric data)- students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)

c) Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wall is test (one way ANOVA)

d) Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient.

e) Introduction to statistical software: SPSS, Epi Info, SAS.

2.4 Statistical methods in epidemiology

Incidence and prevalence, relative risk, attributable risk

3. Computer applications in pharmacy

Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy - Patient record database management, Medication order entry - Drug labels and list - Intravenous solution and admixture, patient medication profiles, Inventory control, Management report & Statistics.

Computer In Community Pharmacy

Computerizing the Prescription Dispensing process Use of Computers for Pharmaceutical Care in community pharmacy

Accounting and General ledger system

Drug Information Retrieval & Storage :

Introduction - Advantages of Computerized Literature Retrieval

Use of Computerized Retrieval

Reference books:

a. Pharmaceutical statistics- practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.

b. Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich, 3rd edition, McGraw Hill Publications 2006

PharmD: Fourth Year Syllabus
PPR 4.5T: BIOPHARMACEUTICS AND PHARMACOKINETICS

Theory: 3 Hrs. /Week

1. Biopharmaceutics

1. Introduction to Biopharmaceutics

a. Absorption of drugs from gastrointestinal tract.

b. Drug Distribution.

c. Drug Elimination.

2. Pharmacokinetics

Introduction to Pharmacokinetics.

a. Mathematical model

b. Drug levels in blood.

c. Pharmacokinetic model

d. Compartment models

e. Pharmacokinetic study.

3. One compartment open model.

a. Intravenous Injection (Bolus)

b. Intravenous infusion.

4. Multicompartment models.

a. Two compartment open model.

b. IV bolus, IV infusion and oral administration

5. Multiple - Dosage Regimens.

a. Repititive Intravenous injections - One Compartment Open Model

b. Repititive Extravascular dosing - One Compartment Open model

c. Multiple Dose Regimen - Two Compartment Open Model

6. Nonlinear Pharmacokinetics.

a. Introduction

b. Factors causing Non-linearity.

c. Michaelis-menton method of estimating parameters.

7. Noncompartmental Pharmacokinetics.

a. Statistical Moment Theory.

b. MRT for various compartment models.

c. Physiological Pharmacokinetic model.

8. Bioavailability and Bioequivalence.

a. Introduction.

b. Bioavailability study protocol.

c. Methods of Assessment of Bioavailability

PharmD: Fourth Year Syllabus
PPR 4.5L: BIOPHARMACEUTICS AND PHARMACOKINETICS LAB

Practical: 3 Hrs./Week

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 protein bound drug and poorly protein bound drug.
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 K_a, K_e, $t_{1/2}$, C_{max}, 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. Bioequivalency 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.

References:

a. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi

b. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.

c. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.

d. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.

e. Biopharmaceutics and Pharmacokinetics; By Robert F Notari

f. Biopharmaceutics; By Swarbrick

g. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil

B. Jaiswal, Vallabh Prakashan Pitampura, Delhi

h. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.

i. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.

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

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

PharmD: Fourth Year Syllabus
PPR 4.6T: CLINICAL TOXICOLOGY

Theory: 2 Hrs. /Week

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications.
3. Supportive care in clinical Toxicology.
4. Gut Decontamination.
5. Elimination Enhancement.
6. Toxicokinetics.

7. Clinical symptoms and management of acute poisoning with the following agents -
   a) Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids.
   b) Opiates overdose.
   c) Antidepressants
   d) Barbiturates and benzodiazepines.
   e) Alcohol: ethanol, methanol.
   f) Paracetamol and salicylates.
   g) Non-steroidal anti-inflammatory drugs.
   h) Hydrocarbons: Petroleum products and PEG.
   i) Caustics: inorganic acids and alkali.
   j) Radiation poisoning
8. Clinical symptoms and management of chronic poisoning with the following agents -Heavy metals: Arsenic, lead, mercury, iron, copper
9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.
10. Plants poisoning. Mushrooms, Mycotoxins.
11. Food poisonings
12. Envenomations - Arthropod bites and stings.
13. Substance abuse:

    Signs and symptoms of substance abuse and treatment of dependence
    a) CNS stimulants :amphetamine
    b) Opioids
    c) CNS depressants
    d) Hallucinogens: LSD
    e) Cannabis group
    f) Tobacco

References:

a. Matthew J Ellenhorn. ELLENHORNS MEDICAL TOXICOLOGY - DIAGNOSIS AND TREATMENT OF POISONING. Second edition. Williams and Willkins publication, London

b. V V Pillay. HANDBOOK OF FORENSIC MEDICINE AND TOXICOLOGY. Thirteenth edition 2003 Paras Publication, Hyderabad

PharmD: Fifth Year Syllabus
PPR 5.1T: CLINICAL RESEARCH

Theory: 3 Hrs. /Week

1. Drug development process:

Introduction

Various Approaches to drug discovery

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

2. Clinical development of drug:

1. Introduction to Clinical trials
2. Various phases of clinical trial.
3. Methods of post marketing surveillance
4. Abbreviated New Drug Application submission.
5. Good Clinical Practice - ICH, GCP, Central drug standard control organisation (CDSCO) guidelines
6. Challenges in the implementation of guidelines
7. Ethical guidelines in Clinical Research
8. Composition, responsibilities, procedures of IRB /IEC
9. Overview of regulatory environment in USA, Europe and India.
10. Role and responsibilities of clinical trial personnel as per ICH GCP
    a. Sponsor
    b. Investigators
    c. Clinical research associate
    d. Auditors
    e. Contract research coordinators
    f. Regulatory authority
11. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)
12. Informed consent Process
13. Data management and its components
14. Safety monitoring in clinical trials.

References :

a. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.

b. International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.

c. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.

d. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.

e. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.

f. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.

g. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

PharmD: Fifth Year Syllabus

PPR 5.2T: PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS

Theory: 3 Hrs. /Week

1. **Pharmacoepidemiology:**

Definition and scope:

Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.

Measurement of outcomes in pharmacoepidemiology

Outcome measure and drug use measures Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement

Concept of risk in pharmacoepidemiology

Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio

Pharmacoepidemiological methods

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods

Drug utilization review, case reports, case series, surveys of drug use, cross - sectional studies, cohort studies, case control studies, case -cohort studies, meta - analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.

Sources of data for pharmacoepidemiological studies

Ad Hoc data sources and automated data systems.

Selected special applications of pharmacoepidemiology

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

2. **Phrmacoeconomics:**

Definition, history, needs of pharmacoeconomic evaluations

Role in formulary management decisions

Pharmacoeconomic evaluation

Outcome assessment and types of evaluation

Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods:

Cost - minimization, cost- benefit, cost - effectiveness, cost utility

3. **Applications of Pharmacoeconomics**

Software and case studies

PharmD: Fifth Year Syllabus

PPR 5.3T: CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING

Theory: 2 Hrs. /Week

1. **Introduction to Clinical pharmacokinetics.**
2. **Design of dosage regimens:**

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

3. **Pharmacokinetics of Drug Interaction:**
   a. Pharmacokinetic drug interactions
   b. Inhibition and Induction of Drug metabolism
   c. Inhibition of Biliary Excretion.
4. **Therapeutic Drug monitoring:**
   a. Introduction
   b. Individualization of drug dosage regimen (Variability - Genetic, Age and Weigh, disease, Interacting drugs).
   c. Indications for TDM. Protocol for TDM.
   d. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy.
   e. TDM of drugs used in the following disease conditions: cardiovascular disease, Seizure disorders, Psychiatric conditions, and Organ transplantations.
5. **Dosage adjustment in Renal and hepatic Disease.**
   a. Renal impairment
   b. Pharmacokinetic considerations
   c. General approach for dosage adjustment in Renal disease.
   d. Measurement of Glomerular Filtration rate and creatinine clearance.
   e. Dosage adjustment for uremic patients.
   f. Extracorporeal removal of drugs.
   g. Effect of Hepatic disease on pharmacokinetics.
6. **Population Pharmacokinetics.**
   a. Introduction to Bayesian Theory.
   b. Adaptive method or Dosing with feed back.
   c. Analysis of Population pharmacokinetic Data.
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

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.

3. ASSESSMENT OF INTERNSHIP:

i) 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 eligible for it.

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

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

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

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

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

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

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

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

NOTES

6

Doctor of Pharmacy-Post Baccalaureate (PharmD (PB))

Courses, Course Outcome (COs) and Course Content and Assessment Plan

First Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.1T**
COURSE TITLE	**Pharmacotherapeutics III (Theory)**

SYNOPSIS	**COs**
This course is designed to impart knowledge and skills necessary for practice of clinical pharmacy and the promotion of rational use of medicines. Chapters cover mainly pharmacotherapy of major diseases with brief pathophysiology. This will enable the student to understand and practice evidence-based pharmacy for the disease management.	On completion of the course, the student shall be able to understand: 1. Therapeutic approach to the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management 2. Treatment objectives for the individual patients and the diseases 3. Importance of developing individualized therapeutic plans 4. Prescribing guidelines for the special populations 5. Patient-specific parameters for selection, initiation and monitoring of drug therapies 6. Most recent updates in relevant treatment guidelines

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (*52 % of total marks of assessment)*			University exam (*48 % of total marks of assessment)*
				S1	S2	S3	
1	Student will learn and understand the pathophysiology and pharmacotherapy of gastrointestinal diseases	Unit I (15 Hrs)	29	15			14
2	Student will learn and understand the pathophysiology and pharmacotherapy of hematological disorders	Unit II (10 Hrs)	19	10			09
3	Student will learn and understand the pathophysiology and pharmacotherapy of Neurological Disorders.	Unit III (15 Hrs)	29		15		14
4	Student will learn various aspects of EBM approaches including EBM sources and literature evaluation	Unit IV (10 Hrs)	19		10		09

5	Student will learn and understand the pathophysiology and pharmacotherapy of psychiatric disorders.	Unit V (15 Hrs)	29			15	14
6	Student will learn and understand the various pathway including neuralgia, headache and its pharmacotherapy	Unit VI (10 Hrs)	20			10	10
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Etiopathogenesis and pharmacotherapy of disease associated with the following system / disease

Unit I **15 Hrs**

1. Gastrointestinal system: peptic ulcer disease, gastro esophageal disease, bowel disease, liver disorders - alcoholic liver disease, viral hepatitis including jaundice, and drug induced liver disorders

Unit II 10 Hrs

2. Haematological system: anaemias, venous thromboembolism, drug induced blood disorders.

UNIT III **15 Hrs**

3. Nervous system: epilepsy, parkinsonism, stroke, alzheimer's disease,

Unit IV **10Hrs**

4. Evidence Based Medicine

UNIT V **15 Hrs**

5. Psychiatry disorders: schizophrenia disorders, anxiety disorders, sleep disorders, obsessive compulsive disorders

UNIT VI **10 Hrs**

6. Pain management including pain pathways, neuralgias, headaches

First Year PharmD (PB) Degree Program	
COURSE CODE	**PPR 4.1L**
COURSE TITLE	**PHARMACOTHERAPEUTICS III Lab**
SYNOPSIS	**COs**

This course is designed to impart knowledge and skills in developing therapeutic plan and provide pharmaceutical care for different types of patients using SOAP format	On completion of the course, the student shall be able to: 1. Understand therapeutic approach for the management of gastrointestinal disorders, hematological disorders, neurological disorders, psychiatric disorders and pain management 2. Identify the treatment goals for specific disease and able to develop the individualized therapeutic plans 3. To identify the patient-specific parameters for selection, initiation and monitoring of drug therapies 4. Provide the feedback regarding the drug related issues to the physicians

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional exam (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University exam (*70 % of total marks of assessment)*
			S1	S2		
1	Student will learn the pharmacotherapy of Gastrointestinal and Hematological system through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor Gastrointestinal and Hematological system related cases with presentations and group discussions	Unit 1 (35Hrs)	20		10	70
2	Student will learn the pharmacotherapy of Psychiatry and Nervous system through a case-based learning approach. Develop therapeutic skills via problem-based learning of major and minor Psychiatry and Nervous system related cases with presentations and group discussions	Unit II (40Hrs)		20		
Total Marks of assessment		**Average of two sessional exams 20**			**10**	**70**

Unit I

Major and Minor Case Presentation on

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

2 Haematological system: Anaemias, Venous thromboembolism, Drug induced blood disorders.

Unit II

Major and Minor Case Presentation on

1. Nervous system: Epilepsy, Parkinsonism, Stroke, Alzheimer's disease,

2. Psychiatry disorders: Schizophrenia disorders, Anxiety disorders, Sleep disorders, Obsessive Compulsive disorders

First Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.2T**
COURSE TITLE	**HOSPITAL PHARMACY (Theory)**

SYNOPSIS	**COs**
The changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug dispensing, manufacturing of parenteral preparations, drug information, patient counselling, and therapeutic drug monitoring for improved patient care.	On completion of the course, the student shall be able to: 1. Know various drug distribution methods 2. Know the professional practice management skills in hospital pharmacies 3. Provide unbiased drug information to the doctors 4. Know the manufacturing practices of various formulations in hospital set up 5. Appreciate the practice based research methods 6. Appreciate the stores management and inventory control

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn and understand the concepts, organization, functions of hospital and hospital pharmacy and budget preparation for hospital pharmacy	Unit I (10 Hrs)	29	15			14
2	Student will understand the concept of hospital drug police, which includes PTC, formulary, infection control committee and ethical committee, development of therapeutic guidelines and newsletter	Unit II (10 Hrs)	29	10	05		14

3	Student will learn the hospital pharmacy services- purchase and inventory control	Unit III (6 Hrs)	17		09		08
4	Student will understand the methods of drug distribution. distribution of narcotics and concept of central sterile supply room	Unit IV (7 Hrs)	20		11		09
5	Student will learn and understand various manufacturing pharmaceutical preparations	Unit V (11 Hrs)	33			17	16
6	Student will understand the continuing professional development programs education and training, radiopharmaceuticals and professional relations and practice of hospital pharmacists	Unit VI (6 Hrs)	17			08	09
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **10 Hrs**

1. Hospital - its organization and functions
2. Hospital Pharmacy-organization and management

a) Organizational structure-staff, infrastructure & work load statistics

b) Management of materials and finance

c) Roles & responsibilities of hospital pharmacist

3. The Budget – Preparation and implementation

Unit II: **10 Hrs**

4. Hospital drug policy

a) Pharmacy and Therapeutic committee (PTC)

b) Hospital formulary

c) Hospital committees

- Infection committee
- Research and ethical committee

d) Developing therapeutic guidelines

e) Hospital pharmacy communication - Newsletter

Unit III: **6 Hrs**

5. Hospital pharmacy services

a) Procurement & warehousing of drugs and pharmaceuticals

b) Inventory control

Definition, various methods of inventory control

ABC, VED, EOQ, Lead time, safety stock

Unit IV: **7 Hrs**

6. Hospital Pharmacy Services

a) Drug distribution in the hospital

i) Individual prescription method ii) Floor stock method iii) Unit dose drug distribution method

b) Distribution of narcotic and other controlled substances

c) Central sterile supply services – role of pharmacist

Unit V: **11 Hrs**

7. Manufacture of pharmaceutical preparations

a) Sterile formulations – large and small volume parenterals

b) Manufacture of ointments, liquids, and creams

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

d) Total parenteral nutrition

Unit VI: **6 Hrs**

8. Continuing professional development programs Education and training

9. Radiopharmaceuticals – handling and packaging

10. Professional relations and practices of hospital pharmacist

<table>
<tr><th colspan="6">First Year PharmD (PB) Degree Program</th></tr>
<tr><td colspan="2">COURSE CODE</td><td colspan="4">PPR 4.2L</td></tr>
<tr><td colspan="2">COURSE TITLE</td><td colspan="4">HOSPITAL PHARMACY LAB</td></tr>
<tr><th colspan="3">SYNOPSIS</th><th colspan="3">COs</th></tr>
<tr><td colspan="3">Hospital pharmacy lab deals with providing drug information, assessing drug-drug interactions in a given prescription and control the inventory in a drug store. Besides it also deals with manufacturing various formulations</td><td colspan="3">On completion of the course, the student shall be able to :
1. provide unbiased drug information to the physician 2. assess the prescription for drug-drug interaction and its management
3. know the manufacturing practice of various formulations in hospital setup
4. appreciate the stores management & inventory control</td></tr>
<tr><th colspan="6">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="2">SL No.</td><td rowspan="2">Course Content</td><td rowspan="2">Syllabus (chapters or Units with hours)</td><td colspan="3">Distribution of marks of assessment</td></tr>
<tr><td colspan="2">Sessional exam (20 % of total marks of assessment)</td><td rowspan="2">Continuous evaluation (10 % of total marks of assessment)</td><td rowspan="2">University exam (70 % of total marks of assessment)</td></tr>
<tr><td>S1</td><td>S2</td></tr>
</table>

1	Student will earn how to provide Drug information queries and Assessment of drug interactions in the given prescriptions	Unit 1 (35Hrs)	20		10	70
2	Student will learn the concept of manufacture of various parenteral formulations & powders. And Understand the concept of Inventory control	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I

1. Drug information queries.
2. Assessment of drug interactions in the given prescriptions

Unit II

3. Manufacture of parenteral formulations, powders.
4. Inventory control

First year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.3T**
COURSE TITLE	**CLINICAL PHARMACY (Theory)**
SYNOPSIS	**COs**
This course is designed to impart the basic knowledge and skills that are required to practice clinical pharmacy Understanding clinical pharmacy concept will make students more equipped with the clinical competencies necessary to practice alongside with doctors, nurses and other health care professionals.	The student shall be able to 1. Monitor drug therapy of patient through medication chart review and clinical review; 2. Obtain medication history interview and counsel the patients; 3. Identify and resolve drug related problems 4. Detect, assess and monitor adverse drug reactions; 5. Interpret selected laboratory results (as monitoring parameter in therapeutics) of specific disease states; and 6. Retrieve, analyze, interpret and formulate drug or medicine information.

Course outcome and its Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional Examination (52% *of marks of assessment)*			University Examination (48% *of marks of assessment)*
				S1	S2	S3	
1	Student will learn the scope of clinical pharmacy services and to understand the daily activities of clinical pharmacist	Unit I (14 Hrs)	27	13			14
2	Student will learn and understand drug and poison information center and to critically evaluate drug and biomedical literature and be able to apply to an article.	Unit II (14 Hrs)	27	12			15
3	Student will learn understand and learn the interpretation of various laboratory data for proper diagnosis	Unit III (16 Hrs)	30		17		13
4	Student will learn the interpretation skills on patient data analysis and review of cases studies	Unit IV (08 Hrs)	15		08		07
5	Student will learn understand the concept of Pharmaceutical care with the provision of communication skills, medication history interview and patient counseling and recognize and prevent medication errors	Unit V (13 Hrs)	26			14	12
6	Student will learn understand the fundamental concepts of pharmacovigilance and its activities	Unit VI (10 Hrs)	20			11	09
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

COURSE CONTENT

Unit I **14 Hrs**

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

Unit II **14 Hrs**

3. Drug and poison information
   a. Establishing a drug information center
   b. Introduction to drug information resources available
   c. Systematic approach in answering drug information queries
   d. Preparation of written and verbal reports
   e. Critical evaluation of drug information and literature
   f. Poison information – organization and information resources

4. Critical evaluation of biomedical literature

Unit III **16 Hrs**

5. Clinical laboratory tests used in the evaluation of disease 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

Unit IV **08 Hrs**

6. Patient data analysis

   The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices. Assessment of cases.

Unit V **13 Hrs**

7. Pharmaceutical care concepts.
8. Communication skills including patient counselling techniques, medication history interview.
9. 9. Medication errors

Unit VI **10 Hrs**

10. 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

First year PharmD (PB) Degree Program	
COURSE CODE	**PPR 4.3L**
COURSE TITLE	**CLINICAL PHARMACY LAB**

SYNOPSIS	**COs**
This course is designed to help students to acquire the knowledge, skills and attitudes necessary to perform comprehensive clinical	On completion of the course, the student shall be able to: 1. Provide drug information services to the health care professionals and patients. 2. Perform patient medication history interview and counseling as a part of pharmaceutical care.

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional exam (*20 % of total marks of assessment)*		Continuous evaluation *(10 % of total marks of assessment)*	University exam (70 *% of total marks of assessment)*
			S1	S2		
1	Student will develop the skills needed to perform drug information and learn the skills to conduct patient medication history interview.	Unit 1 (35Hrs)	20		10	70
2	Student will acquire the skill for patient medication counselling and learn to utilize clinical laboratory data to monitor various disease states.	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I

1. Answering drug information questions (4 Nos)
2. Patient medication history interview (3 Nos)

Unit II

1. Patient medication counseling (4 Nos)
2. Case studies related to laboratory investigations (4 Nos)

First Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.4T**
COURSE TITLE	**BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)**

SYNOPSIS	**COs**
This course introduced to understand the students regarding concept of research methodology, how to write manuscript and understand the application of statistical analysis in data interpretation and presentation.	On completion of the course, the student shall be able to understand 1. Various study designs 2. Development of protocol and biomedical literature search 3. Understand the application of various statistical analysis in data analysis and interpretation 4. Writing research paper and presentation of results

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will understand the different types of data and its spread	Unit I (10 Hrs)	29	15			14
2	Student will understand the construction of different types of graphs and labelling of graphs	Unit II (6 Hrs)	17	10			7
3	Student will understand the basics of hypothesis testing and level of significance using Parametric and Non Parametric tests	Unit III (15 Hrs)	44		23		21
4	Student will understand the various epidemiological measures like Incidence and prevalence, relative risk, attributable risk	Unit IV (4 Hrs)	12		02		10
5	Student will understand the various clinical study designs, writing research methodology and report writing	Unit V (9 Hrs)	26			15	11
6	Student will understand the computers application in Hospital Pharmacy, Community Pharmacy, Drug Prescription and in Drug information	Unit VI (6 Hrs)	17			10	7
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT I **10 Hrs**

Basic Introduction to Statistics a) Types of data distribution

b) Measures describing the central tendency distributions- average, median, mode

c) Measurement of the spread of data-range, variation of mean, standard deviation, variance, of variation, standard error of mean.

Unit II **6 Hrs**

Data Graphics

Data graphics Construction and labeling of graphs, histogram, pie charts, scatter plots, semilogarthimic plots

UNIT III **15 Hrs**

Basics of testing hypothesis

a) Null hypothesis, level of power of test, P value, and statistical estimation of intervals.

b) Level of significance (Parametric data)- student's t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)

c) Level of (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal- Wall is test (one way ANOVA)

d)Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation

e) Introduction to statistical software: SPSS, Epi Info, SAS

UNIT IV **4 Hrs**

Statistical methods in epidemiology

Incidence and prevalence, relative risk, attributable risk

UNIT V **9 Hrs**

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 an interval of width, power of a study

d) Report writing and presentation of data

UNIT VI **6Hrs**

Computer applications in pharmacy computer system in hospital pharmacy

Patterns of Computer use in Hospital Pharmacy - patient record database management, medication order entry - drug labels and list - intravenous solution and admixture, patient medication profiles, inventory control, management report & statistics. computer in community pharmacy computerizing the prescription dispensing process use of computers for pharmaceutical care in community pharmacy accounting and general ledger system

Drug information retrieval & storage

Introduction - advantages of computerized literature retrieval use of computerized retrieval.

First Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.5T**
COURSE TITLE	**BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)**

SYNOPSIS	**COs**
This course is designed to impart the understanding on the basics and applications of biopharmaceutics and clinical pharmacokinetics. Student will be equipped with in-depth knowledge and compartment models and other relevant concepts to apply in understanding dosage form related issues and their application in clinical situations.	The student shall be able to: 1. Understand basic concepts of absorption, distribution, metabolism and elimination 2. Have thorough understanding on pharmacokinetic and bioavailability studies 3. Understand compartment and non-compartment models 4. Appreciate the concepts of multiple dosage regimen 5. Understand the concepts of non-linear kinetics

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Learn the concepts of absorption and various factors affecting and also understand the basics of pharmacokinetics and mathematical models	Unit I (9 Hrs)	18	10			08
2	Learn and understand the concepts of drug distribution and elimination and various factors that influence these processes	Unit II (15 Hrs)	29	15			14
3	To learn and understand the concepts of compartment models, one compartment model for IV bolus and IV infusion and also understand non-linear pharmacokinetics	Unit III (14 Hrs)	27		14		13
4	Learn the concepts of two compartment models for IV bolus, infusion and oral administration	Unit IV (11 Hrs)	21		11		10

5	To understand the concepts of non-compartment, physiologic pharmacokinetic models and bio availability study designs and applications	Unit V (18 Hrs)	36			18	18
6	To understand the principles of Multiple dose administration for one and two compartment model for intravascular and extravascular administration of drugs	Unit VI (8 Hrs)	14			07	07
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **9 Hrs**

11. Absorption
12. Absorption from gastrointestinal tract
13. Introduction to pharmacokinetics
14. Mathematical & pharmacokinetic models

Unit II **15 Hrs**

15. Drug distribution
16. Drug elimination

Unit III **14 Hrs**

17. Compartment models
18. One compartment model for IV bolus and IV Infusion
19. Non-linear Pharmacokinetics
    a. Introduction
    b. Factors causing non-linearity.
    c. Michaelis-menton method of estimating parameters

Unit IV 11 Hrs

20. Multiple compartment models
21. Two compartment model for IV bolus, IV infusion and oral administration

Unit V **18 Hrs**

22. Non-compartmental Pharmacokinetics
    a. Statistical moment theory.
    b. MRT for various compartment models.
    c. Physiological pharmacokinetic model
23. Bioavailability and Bioequivalence-Introduction, study protocols, methods of assessment a. Introduction.
    b. Bioavailability study protocol.
    c. Methods of assessment of bioavailability

Unit VI **8 Hrs**

24. Multiple dosage regimens

e. Repetitive IV bolus and extravascular one compartment model

f. Repetitive administration two compartment models

First Year PharmD (PB) Degree Program	
COURSE CODE	**PPR 4.5L**
COURSE TITLE	**BIOPHARMACEUTICS AND PHARMACOKINETICS LAB**
SYNOPSIS	**COs**
This course is designed to impart knowledge and skills in developing pharmacokinetic models using mathematical models and software package	On Completion of the course the student shall be able to: 1. Understand the concepts of absorption, distribution and Excretion 2. Apply the pharmacokinetic principles for dosage regimen design and bio-availability studies

Course Content and Assessment Plan						
Sl No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional exam (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University exam (*70 % of total marks of assessment)*
			S1	S2		
1	Student will learn how to calculate pharmacokinetic parameters using manual and pharmacokinetic software packages for relevant pharmacokinetic data to assess all relevant pharmacokinetic properties like absorption, distribution, metabolism and Elimination with data from relevant experiments	Unit 1 (35Hrs)	20		10	70
2	Student will assess pharmacokinetic parameters using manual and pharmacokinetic software packages for relevant PK problems and as well as bioavailability studies	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

UNIT I

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 protein bound drug and poorly protein bound drug.
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.

UNIT II

1. In vitro absorption studies.
2. Bio-equivalency studies on the different drugs marketed.(eg) Tetracycline, Sulphamethoxazole, Trimethoprim, Aspirin etc., on animals and human volunteers.
3. Absorption studies in animal inverted intestine using various drugs.
4. Effect on contact time on the plasma protein binding of drugs.
5. Studying metabolic pathways for different drugs based on elimination kinetics data.
6. Calculation of elimination half-life for different drugs by using urinary elimination data and blood level data.
7. Determination of renal clearance.

<table>
<tr><th colspan="8">First Year PharmD (PB) Degree Program
Courses, Course Outcome (COs), Course Content and Assessment Plan</th></tr>
<tr><td>COURSE CODE</td><td colspan="7">PPR 4.6T</td></tr>
<tr><td>COURSE TITLE</td><td colspan="7">CLINICAL TOXICOLOGY (Theory)</td></tr>
<tr><th colspan="2">SYNOPSIS</th><th colspan="6">COs</th></tr>
<tr><td colspan="2">The course is designed to attain an in-depth knowledge in the area of clinical management of different poisoning cases and facilitating the students to involve in direct toxicological care including patient education, identification of toxins and toxidrome. Thereby, protect the local community from the various poisons.</td><td colspan="6">The student shall be able to:
1. Learn general principles in the management of poisoning
2. Know clinical symptoms and management of acute poisoning
3. Learn clinical symptoms and management of chronic poisoning
4. Understand toxic effects and general management of snake bite
5. Learn plant, mushroom and food poisoning and envenomation
6. Understand substance abuse and treatment of dependence</td></tr>
<tr><th colspan="8">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="2">SL No.</td><td rowspan="2">Course Content</td><td rowspan="2">Syllabus (chapters or Units with hours)</td><td rowspan="2">Marks of assessment</td><td colspan="4">Distribution of marks of assessment</td></tr>
<tr><td colspan="3">Sessional exam (52% of marks of assessment)</td><td rowspan="2">University Examination (48% of marks of assessment)</td></tr>
<tr><td>S1</td><td>S2</td><td>S3</td></tr>
<tr><td>1</td><td>Student will understand the concept of general principles in the management of poisoning including supportive care, antidotes and toxicokinetics</td><td>Unit I (10 Hrs)</td><td>29</td><td>15</td><td></td><td></td><td>14</td></tr>
<tr><td>2</td><td>Student will learn clinical symptoms and management of acute poisoning with pesticides,</td><td>Unit II (18 Hrs)</td><td>52</td><td>10</td><td>17</td><td></td><td>25</td></tr>
</table>

	depressants antidepressants, alcohol, paracetamol, NSAIDs, hydrocarbons, caustics and radiation						
3	Student will learn clinical symptoms and management of chronic poisoning with heavy metals such as arsenic, lead, mercury, iron, copper	Unit III (5 Hrs)	15		08		07
4	Student will understand general management of snake bite including first aid, early manifestations, complications and antidotes	Unit IV (3 Hrs)	08			04	04
5	Student will learn plant poisoning, mycotoxins, food poisoning and envenomation with arthropod bites and stings	Unit V (4 Hrs)	12			06	06
6	Student will understand signs and symptoms of substance abuse and treatment of dependence	Unit VI (10 Hrs)	29			15	14
Total marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **10 Hrs**

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications
3. Supportive care in clinical Toxicology
4. Gut Decontamination
5. Elimination Enhancement
6. Toxicokinetics

Unit II **18 Hrs**

7. Clinical symptoms and management of acute poisoning with the following agents –

a) Pesticide poisoning: organophosphorous, compounds, carbamates, organochlorines, pyrethroids
b) Opiates overdose
c) Antidepressants
d) Barbiturates and benzodiazepines
e) Alcohol: ethanol, methanol
f) Paracetamol and salicylates
g) Non-steroidal drugs
h) Hydrocarbons: Petroleum products and PEG
i) Caustics: inorganic acids and alkali
j) Radiation poisoning

Unit III **5 Hrs**

8. Clinical symptoms and management of chronic poisoning with the following agents -Heavy metals: arsenic, lead, mercury, iron, copper

Unit IV: **3 Hrs**

9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms, general management as first aid, early manifestations, complications and snake bite injuries.

Unit V: **4 Hrs**

10. Plants poisoning and mushroom poisoning (Mycotoxins)
11. Food poisonings
12. Envenomation: Arthropod bites and stings

UNIT VI **10 Hrs**

13. Substance abuse: Signs and symptoms of substance abuse and treatment of dependence

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

First Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 4.7T**
COURSE TITLE	**PHARMACOTHERAPEUTICS 1 & 2 (Theory)**

SYNOPSIS	**COs**
This course is designed to impart knowledge and skills necessary for practice of clinical pharmacy and the promotion of rational use of medicines. Chapters cover mainly pharmacotherapy of major diseases with brief pathophysiology. This will enable the student to understand and practice evidence-based pharmacy for the disease management.	On Completion of the course, the student shall be able to understand: 1. Therapeutic approach to the management of 2. Cardiovascular, respiratory and ophthalmic diseases 3. Treatment objectives for the individual patients and the diseases 4. Importance of developing individualized therapeutic plans 5. Prescribing guidelines for the special populations 6. Patient-specific parameters for selection, initiation and monitoring of drug therapies 7. Most recent updates in relevant treatment guidelines

Course Content and Assessment Plan							
SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn and understand the concepts of treatment of cardiovascular and respiratory diseases with clear focus on pathophysiology, laboratory investigations, and treatment-approaches including appropriate guidelines.	Unit I (15 Hrs)	**29**	**15**			**14**
2	Student will learn and understand the ability to apply the acquired knowledge into providing preliminary solutions in specific areas such as clinical practice, pharmaceutical care and patient communication and to create awareness in society about the effective and safe use of medicines and remain as a responsible provider of information.	Unit II (13 Hrs)	**25**	**10**			**15**
3	Student will understand pharmacotherapy with clear focus on pathophysiology, laboratory investigations, and treatment-approaches to ophthalmic diseases and to create awareness to rational drug use in society about the effective and safe use of medicines.	Unit III (10 Hrs)	**19**		**10**		**09**
4	Student will understand and learn skills that translate into problem solving abilities related to treatments for various infectious diseases and to implement pharmaceutical care process.	Unit IV (15 Hrs)	**29**		**15**		**14**

5	Student will understand the concept of use of medicines in treating the patients with renal impairment and pharmacotherapy on basic principles of cancer therapy	Unit V (18 Hrs)	**35**			**19**	**16**
6	Student will understand the fundamental concepts of safe use of medicines in treating the patients with dermatologic diseases.	Unit VI (4 Hrs)	**08**			**06**	**02**
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I **15 Hrs**

1. Hypertension, congestive cardiac failure, angina pectoris, myocardial infarction, hyperlipidemias, electrophysiology of heart and arrhythmias.
2. Introduction to pulmonary function test, asthma, chronic obstructive airways disease, drug induced pulmonary diseases.

Unit II **13 Hrs**

3. Diabetes, thyroid diseases, oral contraceptives, hormone replacement therapy, osteoporosis.
4. General prescribing guidelines: a) pediatric patients. b) geriatric patient's c) pregnancy and breast feeding.

Unit III **10 Hrs**

5. Ophthalmology: Glaucoma, conjunctivitis- viral & bacterial.
6. Introduction to rational drug use, role of pharmacist in Essential drug concept and rational drug formulations.

Unit IV **15 Hrs**

7. Infectious disease: Guidelines for the rational use of antibiotics and surgical prophylaxis.
8. Tuberculosis, meningitis, respiratory tract infections, gastroenteritis, endocarditis, septicemia, urinary tract infections, protozoal infection- malaria, hiv & opportunistic infections, fungal infections, viral infections, gonorrhea and syphilis, rheumatoid arthritis, osteoarthritis, gout, spondylitis, systemic lupus erythematosus.

Unit V **18 Hrs**

9. Acute Renal Failure, Chronic renal failure, renal dialysis, drug induced renal disorders.
10. Basic principles of cancer therapy, general introduction to cancer chemotherapeutic agents, chemotherapy of breast cancer, leukemia. management of chemotherapy nausea and emesis.

Unit VI **4 Hrs**

11. Psoriasis, scabies, eczema, impetigo

First Year PharmD (PB) Degree Program	
COURSE CODE	**PPR 4.7L**
COURSE TITLE	**PHARMACOTHERAPEUTICS 1 & 2 LAB**

SYNOPSIS	**COs**
Pharmacotherapeutics 1 & 2 lab deals with SOAP analysis of Cardiovascular and Respiratory diseases, diabetes and infectious diseases and Osteoporosis and renal diseases from real time cases from Inpatient case records.	On completion of the course, the student shall be able to : 1. Learn diseases with real case based learnings. 2. Learn pharmacotherapy of diseases with laboratory investigations, and interpretations to diagnosis of diseases. 3. Learn medication related problems by assessing the prescriptions and case records. 4. Recommend therapeutics recommendations based on clinical condition of patients.

Course Content and Assessment Plan

Sl No.	Course Content	Syllabus (chapters or Units with hours)	Distribution of marks of assessment			
			Sessional exam (*20 % of total marks of assessment)*		Continuous evaluation (*10 % of total marks of assessment)*	University exam (70 *% of total marks of assessment)*
			S1	S2		
1	Introduction to wards round participation & SOAP analysis and learn how to understand the concepts of treatment of Cardiovascular and Respiratory diseases and diabetes with clear focus with case based learning.	Unit 1 (35Hrs)	20		10	70
2	Understanding in pharmacotherapy with case based learning focus on laboratory investigations, and treatment-approaches to infectious diseases and Osteoporosis and renal diseases.	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Unit I :

1. Case studies on cardiovascular and Respiratory diseases.
2. Assessment of SOAP on cardiovascular and Respiratory diseases.

Unit II:

3. Case studies on various infectious diseases and Osteoporosis and renal diseases.
4. Assessment of SOAP on various infectious diseases and Osteoporosis and renal diseases.

Second Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 5.1T**
COURSE TITLE	**CLINICAL RESEARCH (Theory)**

SYNOPSIS	**COs**
In This course aims to provide the students an opportunity to learn drug development process especially the phases of clinical trials and also the ethical issues involved in the conduct of clinical research. Also, it aims to imparts knowledge and develop skills on conceptualizing, designing, conducting and managing clinical trials.	Upon completion of this course it is expected that students shall be able to: 1. Know the new drug development process. 2. Appreciate and conduct the clinical trials activities 3. Manage the trial coordination process 4. Understand the regulatory and ethical requirements. 5. Know safety monitoring and reporting in clinical trials

Course Content and Assessment Plan

SL No.	Course Content	Syllabus (chapters or Units with hours)	Marks of assessment	Distribution of marks of assessment			
				Sessional exam (52*% of marks of assessment)*			University Examination (48*% of marks of assessment)*
				S1	S2	S3	
1	Student will learn concepts of new drug discovery development process and phases of clinical trials and regulatory requirements for New drug	Unit I (13 Hrs)	27	14			13
2	Student will explore various objectives of Phase IV studies and regulations of generic drugs	Unit II (12 Hrs)	24	11			13
3	Student will demonstrate and be prepared to present a personal view founded on observing, understanding, documenting compiling, analyzing, organizing data and information in clinical research	Unit III (13 Hrs)	26		13		13
4	Student will convert information with judgement and sensitivity in the healthcare domain and in clinical practice.	Unit IV (12 Hrs)	23		12		11

5	Student will cultivate a sense of fair play, professional ethical codes of conduct.	Unit V (13 Hrs)	25			14	11
6	Student will learn concepts of drug regulatory environments in global level. Develop skills to devise clinical trial related documents.	Unit VI (12 Hrs)	20			11	09
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **13 Hrs**

1. Drug development process:

Introduction Various Approaches to drug discovery

1. Pharmacological

2. Toxicological

3. IND Application

4. Drug characterization

5. Dosage form

2. Clinical development of drug:

1. Introduction to Clinical trials

2. Various phases of clinical trial.

Unit II: **12 Hrs**

3. Methods of post marketing surveillance

4. Abbreviated New Drug Application submission.

Unit III: **13 Hrs**

5. Good Clinical Practice – ICH, GCP, Central drug standard control organisation (CDSCO) guidelines

6. Challenges in the implementation of guidelines

7. 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

Unit IV: **12 Hrs**

8. Role and responsibilities of Regulatory authority

9. Composition, responsibilities, procedures of IRB / IEC 10.

10. Data management and its components

11. Safety monitoring in clinical trials.

Unit V: **13 Hrs**

12. Ethical guidelines in Clinical Research

13. Informed consent Process

Unit VI: **12 Hrs**

14. Overview of regulatory environment in USA, Europe and India.

15. Designing of clinical study documents (protocol, CRF, ICF, PIC with assignment)

<table>
<tr><th colspan="8">Second Year PharmD (PB) Degree Program
Courses, Course Outcome (COs), Course Content and Assessment Plan</th></tr>
<tr><td>COURSE CODE</td><td colspan="7">PPR 5.2T</td></tr>
<tr><td>COURSE TITLE</td><td colspan="7">PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS (Theory)</td></tr>
<tr><th colspan="2">SYNOPSIS</th><th colspan="6">COs</th></tr>
<tr><td colspan="2">This course enables the students to understand various pharmacoepidemiological methods and their clinical applications. Also, it aims to impart knowledge on basic concepts, assumptions, terminology, and methods associated with pharmacoeconomics and health related outcomes, and when should be appropriate pharmacoeconomic model should be applied for a health care regimen.</td><td colspan="6">Upon completion of this course the student should be able to:
1. Understand the various epidemiological methods and their applications.
2. Understand the fundamental principles of pharmacoeconomics.
3. Identify and determine relevant cost and consequences associated with pharmacy products and services.
4. Perform key pharmacoeconomics analysis methods.
5. Understand the pharmacoeconomic decision analysis methods and its applications.
6. Describe current pharmacoeconomic method and issues.
7. Understand the applications of pharmacoeconomics to various pharmacy settings</td></tr>
<tr><th colspan="8">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="3">SL No.</td><td rowspan="3">Course Content</td><td rowspan="3">Syllabus (chapters or Units with hours)</td><td rowspan="3">Marks of assessment</td><td colspan="4">Distribution of marks of assessment</td></tr>
<tr><td colspan="3">Sessional exam (52% of marks of assessment)</td><td rowspan="2">University Examination (48% of marks of assessment)</td></tr>
<tr><td>S1</td><td>S2</td><td>S3</td></tr>
<tr><td>1</td><td>Student will learn the definition, scope, applications, outcome measurements in pharmacoepidemiology</td><td>Unit I (10 Hrs)</td><td>19</td><td>10</td><td></td><td></td><td>09</td></tr>
</table>

2	Student will understand the concepts of risk in pharmacoepidemiology and learn the pharmacoepidemiological study methods	Unit II (15 Hrs)	29	15			14
3	Student will learn the application of pharmacoepidemiological study in the field of study review and pharmacovigilance safety managements.	Unit III (15 Hrs)	29		15		14
4	Student will learn the data sources available in pharmacoepidemiological studies	Unit IV (08 Hrs)	19		10		09
5	Student will learn basic of pharmacoeconomics, cost categorization and outcome measurements.	Unit V (10 Hrs)	20			10	10
6	Student will learn various types of pharmacoeconomic evaluations and its application.	Unit VI (20Hrs)	29			15	14
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

UNIT – I **10 Hrs**

1. **Introduction to Pharmacoepidemiology:** Definition, scope, need, aims & applications.
2. **Outcome measurement**: Outcome measures, drug use measures: monetary units, number of prescriptions, units of drug dispensed, defined daily doses, prescribed daily doses, diagnosis and therapy surveys, prevalence, incidence rate, medications adherence measurements.

UNIT – II **15 Hrs**

3. **Concept of risk:** measurement of risk, attributable risk and relative risk, time- risk relationship and odds rat
4. **Pharmacoepidemiological Methods:** Qualitative models: qualitative models: drug utilization review; quantitative models: case reports, case series, cross sectional studies, cohort and case control studies, calculation of odds' ratio,

UNIT – III **12 Hrs**

5. **Pharmacoepidemiological study review and pharmacovigilance safety management's**: meta-analysis models, drug effects study in populations: Spontaneous reporting, prescription event monitoring, post marketing surveillance, record linkage systems.

UNIT – IV **08 Hrs**

6. **Sources of data for Pharmacoepidemiological studies:** Ad Hoc data sources and automated data systems.

UNIT – V **10 Hrs**

7. **Introduction to Pharmacoeconomics:** Definition, history, needs of pharmacoeconomic evaluations.
8. **Cost categorization:** Direct costs, indirect costs, intangible costs.

9. **Outcomes and Measurements of Pharmacoeconomics:** Types of outcomes: Clinical outcome, economic outcomes, humanistic outcomes; quality adjusted life years, disability adjusted life years incremental cost effective ratio, average cost effective ratio, person-time, willingness to pay, time trade off and discounting.

UNIT – VI **20 Hrs**

10. **Pharmacoeconomic evaluations:** Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA), Cost Effective Analysis (CEA), Cost Utility Analysis (CUA). Software used in pharmacoeconomic analysis.
11. **Pharmacoeconomic** role in formulary management decisions.

<table>
<tr><th colspan="8">Second Year PharmD (PB) Degree Program
Courses, Course Outcome (COs), Course Content and Assessment Plan</th></tr>
<tr><td>COURSE CODE</td><td colspan="7">PPR 5.3T</td></tr>
<tr><td>COURSE TITLE</td><td colspan="7">CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING (Theory)</td></tr>
<tr><th colspan="3">SYNOPSIS</th><th colspan="5">COs</th></tr>
<tr><td colspan="3">To Understand the basic and applied concepts in clinical pharmacokinetics and appreciate the concepts of therapeutic drug monitoring. To understand application oriented dosage adjustment concepts and advanced concepts like population pharmacokinetics and pharmacokinetics</td><td colspan="5">Upon completion of the course, the student shall be able to:
1. Design dosage regimen
2. Understand Pharmacokinetic drug interactions
3. Learn and apply the concepts of therapeutic drug monitoring
4. Appreciate the concepts of dosage adjustment in special populations
5. Understand the concepts of population pharmacokinetics
6. Learn the concepts of pharmacogenetics and its application in pharmacokinetics</td></tr>
<tr><th colspan="8">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="2">SL No.</td><td rowspan="2">Course Content</td><td rowspan="2">Syllabus (chapters or Units with hours)</td><td rowspan="2">Marks of assessment</td><td colspan="4">Distribution of marks of assessment</td></tr>
<tr><td colspan="3">Sessional exam (52% of marks of assessment)
S1 S2 S3</td><td>University Examination (48% of marks of assessment)</td></tr>
<tr><td>1</td><td>Student will understand clinical pharmacokinetics. Understand the concepts of therapeutic drug monitoring of various classes of drugs</td><td>Unit I (11 Hrs)</td><td>32</td><td>16</td><td></td><td></td><td>16</td></tr>
<tr><td>2</td><td>Student will understand Pharmacokinetic interactions and their mechanisms.
Understand the mechanisms of inhibition and induction of drug metabolism</td><td>Unit II (7 Hrs)</td><td>21</td><td>9</td><td></td><td></td><td>12</td></tr>
</table>

3	Student will understand dosage adjustment in renal failure, hepatic failure and IV to oral conversion	Unit III (9 Hrs)	26		13		13
4	Student will understand dosage adjustment in elderly, paediatric and obese patients along with dose and dosing intervals. Understand the application of Bayesian theory	Unit IV (8 Hrs)	23		12		11
5	Student will understand population pharmacokinetics and genetic polymorphism of drug transports and targets	Unit V (8 Hrs)	23			13	10
6	Student will understand PKPD correlation, adaptive methods for dosing and nomograms & Tabulation for dosage regimen design	Unit VI (7 Hrs)	20			12	8
Total Marks of assessment			**145**	**25**	**25**	**25**	**70**

Unit I: **11 Hrs**

1. Introduction to Clinical pharmacokinetics.
2. Indications and Protocol for TDM
3. Individualization of Dosage Regimen
4. TDM of CVS & Seizure drugs
5. TDM of Psychiatric & Organ transplant drugs

Unit II: **7 Hrs**

6. Pharmacokinetic drug interactions
7. Inhibition of drug metabolism
8. Induction of drug metabolism
9. Inhibition of Biliary Excretion

UNIT III: **9 Hrs**

10. General approach for dosage adjustment in Renal disease and assessment of renal function
11. Extracorporeal removal of drugs
12. Dosage adjustment in Hepatic disease & uremic patients
13. Conversion from intravenous to oral dosing

UNIT IV: **8 Hrs**

14. Drug dosing in the elderly and pediatric patients
15. Drug dosing in obese patients
16. Determination of dose and dosing intervals
17. Introduction to Bayesian Theory

UNIT V: **8 Hrs**

18. Analysis of Population pharmacokinetic Data.
19. Genetic polymorphism in Drug metabolism.
20. Pharmacogenetics & PKPD considerations
21. Genetic Polymorphism in Drug Transport & Targets

UNIT VI: **7 Hrs**

22. Adaptive method or Dosing with feed-back.
23. PK/PD Correlation in drug therapy
24. Nomograms & Tabulation in dosage regimen

<table>
<tr><th colspan="7">Second Year PharmD (PB) Degree Program</th></tr>
<tr><td>COURSE CODE</td><td colspan="6">PPR 5.4L</td></tr>
<tr><td>COURSE TITLE</td><td colspan="6">CLERKSHIP</td></tr>
<tr><th colspan="3">SYNOPSIS</th><th colspan="4">COs</th></tr>
<tr><td colspan="3">This course is designed to impart knowledge and skills in evaluating clinical cases and assess the pharmacotherapy and recommend appropriate dosage regimen</td><td colspan="4">On Completion of the course the student shall be able to:
1. Understand the concepts of case assessment and pharmacotherapy
2. Apply pharmaceutical care plan considering
therapeutic and toxic monitoring plans</td></tr>
<tr><th colspan="7">Course Content and Assessment Plan</th></tr>
<tr><td rowspan="2">Sl No.</td><td rowspan="2">Course Content</td><td rowspan="2">Syllabus (chapters or Units with hours)</td><td colspan="4">Distribution of marks of assessment</td></tr>
<tr><td colspan="2">Sessional exam (20 % of total marks of assessment)</td><td rowspan="2">Continuous evaluation (10 % of total marks of assessment)</td><td rowspan="2">University exam (70 % of total marks of assessment)</td></tr>
<tr><td>S1</td><td>S2</td></tr>
<tr><td>1</td><td>Student will earn to assess the cases as per the SOAP format and other clinically relevant approaches and able to present. The assessment will be in the format of long and short cases considering the biochemical lab parameters and pathophysiological conditions</td><td>Unit 1 (35Hrs)</td><td>20</td><td></td><td>10</td><td>70</td></tr>
</table>

2	Student will assess the cases in all disease areas and will be able to recommend necessary interventions. Student will be able to assess recommend management strategies for the disease in question.	Unit II (40Hrs)		20		
Total Marks of assessment			**Average of two sessional exams 20**		**10**	**70**

Second Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan				
COURSE CODE	**PPR 5.5P**			
COURSE TITLE	**PROJECT WORK**			
SYNOPSIS		**COs**		
This course is designed to impart knowledge and skills in developing appropriate research protocol and execution of research work with ethical committee approval.		On completion of the course, the student shall be able to: 1. Undertake literature search, identify topics, design, plan, execute studies, document, compile, analyze and interpret data 2. Present the results of the project work as a written report, conference presentations and publications in peer reviewed journals.		
Course Content and Assessment Plan				
Sl No.	Course Contents	Distribution of marks of assessment Project evaluation (70 marks) Evaluation of project work: 65% of total marks of assessment	Publication of project work (5 *% of total marks of assessment)*	**Viva voce (30% of total marks of assessment)**
1	Students will be taking up a research work in novel and appropriate areas relevant to the discipline to explore, innovate and contribute to scientific and professional body of knowledge and demonstrate skills and capabilities in literature search, identification of topics, design and plan of study, execution, documentation, compilation, analysis and interpretation. Students will present the results of the project work as a written	65	05	30

	report, conference presentations and publications in peer reviewed journals.			
Total Marks of assessment		**100 marks**		

Topic Selection and Project execution

A group of students (2-4 students) will be choosing a topic on contemporary and advanced areas of the discipline in consultation with their respective dissertation guides. The topics will be connected to the planned dissertation work to be carried out in the 5th year/2nd year of Pharm D and Pharm D (PB) programme respectively. The group of students shall work on the project by consulting with their guides during all the stages of the dissertation from planning to the final presentation.

Guidelines to Prepare Project work report

COVER PAGE

- Title of the dissertation, name and affiliation of the student and registration number. Names and affiliation of guides

PAPER

- Use A4 (210 mm X 297 mm) bond plain white paper Margin 1" on all 4 sides.

CONTENT

- Title of the work
- Introduction/background
- Aims and objective
- Methodology
- Results
- Discussion
- Conclusion
- References

NUMBERING

- Every page in the report must be accounted for except the cover page.
- Page numbering Position: numbering should be at the bottom of page with right justified and continuous numbering from the introduction chapter. for the pages before this, use roman numerals.
- For sections, use only Arabic numerals with decimals. Section numbering should be left justified using bold print. Example: 1.1, 1.2,1.3, etc.
- For equations, use only Arabic numerals with single decimal. Equation numbers should be right justified using normal print. example (1.1)

TEXT

- Black print, Times New Roman
- Section headings (12 pts. and bold print and capitals), Subsection Headings (12 pts., bold print and leading capitals), regular text (12 pts. and normal print), special text (italics / superscript / subscript / special symbols etc., as per necessity. Special text may include footnotes, endnotes, physical or chemical symbols, mathematical notations, etc.).
- Use 1.5 spacing between the lines. Use double spacing between paragraphs, and entirely justified.

TABLES

- Tables should follow immediately after they are referred to for the first time in the text.
- Each table has to be numbered (ex: Table 1, 2, 3 etc.).
- The table title should be centered with respect to the table and must be on the top of the Table.
- The titles must be in the same font as the regular text and should be single spaced.

FIGURES

- Figures should follow immediately after they are referred to for the first time in the text.
- Each figure has to be numbered (example figure 1, 2, etc.).
- The figure caption should be centered with respect to the figure and must be at the bottom of the figure.
- The titles must be in the same font as the regular text and should be single spaced.
- Graphs, photographs are also considered to be figure.

REFERENCE

- Vancouver or Harvard style of referencing

Submission

- The last page of the project work report must contain a copy of plagiarism report (one page only of less than 15% similarity index.
- Ethical committee approval letter must attach as appropriate
- All the students should submit the hard copy of the bound dissertation report in the required numbers (two copy) to the department office and follow all other regulations as stipulated from time to time.
- A copy of published article/ submitted manuscript/draft manuscript must be attached
- Submission of project report shall be done at least one month prior to the commencement of annual or supplementary examination

Project work evaluation

The performance of the student in the project work is assessed as per the scheme given below by the two examiners (guide with other expert staff) appointed by the department.

<table>
<tr><th colspan="4">Evaluation of project work and viva voce</th></tr>
<tr><th colspan="2">Evaluation of project work</th><th colspan="2">Evaluation of Presentation and Viva-voce</th></tr>
<tr><th>Contents</th><th>Marks</th><th>Contents</th><th>Marks</th></tr>
<tr><td>Objective(s) of the study</td><td>15</td><td rowspan="2">Presentation of work</td><td rowspan="2">10</td></tr>
<tr><td>Literature search</td><td>15</td></tr>
<tr><td>Methodology adopted</td><td>10</td><td rowspan="2">Communication skills</td><td rowspan="2">10</td></tr>
<tr><td>Results and discussions</td><td>10</td></tr>
<tr><td>Conclusions and outcomes</td><td>10</td><td rowspan="3">Answering skill</td><td rowspan="3">10</td></tr>
<tr><td>Bibliography</td><td>05</td></tr>
<tr><td>Publication of project work*</td><td>05</td></tr>
<tr><td>Total Marks</td><td>70</td><td>Total Marks</td><td>30</td></tr>
<tr><td>Total project work evaluation Marks</td><td colspan="3">100 Marks</td></tr>
</table>

Note: *Published and accepted for publication awards 5 marks. Manuscript under review 4 marks, manuscript submitted to journal 3 marks and for under preparation 2marks. Publication must be in Q1 to Q4 Journals and under the affiliation of the department.

Third Year PharmD (PB) Degree Program Courses, Course Outcome (COs), Course Content and Assessment Plan	
COURSE CODE	**PPR 6.1 R**
COURSE TITLE	**INTERNSHIP**

SYNOPSIS	**COs**
Internship is a phase of training wherein a student is expected to conduct actual practice of pharmacy and healthcare and acquires skills under the supervision so that he or she may become capable of functioning independently.	(1) To provide patient care in cooperation with patients, prescribers, and other inter-professional health care teams based upon sound therapeutic principles and evidence-based data. (2) To manage and use the health care system's resources to promote health; to provide, assess, and coordinate safe, accurate, and time-sensitive medication distribution; and improve therapeutic outcomes of medication use. (3) To promote health, wellness, and disease prevention in cooperation with patients, communities, at-risk populations, and other members of an interprofessional team of health care providers. (4) To demonstrate skills in monitoring the national health programs and schemes, oriented to provide preventive and promotive health care services to the community. (5) To develop leadership qualities to function effectively as a member of the health care team organized to deliver the health and family welfare services in the existing socio-economic, political, and cultural environment. (6) To communicate effectively with patients and the community.

Assessment Plan

SL No	Assessment parameters	Scores		
		S1 *(6 months)*	S2 *(6 months)*	University Evaluation *(Average of S1, S2 assessment)*
1	Proficiency of knowledge required for each case management			
2	The competency in skills expected for providing clinical pharmacy services			
3	Responsibility, punctuality, work up of case, involvement in patient care			
4	Ability to work in a team (Behavior with other healthcare professionals including medical doctors, nursing staff and colleagues)			
5	Initiative, participation in discussions, research aptitude			
Total scores of assessment (average)		**5**	**5**	**5**

NOTES

7

Doctor of Pharmacy-Post Baccalaureate (PharmD (PB))

Course Contents In-Detail (Syllabus)

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.1T: PHARMACOTHERAPEUTICS – III

Theory: 3 Hrs. /Week

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

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

a. the pathophysiology of selected disease states and the rationale for drug therapy;

b. the therapeutic approach to management of these diseases;

c. the controversies in drug therapy;

d. the importance of preparation of individualised therapeutic plans based on diagnosis;

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

f. describe the pathophysiology of selected disease states and explain the rationale for drug therapy;

g. to summarize the therapeutic approach to management of these diseases including reference to the latest available evidence;

h. to discuss the controversies in drug therapy;

i. to discuss the preparation of individualised therapeutic plans based on diagnosis; and

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

Text Books

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

b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication

b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication

c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication

d. Applied Therapeutics: The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA

e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.

f. Relevant review articles from recent medical and pharmaceutical literature.

3. Lecture wise programme :

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

Title of the topic

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

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

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

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

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

6 **Evidence Based Medicine**

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.1L: PHARMACOTHERAPEUTICS – III LAB

Practical: 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.

Assignments:

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

Format of the assignment:

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

Scheme of Practical Examination :

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

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

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.2T: HOSPITAL PHARMACY

Theory: 2 Hrs. /Week

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

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

a. know various drug distribution methods;

b. know the professional practice management skills in hospital pharmacies;

c. provide unbiased drug information to the doctors;

d. know the manufacturing practices of various formulations in hospital set up;

e. appreciate the practice based research methods; and

f. appreciate the stores management and inventory control.

Text books: (latest editions)

a. Hospital pharmacy by William E Hassan

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

References:

a. WHO consultative group report.

b. R.P.S. Vol.2. Part –B; Pharmacy Practice section.

c. Handbook of pharmacy – health care. Edt. Robin J Harman. The Pharmaceutical press.

3. Lecture wise programme :

Topics

1 Hospital - its Organisation and functions

2 Hospital pharmacy-Organisation and management

a) Organizational structure-Staff, Infrastructure & work load statistics

b) Management of materials and finance

c) Roles & responsibilities of hospital pharmacist

3 The Budget – Preparation and implementation

4 Hospital drug policy

a) Pharmacy and Therapeutic committee (PTC)

b) Hospital formulary

c) Hospital committees

- Infection committee
- Research and ethical committee

d) developing therapeutic guidelines

e) Hospital pharmacy communication - Newsletter

5 Hospital pharmacy services

a) Procurement & warehousing of drugs and Pharmaceuticals

b) Inventory control

Definition, various methods of Inventory Control

ABC, VED, EOQ, Lead time, safety stock

c) Drug distribution in the hospital

i) Individual prescription method

ii) Floor stock method

iii) Unit dose drug distribution method

d) Distribution of Narcotic and other controlled substances

e) Central sterile supply services – Role of pharmacist

6 Manufacture of Pharmaceutical preparations

a) Sterile formulations – large and small volume parenterals

b) Manufacture of Ointments, Liquids, and creams

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

d) Total parenteral nutrition

7 Continuing professional development programs Education and training

8 Radio Pharmaceuticals – Handling and packaging

9 Professional Relations and practices of hospital pharmacist

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.2L: HOSPITAL PHARMACY LAB

Practical: 3 Hrs./Week

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

List of Assignments:

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

Special requirements:

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

Scheme of Practical Examination:

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

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

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.3T: CLINICAL PHARMACY

Theory: 3 Hrs. /Week

1. Objectives of the Subject:

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

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

Text books (Theory)

a. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia.
b. Basic skills in interpreting laboratory data - Scott LT, American Society of Health System Pharmacists Inc.
c. Biopharmaceutics and AppliedPharmacokinetics - Leon Shargel, Prentice Hall publication.
d. A text book of Clinical Pharmacy Practice; Essential concepts and skills, Dr.G.Parthasarathi etal, OrientOrientLangram Pvt.Ltd. IS S BN8125026

References

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

2. Detailed syllabus and lecture wise schedule:

Title of the topic

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

3. Patient data analysis

The patient's case history, its structure and use in evaluation of drug therapy & Understanding common medical abbreviations and terminologies used in clinical practices.

4. Clinical laboratory tests used in the evaluation of disease states, and interpretation of test results

a. Haematological, Liver function, Renal function, thyroid function tests

b. Tests associated with cardiac disorders

c. Fluid and electrolyte balance

d. Microbiological culture sensitivity tests

e. Pulmonary Function Tests

5. Drug & Poison information

a. Introduction to drug information resources available

b. Systematic approach in answering DI queries

c. Critical evaluation of drug information and literature

d. Preparation of written and verbal reports

e. Establishing a Drug Information Centre

f. Poisons information- organization & information resources

6. 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.

7. Communication skills, including patient counselling techniques, medication history interview, presentation of cases.

8. Pharmaceutical care concepts

9. Critical evaluation of biomedical literature

10. Medication errors

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.3L: CLINICAL PHARMACY LAB

Practical: 3 Hrs./Week

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

a. Answering drug information questions (4 Nos)

b. Patient medication counselling (4 Nos)

c. Case studies related to laboratory investigations (4 Nos)

d. Patient medication history interview (3 Nos)

Assignment:

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

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

Format of the assignment:

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

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.4T: BIOSTATISTICS AND RESEARCH METHODOLOGY

Theory: 2 Hrs. /Week

1. Detailed syllabus and lecture wise schedule

1 Research Methodology

a) Types of clinical study designs:

Case studies, observational studies, interventional studies,

b) Designing the methodology

c) Sample size determination and Power of a study Determination of sample size for simple comparative experiments, determination of sample size to obtain a confidence interval of specified width, power of a study

d) Report writing and presentation of data

2 Biostatistics

2.1 a) Introduction

b) Types of data distribution

c) Measures describing the central tendency distributions- average, median, mode

d) Measurement of the spread of data-range, variation of mean, standard deviation, variance, c oefficient of variation, standard error of mean.

2.2 Data graphics

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

2.3 Basics of testing hypothesis

a) Null hypothesis, level of significance, power of test, P value, statistical estimation of confidence intervals.

b) Level of significance (Parametric data)- students t test (paired and unpaired), chi Square test, Analysis of Variance (one-way and two-way)

c) Level of significance (Non-parametric data)- Sign test, Wilcoxan's signed rank test, Wilcoxan rank sum test, Mann Whitney U test, Kruskal-Wall is test (one way ANOVA)

d) Linear regression and correlation- Introduction, Pearsonn's and Spearmann's correlation and correlation co-efficient.

e) Introduction to statistical software: SPSS, Epi Info, SAS.

2.4 Statistical methods in epidemiology Incidence and prevalence, relative risk,attributable risk

3. Computer applications in pharmacy

Computer System in Hospital Pharmacy: Patterns of Computer use in Hospital Pharmacy – Patient record database management, Medication orderentry – Drug labels and list – Intravenous solution and admixture, patient medication profiles, Inventory control, Management report & Statistics.

Computer In Community Pharmacy

Computerizing the Prescription Dispensing process

Use of Computers for Pharmaceutical Care in community pharmacy

Accounting and General ledger system

Drug Information Retrieval & Storage :

Introduction – Advantages of Computerized Literature Retrieval

Use of Computerized Retrieval

Reference books:

a. Pharmaceutical statistics - practical and clinical applications, Sanford Bolton 3rd edition, publisher Marcel Dekker Inc. NewYork.

b. Drug Information- A Guide for Pharmacists, Patrick M Malone, Karen L Kier, John E Stanovich , 3rd edition, McGraw Hill Publications 2006

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.5T: BIOPHARMACEUTICS AND PHARMACOKINETICS

Theory: 3 Hrs. /Week

1. Biopharmaceutics

Introduction to Biopharmaceutics

a. Absorption of drugs from gastrointestinal tract.
b. Drug Distribution.
c. Drug Elimination.

2. Pharmacokinetics

Introduction to Pharmacokinetics.

a. Mathematical model
b. Drug levels in blood.
c. Pharmacokinetic model
d. Compartment models
e. Pharmacokinetic study.

3. One compartment open model.

a. Intravenous Injection (Bolus)
b. Intravenous infusion.

4. Multicompartment models.

a. Two compartment open model.
b. IV bolus, IV infusion and oral administration

5. Multiple – Dosage Regimens.

a. Repetitive Intravenous injections – One Compartment Open Model
b. Repetitive Extravascular dosing – One Compartment Open model
c. Multiple Dose Regimen – Two Compartment Open Model

6. Nonlinear Pharmacokinetics.

a. Introduction
b. Factors causing Non-linearity.
c. Michaelis-menton method of estimating parameters.

7. Noncompartmental Pharmacokinetics.

a. Statistical Moment Theory.
b. MRT for various compartment models.
c. Physiological Pharmacokinetic model.

8. Bioavailability and Bioequivalence.

a. Introduction.
b. Bioavailability study protocol.
c. Methods of Assessment of Bioavailability

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.5L: BIOPHARMACEUTICS AND PHARMACOKINETICS LAB

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 protein bound drug and poorly protein bound drug.

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 K_a, K_e, $t_{1/2}$, C_{max}, 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. Bioequivalency 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.

References:

a. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi
b. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia.
c. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
d. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
e. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
f. Biopharmaceutics; By Swarbrick
g. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil
B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
h. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
i. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
j. Biopharmaceutics and Clinical Pharmacokinetics - An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
k. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C. Roylan, Marcel Dekker Inc, New York 1996.

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.6T: CLINICAL TOXICOLOGY

Theory: 2 Hrs. /Week

1. General principles involved in the management of poisoning
2. Antidotes and the clinical applications.
3. Supportive care in clinical Toxicology.
4. Gut Decontamination.
5. Elimination Enhancement.
6. Toxicokinetics.
7. Clinical symptoms and management of acute poisoning with the following agents –

a) Pesticide poisoning: organophosphorous compounds, carbamates, organochlorines, pyrethroids.
b) Opiates overdose.
c) Antidepressants
d) Barbiturates and benzodiazepines.
e) Alcohol: ethanol, methanol.
f) Paracetamol and salicylates.
g) Non-steroidal anti-inflammatory drugs.
h) Hydrocarbons: Petroleum products and PEG.
i) Caustics: inorganic acids and alkali.
j) Radiation poisoning

8. Clinical symptoms and management of chronic poisoning with the following agents –

   Heavy metals: Arsenic, lead, mercury, iron, copper
9. Venomous snake bites: Families of venomous snakes, clinical effects of venoms,general management as first aid, early manifestations, complications and snake bite injuries.
10. Plants poisoning. Mushrooms, Mycotoxins.
11. Food poisonings
12. Envenomations – Arthropod bites and stings.

13. Substance abuse:

Signs and symptoms of substance abuse and treatment of dependence

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

References:

a. Matthew J Ellenhorn. ELLENHORNS MEDICAL TOXICOLOGY – DIAGNOSIS AND TREATMENT OF POISONING. Second edition. Williams and Willkins publication, London

b. V V Pillay. HANDBOOK OF FORENSIC MEDICINE AND TOXICOLOGY. Thirteenth edition 2003 Paras Publication, Hyderabad

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.7T: PHARMACOTHERAPEUTICS – I & II

Theory: 3 Hrs. /Week

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

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

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

a. the pathophysiology of selected disease states and the rationale for drug therapy;

b. the therapeutic approach to management of these diseases;

c. the controversies in drug therapy;

d. the importance of preparation of individualised therapeutic plans based on diagnosis;

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

f. summarise the therapeutic approach to management of these diseases including reference to the latest available evidence; and

g. discuss the controversies in drug therapy;

Text Books

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

b. Pharmacotherapy: A Pathophysiologic approach - Joseph T. Dipiro et al. Appleton & Lange.

Reference Books

a. Pathologic basis of disease - Robins SL, W.B.Saunders publication.

b. Pathology and therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice - Green and Harris, Chapman and Hall publication.

c. Clinical Pharmacy and Therapeutics - Eric T. Herfindal, Williams and Wilkins Publication.

d. Applied Therapeutics:The clinical Use of Drugs. Lloyd Young and Koda-Kimble MA

e. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.

f. Relevant review articles from recent medical and pharmaceutical literature

3. **Detailed syllabus and lecture wise schedule** :

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

Title of the topic

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

2. **Respiratory system:** Introduction to Pulmonary function test, Asthma, Chronic obstructive airways disease, Drug induced pulmonary diseases

3. **Endocrine system:** Diabetes, Thyroid diseases, Oral contraceptives, Hormone replacement therapy, Osteoporosis

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

5. **Ophthalmology:** Glaucoma, Conjunctivitis- viral & bacterial

6. **Introduction to rational drug use**

   Definition, Role of pharmacist Essential drug concept Rational drug formulations

7. **Infectious disease:** Guidelines for the rational use of antibiotics and surgical Prophylaxis, Tuberculosis, Meningitis, Respiratory tract infections, Gastroenteritis, Endocarditis, Septicemia, Urinary tract infections, Protozoal infection- Malaria, HIV & Opportunistic infections, Fungal infections, Viral infections, Gonarrhoea and Syphillis

8. **Musculoskeletal disorders** Rheumatoid arthritis, Osteoarthritis, Gout, Spondylitis, Systemic lupus erythematosus.
9. Renal system Acute Renal Failure, Chronic Renal Failure, Renal Dialysis, Drug induced renal disorders
10. **Oncology:** Basic principles of Cancer therapy, General introduction to cancer chemotherapeutic agents, Chemotherapy of breast cancer, leukemia. Management of chemotherapy nausea and emesis
11. **Dermatology:** Psoriasis, Scabies, Eczema, Impetigo

PharmD – Post Baccalaureate: First Year Syllabus
PPR 4.7L: PHARMACOTHERAPEUTICS – I & II LAB

Practical: 3 Hrs./Week

Practicals:

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

The student shall be trained to understand the principle and practice involved in selection of drug therapy including clinical discussion.

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

Assignments:

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

Format of the assignment:

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

Scheme of Practical Examination:

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

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

PharmD – Post Baccalaureate: Second Year Syllabus
PPR 5.1T: CLINICAL RESEARCH

Theory: 3 Hrs. /Week

1. Drug development process:

Introduction

Various Approaches to drug discovery

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

2. Clinical development of drug:

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

References:

a. Central Drugs Standard Control Organization. Good Clinical Practices-Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.
b. International Conference on Harmonisation of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonised Tripartite Guideline. Guideline for Good Clinical Practice.E6; May 1996.
c. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.
d. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
e. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
f. Clinical Data Management edited by R K Rondels, S A Varley, C F Webbs. Second Edition, Jan 2000, Wiley Publications.
g. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.

PharmD – Post Baccalaureate: Second Year Syllabus
PPR 5.2T: PHARMACOEPIDEMIOLOGY AND PHARMACOECONOMICS

Theory: 3 Hrs. /Week

1. **Pharmacoepidemiology:**

   Definition and scope:

   Origin and evaluation of pharmacoepidemiology need for pharmacoepidemiology, aims and applications.

   Measurement of outcomes in pharmaco epidemiology

   Outcome measure and drug use measures Prevalence, incidence and incidence rate. Monetary units, number of prescriptions, units of drugs dispensed, defined daily doses and prescribed daily doses, medication adherence measurement

   Concept of risk in pharmacoepidemiology

   Measurement of risk, attributable risk and relative risk, time-risk relationship and odds ratio

   Pharmacoepidemiological methods

   Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods

   Drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control studies, case –cohort studies, meta – analysis studies, spontaneous reporting, prescription event monitoring and record linkage system.

   Sources of data for pharmacoepidemiological studies

   Ad Hoc data sources and automated data systems.

   Selected special applications of pharmaco epidemiology

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

2. **Phrmacoeconomics:**

   Definition, history, needs of pharmacoeconomic evaluations

   Role in formulary management decisions

   Pharmacoeconomic evaluation

   Outcome assessment and types of evaluation

   Includes theoretical aspects of various methods and practical study of various methods with the help of case studies for individual methods: Cost – minimization, cost- benefit, cost – effectiveness, cost utility

3. **Applications of Pharmacoeconomics**

   Software and case studies

PharmD – Post Baccalaureate: Second Year Syllabus
PPR 5.3T: CLINICAL PHARMACOKINETICS AND PHARMACOTHERAPEUTIC DRUG MONITORING

Theory: 2 Hrs. /Week

1. **Introduction to Clinical pharmacokinetics.**
2. **Design of dosage regimens:**

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

3. **Pharmacokinetics of Drug Interaction:**
   a. Pharmacokinetic drug interactions
   b. Inhibition and Induction of Drug metabolism
   c. Inhibition of Biliary Excretion.
4. **Therapeutic Drug monitoring:**
   a. Introduction
   b. Individualization of drug dosage regimen (Variability – Genetic, Age and Weight , disease, Interacting drugs).
   c. Indications for TDM. Protocol for TDM.
   d. Pharmacokinetic/Pharmacodynamic Correlation in drug therapy.
   e. TDM of drugs used in the following disease

conditions: cardiovascular disease, Seizure disorders, Psychiatric conditions, and Organ transplantations.

5. **Dosage adjustment in Renal and hepatic Disease.**
   a. Renal impairment
   b. Pharmacokinetic considerations
   c. General approach for dosage adjustment in Renal disease.
   d. Measurement of Glomerular Filtration rate and creatinine clearance.
   e. Dosage adjustment for uremic patients.
   f. Extracorporeal removal of drugs.
   g. Effect of Hepatic disease on pharmacokinetics.

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

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

PharmD – Post Baccalaureate: Third Year Syllabus
PPR 6.1R: 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.

3. ASSESSMENT OF INTERNSHIP :

i) 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 eligible for it.

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

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

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

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

(4) Ability to work in a team (Behavior 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	Average Above	Excellent
0	1	2	3	4	5

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

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