

B. PHARM DEGREE PROGRAMME CHOICE BASED CREDIT SYSTEM**ACADEMIC REGULATIONS – 2015 [B.PHARM-AR-2015]**

This shall be called as B. Pharm. Academic Regulations – 2015 of Annamalai University. These academic regulations shall come in to force from the academic year 2015-16.

PREAMBLE

Periodically University needs to revise the curriculum of its Academic Programmes to keep abreast with the new developments and discoveries. These regulations have been brought about primarily to meet three goals, namely the Removal of Redundancy, Relevance Reinforcement and ease the undue burden on the students pursuing the programme. Efforts have been made to achieve these goals with the new framework of syllabus drafted by the vastly experienced teaching faculty by mutual consultations and group discussions. The new curriculum provides updated content, latest textbooks and books for reference. In an unique attempt, a first of its kind in any Pharmacy Institute, a concrete list of experiments / exercises to be carried out by the students for each laboratory practical course as been explicitly provided (with built-in flexibility) without leaving anything to assumption. It is hoped that the revised curriculum would serve its objectives and benefit the prospective students.

1. INTRODUCTION

Programme Title	: Bachelor of Pharmacy
Abbreviation (Degree)	: B. Pharm.
Duration of the Programme	: Four Years [First Year Annual Pattern followed by three years of Semester Pattern]
Eligibility	: The candidate must have passed 10 + 2 Exam of the Tamil Nadu Board of Secondary Education, or any other Board recognized by this University with an aggregate of 45% marks (only pass in case of SC/ST) and Physics and Chemistry as compulsory subjects, along with any one of the subjects, viz., Mathematics / Biology / (Botany + Zoology) / Biotechnology / Computer Science.
Medium of Instruction & Examination	: English
Programme Title	: Bachelor of Pharmacy (Lateral Entry)
Abbreviation (Degree)	: B. Pharm.
Duration of the Programme	: Three Years [Divided into Six Semesters]
Eligibility	: The candidates must have qualified Diploma in Pharmacy course, from any institute approved by Pharmacy Council of India, New Delhi, obtaining at least 45 % marks in aggregate in D. Pharmacy.
Medium of Instruction & Examination	: English

2. ACADEMIC CALENDAR

Each academic year shall be divided into two semesters. The second academic year will consist of Third & Fourth Semesters, and so on. The number of teaching weeks in each semester shall be fifteen to seventeen with a minimum of 90 teaching days excluding the period of examination. At the end of each semester, there shall be an examination wherein candidates will be examined in the courses prescribed for that semester and the semester examination shall be designated as End Semester Examination for that Semester. The examination for all odd semesters shall be held in November/December and in May/ June for all even semesters, on dates as scheduled by the University. Each year ANNAMALAI UNIVERSITY will publish a calendar of academic & associated activities, list of holidays & such other aspects as may be deemed appropriate for each semester/year.

3. DURATION OF THE PROGRAMME

A student is ordinarily expected to complete the regular B. Pharm. Degree Programme in four-year term consisting of eight semesters and the B. Pharm. (Lateral Entry) Programme in three-year term consisting of six semesters. However a student may complete the programme in not more than seven years of his / her admission to the First Year of the Course of regular B. Pharm. Programme and not more than six years of his/her admission to the B. Pharm. (Lateral Entry) Programme.

Any candidate, who fails to pass the Bachelor of Pharmacy course, within a period of Seven years (Regular) or Six years (Lateral) of his / her admission to the course, shall be deemed to be not eligible for pursuing the B. Pharm degree programme any further.

4. REGISTRATION FOR COURSES

The scheme of Courses, Contact Periods, Credits, Maximum Marks, Electives and Summary are presented in tables as given below:

B. Pharm. Programme (Regular)	Tables 1 - 9
B. Pharm. Programme (Lateral Entry)	Tables 10 - 17
Course Equivalence for B. Pharm. (Lateral Entry)	Table - 18

A newly admitted student will automatically be registered for all the courses for the first semester without any option.

Every other student shall submit a completed register form indicating the list of courses intended to be credited during that semester. The registration will be done on the notified date after the reopening for that semester. Registration for the project work will be done only in the final semester. Registration for the project work shall be done only for the final semester.

5. ELECTIVES

Students can exercise their option for one elective course from a list of Elective Courses offered (TABLE – 8 /TABLE – 16) in the curriculum during the 8th Semester of programme with the approval of the Head of the Department.

6. MID-TERM (INTERNAL) ASSESSMENTS

The Internal assessment of the student's performance in each course will be based Mid-Term Assessment tests in Theory and Practical courses. The various components of internal assessment and the division of marks are given in the table below:

Break-up of assessment marks for Theory courses are as follows:

Mid Semester Test – I	:	08 Marks
Mid Semester Test – II	:	08 Marks
Assignment	:	09 Marks
End of Semester Examination	:	75 Marks

Break-up of assessment marks for Practical courses are as follows:

First assessment (Test)	:	15 Marks
Second assessment (Test)	:	15 Marks
Maintenance of Record Book	:	10 Marks
End of Semester Examination	:	60 Marks

7. STUDENT COUNSELOR

To help the students in planning their course of study and for general advice on the academic programme, the head of department will attach a certain number of students to a member of the Faculty who shall function as student counselor for those students throughout their period of study. Such student counselors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the head of the department. Student counselor must make sure that every student is aware of passing rules and regulations at the beginning of the academic session.

8. CLASS COMMITTEE

The Head of Department shall constitute Class Committee for the First year and all the following higher semesters.

The composition of the Class Committee shall be as follows:

- Teachers of the individual courses.
- A Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.
- All student counselors of the class and the Head of the Department (if not already a member) or any faculty member nominated by the Head of the Department may opt to be special invitees.
- A Project coordinator (Eighth semester committee only) shall be appointed by the Head of the Department from among the project supervisors.

The class committee shall meet four times during the semester.

The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc for the first and third assessments and the dates of completion of the assessment will be decided.

The second meeting shall be held within a week after the completion of the first assessment to review the performance and for follow-up action. The second assessment will be the mid semester examination.

The third meeting shall be held within a week after the second assessment is completed to review the performance and for follow up action.

During these three meetings the student member representing the entire class shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching learning process.

The fourth meeting shall be held after all the assessments except the end of semester examination are completed for all the courses, and at least one week before the commencement of the end of semester examinations. During this meeting the Mid-Term Assessment marks shall be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of first year) for approval and transmission to the controller of Examinations.

9. WITHDRAWAL FROM A COURSE

A student can withdraw from a course at any time before a date fixed by the Head of the Department prior to the second assessment, with the approval of the Dean of the Faculty on the recommendation of the Head of the Department.

10. TEMPORARY BREAK OF STUDY

A student can take a onetime temporary break of study covering the current semester and / or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester examination, within the maximum period of seven years.

11. ATTENDANCE REQUIREMENTS

The teacher in charge will consolidate the attendance record for the lectures and practical for each term.

To be eligible to appear for the end of semester examination in a particular course, a student must put in a minimum of 80% of attendance in that course. However the authorities can exempt the students with up to 75% on payment of condonation fee.

The candidate has to complete any experiment which he / she might have missed on account of absence in laboratory during the practical class.

Attendance on account of participation cocurricular an extra-curricular activity shall be credited to aggregate, provided the attendance record, provided due prior approval is obtained from the appropriate authority of the University.

If any candidate fails to satisfy the meet the minimum attendance requirement, he/she shall not be allowed for the University Examinations at the end of the semester, and he/she shall not be allowed for promotion to the next higher class of study. He/she shall be required to pay the due fees to register and repeat the regular course of study of that academic semester along with the next regular batch of that particular semester.

12. MODE OF EXAMINATIONS

Each Mid-Semester Theory examination shall be of 1.5 hours duration. Each Theory End Semester examination shall be of 3 hours duration. All Practical Examinations shall be conducted in the laboratories as prescribed in the syllabus for a period of not less than 3 hours. The skills of the candidates in conducting experiments, interpreting results and arriving at logical conclusions shall be assessed. The oral examination is an integral part of the practical examination.

The End Semester Examination in each **Theory** course shall be of **75** marks. Two Main Questions would be asked from each Unit of Study prescribed in the Syllabus and the Candidate need to answer any ONE from each Unit. As a result, from a total of TEN questions the candidate needs to answer ONLY FIVE questions as illustrated below with marks distribution:

Question No.	SOURCE UNITS	Choice	Max. Marks
Question– 1	Unit – 1	Any ONE question needs to be answered	15
Question– 2			
Question– 3	Unit – 2	Any ONE question needs to be answered.	15
Question– 4			
Question– 5	Unit – 3	Any ONE question needs to be answered.	15
Question– 6			
Question– 7	Unit – 4	Any ONE question needs to be answered.	15
Question– 8			
Question– 9	Unit – 5	Any ONE question needs to be answered.	15
Question–10			

Each Individual Main Question can be in any of the pattern or as a slight variant of the pattern illustrated below:

Question	Question Type	Marks
Question - X	Essay type question without any subdivisions	15
Question - X	A. Long Answer Question	7
	B. Long Answer Question	8
Question - X	A. Intermediate Answer Question	5
	B. Intermediate Answer Question	5
	C. Intermediate Answer Question	5
Question - X	A. Short Answer Question	3
	B. Short Answer Question	3
	C. Short Answer Question	3
	D. Short Answer Question	3
	E. Short Answer Question	3

Question	Question Type	Marks
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X = The main question number ranging from 1 to 10.

13. MODE OF EVALUATION

The theory papers of End-Semester examination will be evaluated by an examiner appointed by the University as per the prescribed norms.

The appointment of examiners for evaluation of theory papers will be done by the appropriate authority on the recommendations of Controller of Examinations from a panel of examiners approved by the Board of Studies in Pharmacy.

14. SUBSTITUTE ASSESSMENTS

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end of semester examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the fourth meeting of the respective class committees.

Students wishing to have substitute assessment(s) due to absenteeism must apply to the Head of the Department within a week from the date of the missed assessment.

15. PASSING MARKS AND COMPUTATION OF GRADES

Candidates are required to secure minimum 40% marks in End Semester Examination for each course NOT including the Mid-Semester internal assessment marks and aggregate 50% marks including the Mid-Semester assessment marks in each course as Illustrated below:

	Required Minimum for Pass		
	%	Marks	Grade
End Semester Examination (Theory) Marks	40	30	-
End Semester Examination (Practical) Marks	40	24	-
Mid-Term + End Semester (Aggregate Marks)	50	50	E

All assessments of all the courses on an absolute mark basis will be considered and passed by the respective results passing boards in accordance with the rules of the university. Thereafter, the controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, computer the grade point average and cumulative grade point average, and prepare the grade cards.

Marks / Status	Grade
90 to 100 marks	“S”
80 to 89 marks	“A”
70 to 79 marks	“B”
60 to 69 marks	“C”
55 to 59 marks	“D”
50 to 54 marks	“E”
Less than 50 marks	“F”

Insufficient attendance	:	“ T ”
Withdrawn from the course	:	“ W ”

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S =	10	A =	09	B =	08
C =	07	D =	06	E =	05
		F =	00		

Course with grade **I** and **W** are not considered for calculating of grade point average or cumulative point average. F grade will be considered for GPA and CGPA.

A student who absents or secures a letter grade F in any course has to reappear for that course.

16. GRADE POINT AVERAGE

GPA is the ratio of sum of the products of the number of credits of a course and the grade point scored in that course, taken over all the courses for that semester, to the sum of number of credits for all courses taken in that semester. CGPA is similarly calculated considering all the courses taken from the time of admission. A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$\text{GPA} = \frac{\sum (C \times G)}{\sum C}$$

Where,

C = number of credits for the course in that semester,

G = grade points obtained by the student in that course.

Grade Point Average (GPA) for each Semester is awarded to those candidates who pass in all the courses of the semester.

The cumulative Grade point Average (CGPA) is calculated for all courses registered from the first year onwards. Cumulative Grade Point Average (CGPA) is calculated using the same formula, considering all the courses taken in all the semesters completed up to that period of time.

17. DECLARATION OF RESULTS

A student who earns a minimum of 5 grade points for a course is declared to have successfully completed the course provided a minimum of 40% is secured in the final examination of the course. The student cannot repeat such a course.

A student can apply for re-totaling of his end of semester examination answer paper within a week from the date of issue of grade sheet to the student on payment of the prescribed fee. The application must be made to the controller Examinations with the recommendations of the Head of the Department.

18. MOVEMENT TO HIGHER SEMESTERS

The following minimum credits must be earned by the student to move to the higher semester:

To move to the fourth semester	:	25 Credits
To move to the fifth semester	:	50 Credits
To move to the sixth semester	:	75 Credits
To move to the seventh semester	:	100 Credits
To move to the eighth semester	:	125 Credits

A student who has not fulfilled NCC / NSS requirements will not be eligible to register for the fifth semester.

19. ELIGIBILITY FOR AWARD OF THE B. PHARM. DEGREE

A student shall be eligible for award of the B. Pharm. degree if he / she fulfils all the following conditions:

- a) Registered and successfully completed all the courses and projects.
- b) Acquired the required Credits as specified in the curriculum within the maximum stipulated period as given below:

B.Pharm. Degree Programme (Regular)	200 Credits
B.Pharm. Degree Programme (Lateral Entry)	157 Credits

- c) Has no dues to the Institute, Hostels, Libraries, NCC / NSS etc, and
- d) No disciplinary action is pending against him / her.

The degree shall be awarded after approval by the appropriate authority of the University.

20. CLASSIFICATION

After successful completion of the programme, the degree will be awarded with the following classifications based on CGPA.

20.1. B. Pharm. Programme (Regular)

For First class with Distinction the student must earn a minimum of **200** credits within four years from the time of admission, pass all the courses in the first attempt and obtain a **CGPA** of **8.25** or above for all the subjects from I Year to VIII Semester.

For First class the student must earn a minimum of **200** credits within five years from the time of admission and obtain a **CGPA** of **6.75** or above calculated for all courses from I Year to VIII Semester.

For Second class the student must earn a minimum of **200** credits within seven years from the time of admission.

20.2. B. Pharm. Programme (Lateral Entry)

For First class with Distinction the student must earn a minimum of **157** credits within four years from the time of admission, pass all the courses in the first attempt and obtain a **CGPA** of **8.25** or above for all the subjects from III Semester to VIII Semester.

For First class the student must earn a minimum of **157** credits within five years from the time of admission and obtain a **CGPA** of **6.75** or above calculated for all courses from III Semester to VIII Semester.

For Second class the student must earn a minimum of **157** credits within seven years from the time of admission.

Degree Programme	Minimum Credits	First Class with Distinction CGPA¹	First Class CGPA¹	Second Class¹
B. Pharm. (Regular)	200	8.25	6.75	5
B. Pharm. (Lateral Entry)	157	8.25	6.75	5

¹ Associated Conditions mentioned Sections 20.1 OR 20.2 must be fulfilled.

21. RANKING OF CANDIDATES

The candidates eligible to get the B. Pharm. Degree in First Class with distinction will be ranked together on the basis of CGPA for all the subjects of study from III to VIII semester.

The candidate passing with First class will be ranked next after those with distinction on the basis of CGPA for all the subjects of study from III to VIII Semester.

22. MISCELLANEOUS

Candidates who have been admitted to B. Pharm. Degree programme, without having studied biology subjects at the plus-two (higher secondary) level have to undergo two bridge courses, referred to as Remedial Biology Theory and Remedial Biology Practical in addition to other First semester B. Pharm. courses prescribed in the curriculum during the first semester of study. There shall be a university examination of three hours duration continuous at the end of First semester B. Pharmacy programme. There shall be continuous internal assessment for 25 marks in theory & 40 marks in Practical courses. The End semester University examination shall be for 75 marks in theory and 60 marks in practical courses.

Candidates who have been admitted to First semester B. Pharmacy programme without mathematics subjects at the plus two levels are required to undertake a course on remedial mathematics. There shall be university examination of three hours duration at the end of first semester. There shall be a continuous internal assessment for 25 marks and university examination for 75 marks.

A separate mark sheet shall be issued for remedial biology or remedial mathematics and these marks/credits/grades shall not be considered for classification of division. However the candidates are required to pass the course(s).

Industrial / Hospital Training / Internship: University would provide a clear window for 31 days which will be free from any academic commitment in the campus to enable and encourage students to undergo practical training for a period of four weeks during their study at the department. The candidate may choose any pharmaceutical industry or/and hospital or/and pharmacy approved by the university for that purpose. A training certificate may also be acquired by the candidate from the respective Organizations/Institutes by the candidate himself / herself.

Guest Lectures: Guest Lectures would be organized by the Department inviting experts from various functional areas of the profession of pharmacy including Pharmaceutical industries, Research and teaching faculties from reputed institutes, Regulatory bodies, Marketing professionals etc.

Project Work/Assignment: The project report component will be assigned to students at the beginning of the eighth semester. The topics may be assigned by the teacher or the students may choose their own topics.

The topics for the study will be in any one of the following specialized fields of pharmaceutical science:

Pharmaceutics	Pharmaceutical Chemistry
Pharmacognosy	Pharmacology
Pharmaceutical Analysis	Medicinal Plant Biotechnology
Quality Assurance	Drug design
Bio availability	Therapeutic drug monitoring
Cosmetics	Packaging Technology
Pharmaceutical Marketing	Community Pharmacy

Any other relevant area of current interest.

The project assignment shall be carried out under the guidance of a pharmacy Faculty. The project can be carried out either individually or in groups not exceeding five in number. The purpose of the project report is to emphasize scientific methods, literature survey, citation, data analysis, interpretation, writing scientific reports (article, reviews, and thesis), presentation etc. A draft copy of the project report has to be presented to the concerned faculty member before finalization. The final project report after due correction shall be submitted to the office of the Department on or before the last date stipulated for submission. The Project report would be evaluated by a panel of examiners appointed by the University including the guide concerned.

Internal Assessment marks for Project work shall be awarded by the guide on the basis of candidate's efforts and seminars presented by the candidate on topics / methods / reviews relevant to his/her project work.

Seminar: In order to develop the communication and presentation skills, students are encouraged to present seminars on diverse topics of their choice pertinent to their course work. The topic may be chosen across the professional or general areas. Seminars will be conducted with the co-ordination of Faculty. The final year students must present at least two seminars in addition to the seminars that may be presented with regard to their project work.

Group Discussions: Students may achieve very well in their acquisition of knowledge and skills, but often found lacking in leadership and communication skills. Group Discussion can be used as a vehicle to encourage students to think about and to practice a wide range of skills, such as group communication skills, conflict resolution skills, opinion making, participation in group event and problem-solving skills that may be required in their future working life. Group discussion may be conducted with the participation of willing/interested

candidates in final year. In this process, the teacher assists every student in groups of five to seven students by debriefing them. Students see that they possess a range of skills and identify those in which they need improvement through training and practice.

Soft Skills: Soft skills have become important to graduates to get an edge over the competitors in finding employment. While hard skills refer to things such as academic qualifications, soft skills include interpersonal skills, writing and communication skills, team working, time management, problem solving, attitude to work, etiquette, creative and critical thinking etc. While many soft skills are inherent, others can be learned. The faculty would strive to help the students in improving their skills in the normal course of contact hours. In addition training and counseling sessions may be organized to the benefit of the students.

Transitory Regulations: These new regulations (Academic Regulations 2014) would not affect the candidates admitted under the earlier regulations for a period of six years from the date of admission into the programme. Beyond that period, such candidates will forfeit their right to appear in the examination under the previous regulations and would need to appear under the Academic Regulations 2014. The Head of the Department with due academic considerations may prescribe the Equivalent courses.

B.PHARM. DEGREE PROGRAM
CHOICE BASED CREDIT SYSTEM CURRICULUM DESIGN
SCHEME OF COURSES, CONTACT HOURS, CREDITS AND MARKS

TABLE – 1: B.PHARM FIRST SEMESTER						
CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-101	Introductory Pharmaceutics Theory	3	-	3	25	75
BPH-102	Pharmaceutical Chemistry – I Theory	3	-	3	25	75
BPH-103	Organic Chemistry – I Theory	3	-	3	25	75
BPH-104	Anatomy, Physiology & Health Education – I Theory	3	-	3	25	75
BPH-105	Pharmacognosy – I Theory	3	-	3	25	75
BPH-105P	Pharmacognosy – I Practical	-	3	3	40	60
	TOTAL	15	3	18	165	435
Non-Credit Courses:		-	-	-	-	-
BPH-106	Remedial Mathematics Theory	3	-	-	25	75
BPH-107	Remedial Biology Theory	3	-	-	25	75
BPH-107P	Remedial Biology Practical	-	3	-	40	60

L = Lectures; P = Practical Work in Laboratory

MID SEM = Mid Semester Assessment (Test) Maximum Marks

END SEM = End Semester University Examination Maximum Marks.

TABLE – 2: B.PHARM SECOND SEMESTER						
CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-201	Environmental Science Theory	3	-	3	25	75
BPH-202	Pharmaceutical Chemistry – II Theory	3	-	3	25	75
BPH-202P	Pharmaceutical Chemistry Practical	-	3	3	40	60
BPH-203	Organic Chemistry – II Theory	3	-	3	25	75
BPH-204	Anatomy, Physiology & Health Education – II	3	-	3	25	75
BPH-204P	Anatomy, Physiology & Health Education – Practical	-	4	4	40	60
BPH-205	Pharmacognosy – II Theory	3	-	3	25	75
BPH-205P	Pharmacognosy – II Practical	-	3	3	40	60
	TOTAL	15	9	25	245	555

TABLE – 3: B.PHARM SECOND YEAR – III SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-301	Physical Pharmacy – I Theory	3	-	3	25	75
BPH-302	Organic Chemistry – III Theory	3	-	3	25	75
BPH-302P	Organic Chemistry Practical	-	3	3	40	60
BPH-303	Pharmaceutical Analysis – I Theory	3	-	3	25	75
BPH-303P	Pharmaceutical Analysis – I Practical	-	3	3	40	60
BPH-304	Pathophysiology Theory	3	-	3	25	75
BPH-305	Mathematics & Biostatistics Theory	3	-	3	25	75
BPH-306P	Computer Skills Practical	-	4	3	40	60
	TOTAL	15	10	24	245	555

TABLE – 4: B.PHARM SECOND YEAR – IV SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-401	Physical Pharmacy – II Theory	3	-	3	25	75
BPH-401P	Physical Pharmacy Practical	-	3	3	40	60
BPH-402	Pharmaceutical Unit Operations – I Theory	3	-	3	25	75
BPH-403	Pharmaceutical Analysis – II Theory	3	-	3	25	75
BPH-403P	Pharmaceutical Analysis – II Practical	-	3	3	40	60
BPH-404	Biochemistry – I Theory	3	-	3	25	75
BPH-405	Pharmaceutical Microbiology Theory	3	-	3	25	75
BPH-405P	Pharmaceutical Microbiology Practical	-	3	3	40	60
	TOTAL	15	9	24	245	555

TABLE – 5: B.PHARM THIRD YEAR – V SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-501	Hospital & Community Pharmacy Theory	3	-	3	25	75
BPH-501P	Hospital & Community Pharmacy Practical	-	3	3	40	60
BPH-502	Pharmaceutical Unit Operations – II Theory	3	-	3	25	75
BPH-502P	Pharmaceutical Unit Operations Practical	-	3	3	40	60
BPH-503	Biochemistry – II Theory	3	-	3	25	75
BPH-503P	Biochemistry Practical	-	3	3	40	60
BPH-504	Pharmacology – I Theory	3	-	3	25	75
BPH-505	Pharmaceutical Biotechnology Theory	3	-	3	25	75
	TOTAL	15	9	24	245	555

TABLE – 6: B.PHARM THIRD YEAR – VI SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-601	Pharmaceutical Dosage Forms – I Theory	3	-	3	25	75
BPH-601P	Pharmaceutical Dosage Forms – I Practical	-	4	4	40	60
BPH-602	Medicinal Chemistry – I Theory	3	-	3	25	75
BPH-602P	Medicinal Chemistry – I Practical	-	3	3	40	60
BPH-603	Pharmaceutical Management Theory	3	-	3	25	75
BPH-604	Pharmacology – II Theory	3	-	3	25	75
BPH-604P	Pharmacology Practical	-	3	3	40	60
BPH-605	Pharmacognosy – III Theory	3	-	3	25	75
BPH-605P	Pharmacognosy – III Practical	-	3	3	40	60
	TOTAL	15	13	28	285	615

TABLE – 7: B.PHARM FOURTH YEAR – VII SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-701	Pharmaceutical Dosage Forms – II Theory	3	-	3	25	75
BPH-701P	Pharmaceutical Dosage Forms – II Practical	-	4	4	40	60
BPH-702	Biopharmaceutics & Pharmacokinetics Theory	3	-	3	25	75
BPH-702P	Biopharmaceutics & Pharmacokinetics Practical	-	3	3	40	60
BPH-703	Medicinal Chemistry – II Theory	3	-	3	25	75
BPH-703P	Medicinal Chemistry – II Practical	-	3	3	40	60
BPH-704	Pharmaceutical Jurisprudence Theory	3	-	3	25	75
BPH-705	Pharmacognosy – IV Theory	3	-	3	25	75
BPH-705P	Pharmacognosy – IV Practical	-	3	3	40	60
	TOTAL	15	13	28	285	615

TABLE – 8: B.PHARM FOURTH YEAR – VIII SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPH-801	Modern Drug Delivery Systems Theory	3	-	3	25	75
BPH-801P	Modern Drug Delivery Systems Practical	-	4	4	40	60
BPH-802	Pharmaceutical Analysis – III Theory	3	-	3	25	75
BPH-802P	Pharmaceutical Analysis – III Practical	-	4	4	40	60
BPH-803	Medicinal Chemistry – III Theory	3	-	3	25	75
BPH-804	Pharmacology – III Theory	3	-	3	25	75
BPH-805	Elective Course Theory	3	-	3	25	75
BPH-806T	Project Work	-	6	6	40	60
	TOTAL	15	14	29	245	555

TABLE – 9: List of Elective Courses (Eighth Semester):

BPH-805a	Pharmaceutical Packaging
BPH-805b	Pharmaceutical Marketing
BPH-805c	Pharmaceutical Regulatory Affairs
BPH-805d	Clinical Research

A student may choose any one the above subjects.

Each subject is divided into five units with duration of 3 periods/week.

Electives will be offered depending upon the availability of expertise.

B. PHARM Degree Programme

TABLE – 10: SUMMARY OF CREDITS & MARKS FOR EACH YEAR/SEMESTER

S.No.	YEAR / SEMESTER	PERIODS / WEEK		CREDITS	TOTAL MARKS
		L	P		
1.	I Semester*	15	3	18	600
2.	II Semester	15	9	25	800
3.	III Semester	15	9	24	800
4.	IV Semester	15	9	24	800
5.	V Semester	15	9	24	800
6.	VI Semester	15	13	28	900
7.	VII Semester	15	13	28	900
8.	VIII Semester	15	14	29	800
	TOTAL			200	6400

* Does NOT include the marks of Remedial courses.

B.PHARM DEGREE PROGRAM (LATERAL)
CHOICE BASED CREDIT SYSTEM CURRICULUM DESIGN
YEAR / SEMESTER WISE COURSE DETAILS

TABLE – 11: B.PHARM SECOND YEAR – III SEMESTER						
CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-301	Physical Pharmacy - I	3	-	3	25	75
BPL-302	Organic Chemistry – III	3	-	3	25	75
BPL-302P	Organic Chemistry Practical	-	3	3	40	60
BPL-303	Pharmaceutical Analysis – I	3	-	3	25	75
BPL-303P	Pharm. Analysis – I Practical	-	3	3	40	60
BPL-304	Pathophysiology	3	-	3	25	75
BPL-305	Mathematics & Biostatistics	3	-	3	25	75
BPL-306P	Computer Skills Practical	-	4	3	40	60
	TOTAL	15	10	24	245	555

L = Lectures; P = Practical Work in Laboratory

MID SEM = Mid Semester Assessment (Test) Maximum Marks

END SEM = End Semester University Examination Maximum Marks.

TABLE – 12: B.PHARM SECOND YEAR – IV SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-401	Physical Pharmacy – II	3	-	3	25	75
BPL-401P	Physical Pharmacy Practical	-	3	3	40	60
BPL-402	Unit Operations – I	3	-	3	25	75
BPL-403	Pharmaceutical Analysis – II	3	-	3	25	75
BPL-403P	Pharmaceutical Analysis – II Practical	-	3	3	40	60
BPL-404	Biochemistry – I	3	-	3	25	75
BPL-405	Pharmaceutical Microbiology	3	-	3	25	75
BPL-405P	Pharmaceutical Microbiology Practical	-	3	3	40	60
	TOTAL	15	9	24	245	555

TABLE – 13: B.PHARM THIRD YEAR – V SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-501	Hospital & Community Pharmacy	3	-	3	25	75
BPL-501P	Hospital & Community Pharmacy Practical	-	3	3	40	60
BPL-502	Unit Operations – II	3	-	3	25	75
BPL-502P	Unit Operations Practical	-	3	3	40	60
BPL-503	Biochemistry – II	3	-	3	25	75
BPL-503P	Biochemistry Practical	-	3	3	40	60
BPL-504	Pharmacology – I	3	-	3	25	75
BPL-505	Pharmaceutical Biotechnology	3	-	3	25	75
	TOTAL	15	9	24	245	555

TABLE – 14: B.PHARM THIRD YEAR – VI SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-601	Pharmaceutical Dosage Forms – I	3	-	3	25	75
BPL-601P	Pharmaceutical Dosage Forms – I Practical	-	4	4	40	60
BPL-602	Medicinal Chemistry – I	3	-	3	25	75
BPL-602P	Medicinal Chemistry – I Practical	-	3	3	40	60
BPL-603	Pharmaceutical Management	3	-	3	25	75
BPL-604	Pharmacology – II	3	-	3	25	75
BPL-604P	Pharmacology Practical	-	3	3	40	60
BPL-605	Pharmacognosy – III	3	-	3	25	75
BPL-605P	Pharmacognosy – III Practical	-	3	3	40	60
	TOTAL	15	13	28	285	615

TABLE – 15: B.PHARM FOURTH YEAR – VII SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-701	Pharmaceutical Dosage Forms – II	3	-	3	25	75
BPL-701P	Pharmaceutical Dosage Forms – II Practical	-	4	4	40	60
BPL-702	Biopharmaceutics & Pharmacokinetics	3	-	3	25	75
BPL-702P	Biopharmaceutics & Pharmacokinetics Practical	-	3	3	40	60
BPL-703	Medicinal Chemistry – II	3	-	3	25	75
BPL-703P	Medicinal Chemistry – II Practical	-	3	3	40	60
BPL-704	Pharmaceutical Jurisprudence	3	-	3	25	75
BPL-705	Pharmacognosy – IV	3	-	3	25	75
BPL-705P	Pharmacognosy – IV Practical	-	3	3	40	60
	TOTAL	15	13	28	285	615

TABLE – 16: B.PHARM FOURTH YEAR – VIII SEMESTER

CODE	COURSE / SUBJECT TITLE	PERIODS / WEEK		CREDITS	MARKS	
		L	P		MID SEM	END SEM
BPL-801	Modern Drug Delivery Systems	3	-	3	25	75
BPL-801P	Modern Drug Delivery Systems Practical	-	4	4	40	60
BPL-802	Pharmaceutical Analysis – III	3	-	3	25	75
BPL-802P	Pharm. Analysis – III Practical	-	4	4	40	60
BPL-803	Medicinal Chemistry – III	3	-	3	25	75
BPL-804	Pharmacology – III	3	-	3	25	75
BPL-805	Elective Course	3	-	3	25	75
BPL-806T	Project Work	-	6	6	40	60
	TOTAL	15	14	29	245	555

TABLE – 17: List of Elective Courses (Eighth Semester):

BPL-805a	Pharmaceutical Packaging
BPL-805b	Pharmaceutical Marketing
BPL-805c	Pharmaceutical Regulatory Affairs
BPL-805d	Clinical Research

A student may choose any one the above subjects.

Each subject is divided into five units with 3-hours/week duration.

Electives will be offered depending upon the availability of expertise.

B. PHARM Degree Programme (LATERAL ENTRY)

TABLE – 18: SUMMARY OF CREDITS & MARKS FOR EACH SEMESTER

S.No.	YEAR / SEMESTER	PERIODS / WEEK		CREDITS	TOTAL MARKS
		L	P		
1.	III Semester	15	9	24	800
2.	IV Semester	15	9	24	800
3.	V Semester	15	9	24	800
4.	VI Semester	15	13	28	900
5.	VII Semester	15	13	28	900
6.	VIII Semester	15	14	29	800
	TOTAL			157	5000

TABLE – 19: Equivalence Table for B.Pharm. Lateral Entry Courses:

BPL-301 = BPL-301	BPL-501 = BPH-501	BPL-701 = BPH-701
BPL-302 = BPH-302	BPL-501P = BPH-501P	BPL-701P = BPH-701P
BPL-302P = BPH-302P	BPL-502 = BPH-502	BPL-702 = BPH-702
BPL-303 = BPH-303	BPL-502P = BPH-502P	BPL-702P = BPH-702P
BPL-303P = BPH-303P	BPL-503 = BPH-503	BPL-703 = BPH-703
BPL-304 = BPH-304	BPL-503P = BPH-503P	BPL-703P = BPH-703P
BPL-305 = BPH-305	BPL-504 = BPH-504	BPL-704 = BPH-704
BPL-306P = BPH-306P	BPL-505 = BPH-505	BPL-705 = BPH-705
		BPL-705P = BPH-705P
BPL-401 = BPH-401	BPL-601 = BPH-601	BPL-801 = BPH-801
BPL-401P = BPH-401P	BPL-601P = BPH-601P	BPL-801P = BPH-801P
BPL-402 = BPH-402	BPL-602 = BPH-602	BPL-802 = BPH-802
BPL-403 = BPH-403	BPL-602P = BPH-602P	BPL-802P = BPH-802P
BPL-403P = BPH-403P	BPL-603 = BPH-603	BPL-803 = BPH-803
BPL-404 = BPH-404	BPL-604 = BPH-604	BPL-804 = BPH-804
BPL-405 = BPH-405	BPL-604P = BPH-604P	BPL-805 = BPH-805
BPL-405P = BPH-405P	BPL-605 = BPH-605	BPL-806T = BPH-806T
	BPL-605P = BPH-605P	



B. Pharm. I Semester



BPH-101

INTRODUCTORY PHARMACY - THEORY

35 Hrs

UNIT – 1: Historical Background

A. History of Pharmacy - Ancient and medieval India and its contemporary systems in other parts of the world. Brief survey of different systems of Medicine. Introduction to profession of pharmacy and important historical events which led to the development of this profession from middle ages to the current era.

UNIT – 2: Introduction to Pharmacy

A. Definition of pharmacy. Pharmaceutical sciences and their scope. Major areas of pharmaceutical sciences – Pharmaceutics, Pharmacology, Pharmaceutical Chemistry, Pharmacognosy and Pharmaceutical Jurisprudence.

B. Definition of drug and medicine. Types of medicines: Prescription and Over the counter (OTC).

UNIT – 3: Pharmacopoeias & Compendia

A. Definition of a Pharmacopoeia. Indian Pharmacopoeia, The United States Pharmacopeia and the National Formulary (USP/NF): History, frequency of publication and the current edition. The British Pharmacopoeia (BP).

UNIT – 4: Introduction to Drug Dosage forms

A. Need for dosage forms, routes of drug administration (only definitions). Introduction to solutions – Purified water IP, Syrup IP, Elixir, Aromatic water and Spirits.

B. Containers for packaging pharmaceuticals – Well closed, Tightly closed and Hermetic containers.

UNIT – 5: Prescriptions, Dispensing and Measurements

A. Dispensing the medicines. The Prescription: definition, parts of an ideal prescription, handling of prescription, Categories of prescription orders. Commonly used abbreviations (including Latin terms) in prescriptions.

B. Important Latin terms used in the prescriptions and their translation in to English. Calculation of children and infant doses formulae.

C. Metric and imperial systems measures. Grains, minim, Drachm, ounce, pound gallon and their metric equivalents.

TEXT BOOKS

1. Allen Jr. LV, Popovich NG, Ansel HC.; *Ansel's pharmaceutical dosage forms and drug delivery systems*; 2010; 9th edition; Lippincott Williams, Philadelphia; ISBN:9788184733914

2. Allen Jr. LV.; *Remington: The science and practice of pharmacy*; 2010; 22nd edition. Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626

REFERENCE BOOKS

1. Sharma, SN, Jain, NK.; *A Textbook of Professional Pharmacy*; 2011; 5th edition; Vallabh

Prakashan; ISBN:9788185731100

2. Winfield, AJ, Rees, JA, Smith, I.; *Pharmaceutical Practice*; 2009; 4th edition; Churchill Livingstone Elsevier; ISBN:9780443069093

3. Singh H. *History of pharmacy in India and related aspects. Volume 1*; 1998; 1st edition; VallabhPrakashan, Delhi; ISBN:9788185731308

4. Rowling, EA; *Bentleys Textbook of Pharmaceutics*; 2010; 8th edition; Elsevier; ISBN:9788131224816

5. Ansel HC.; *Pharmaceutical calculations*; 2010; 14th edition, Lippincott Williams & Wilkins, Philadelphia; ISBN:1451120362



BPH-102

**PHARMACEUTICAL CHEMISTRY-I
THEORY**

35 Hrs

UNIT – 1: Thermodynamics I

A. Scope & Limitations of thermodynamics, terms & basic concepts: system, boundary, surroundings, isolated, closed, open, adiabatic systems, intensive & extensive properties, state of a system, equilibrium & non equilibrium states, thermodynamic processes, reversible & irreversible process, heat & temperature, heat & work and their sign conventions, pressure – volume work, maximum work in reversible process, internal energy.

B. First law of thermodynamics, enthalpy. Thermochemistry: exothermic & endothermic processes, definitions: heat of reaction, formation, combustion, solution, neutralisation, vapourisation, fusion, sublimation, transition. Hess law of constant heat summation. Bond energy & bomb calorimeter.

UNIT – 2: Thermodynamics II & Chemical equilibrium

A. Second law of thermodynamics - definition(s), Entropy, Equations, Absolute Entropy, Gibb's free energy. Relation between Free energy & equilibrium constant. Third law of thermodynamics. Applications.

B. Chemical equilibrium: Law of mass action, equilibrium constant, Homogeneous & heterogeneous equilibrium, Le chatelier's principle, effect of change in concentration, applications.

UNIT – 3: Chemical kinetics

A. Chemical kinetics: scope & factors affecting kinetics, units of rate & rate constant, Order of reaction and its determination, pseudo I order reaction, Zero order reaction.

B. Integrated rate laws I, II, III order reactions. Transition state theory. Applications including reaction mechanism and shelf life of formulation.

UNIT – 4: Ionic Equilibrium

A. Ionic Equilibrium: Definition of Acids & Bases [Arrhenius, Lowry – Bronsted, Lewis], definition of Strong & weak electrolytes, Salt hydrolysis: definition & types of salts and their hydrolysis [no derivation only final equation], pH calculations: acids & bases [strong & weak], salts.

B. Buffers: Definition, buffer capacity, Henderson-Hasselbach equation, Common ion effect, Calculations. Applications of buffers in Pharmacy.

UNIT – 5: Neutralisation titrations & Basic analytical concepts.

A. Volumetric analysis: Definition of Mole, Equivalent, Molarity, Normality, Equivalent of Acids, Bases, Oxidizing & Reducing agents, Stoichiometry, Primary, secondary standards. Calculations involving the preparation, dilutions, assay & standardisation of volumetric (Molar, Normal) solutions. Conversion from Molarity to Normality & vice versa.

B. Neutralisation Titrations: Theory of neutralisation indicators, neutralisation curves, Selection of indicators based on neutralisation curves: neutralisation of strong base with strong acid, weak acid; neutralisation of strong acid with weak base. Standardisation involving primary standard substances: Oxalic acid, Anhydrous Sodium carbonate.

TEXT BOOKS

1. Arun Bahl, Tuli, GD.; *Essential of Physical Chemistry*; S Chand & Co Ltd; 2010; ISBN:9788121929783

2. Beckett, AH, Stenlake, JB.; *Practical Pharmaceutical Chemistry: Part I & II*, 2001; 4th edition; CBS; ISBN:9780485113235

REFERENCE BOOKS

1. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch, *Fundamentals Of Analytical Chemistry*; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286

2. Patrick J. Sinko; *Martin's Physical Pharmacy and Pharmaceutical Sciences*; 2010; 6th edition; Lippincott Williams & Wilkins; ISBN:9780781797665



BPH-103

ORGANIC CHEMISTRY - I- THEORY

35 Hrs

UNIT – 1: Organic Chemistry Principles:

A. Structure: Classification and sources of organic compounds; Structural theory, chemical bond, Atomic orbitals, electronic configuration, molecular orbitals, Hybridisation (sp^3 , sp^2 , sp) of carbon, nitrogen and oxygen atom, bond lengths, bond angles, bond energy,

B. Electronic effects: Inductive effect, resonance effect and hyperconjugation), polarity of bonds, polarity of molecules, dipole moments, acidity, basicity (different theories)

C. Charged Species: Generation - homolytic and heterolytic bond fission; ease of formation and order of stabilities of electron deficient and electron rich species along with reasons.

D. Electron flow: Different types of arrows and how to use them.

UNIT – 2: Alkanes and Cycloalkanes

A. Alkanes: Nomenclature, Structure, Classification of carbon atoms of alkanes, isomerism in alkanes, methods of preparation, physical properties and chemical reactions, mechanism of free radical halogenation of alkanes, orientation, reactivity and selectivity, chlorofluorohydrocarbons

and ozone layer.

B. Cycloalkanes: Nomenclature, Methods of preparation, chemical reactions, Baeyer's strain theory, ring strain, isomerism in cyclopentane and cyclohexane, reactions of carbene, cyclic ethers, crown ethers, and epoxides.

UNIT – 3: Alkyl Halides

Alkyl Halides: Nomenclature and classes of alkyl halides, methods of preparation and reactions, mechanism of nucleophilic substitution reactions (S_N1 & S_N2); carbonium ions, structure, relative stability, ease of formation, rearrangements

UNIT – 4: Alkenes

Alkenes: Nomenclature, structure, methods of preparation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, $E1$ and $E2$ reaction mechanisms, physical properties, relative stabilities of alkenes, chemical reactions, electrophilic and free radical additions, Markovnikov's rule, peroxide effect, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$. Substitution at allylic and vinylic positions, theory of resonance and conjugation, free radical polymerization of alkenes

UNIT – 5: Dienes and Alkynes

A. Dienes: Nomenclature, structures of isolated conjugated and cumulated dienes, 1,2- and 1,4-addition reactions, free radical polymerization of dienes.

B. Alkynes: Nomenclature, structure and bonding in alkyne, method of preparation, chemical reactions, acidity and electrophilic addition reactions

TEXT BOOKS

1. Morrison RT., Boyd RN.; *Organic Chemistry*; Pearson Publishers; 7th edition; 2011; ISBN:8131704815.

2. Graham Solomons, TW., Craig. B. Fryhle; *Solomons and fryhle organic chemistry*; John Wiley & Sons; 8th edition; 2004; ISBN:9812530592.

REFERENCE BOOKS

1. Finar, IL.; *Organic Chemistry Vol 1 – The fundamental principles*; Longman scientific and technical; 6th edition; 1995; ISBN: 0582277728.

2. Finar, IL.; *Organic Chemistry Vol 2 – Stereochemistry and the chemistry of natural products*; Addison Wesley longman limited; 5th edition; 1996; ISBN: 0582305594.

3. Jerry March; *Advanced Organic Chemistry-Reactions, Mechanisms and structure*; John Wiley & Sons; 4th edition; 2005; ISBN: 9971512572.



BPH-104

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-I THEORY

35 Hrs

UNIT – 1: Cells & Tissues

A. Scope of Anatomy and Physiology and basic terminology used in these subjects.

B. Structure of cell, its components and their functions.

C. Elementary Tissues of the Human Body: Epithelial, connective, muscular and nervous tissues, their sub-types and their characteristics.

UNIT – 2: Bones & Muscles

D. Osseous System : Structure, composition and functions of skeleton, Classification of joints, types of movements of joints and disorders of joints.

E. Skeletal Muscles : Gross anatomy; physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

UNIT – 3: Blood & Lymph

A. Haemopoietic System : Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.

B. Lymph and Lymphatic System : Composition, formation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

UNIT – 4: Cardiovascular System

C. Cardiovascular System: Basic anatomy of the heart, Physiology of heart, blood vessels and circulation. Basic understanding of Cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

UNIT – 5: Digestive & Respiratory System

A. Digestive System: Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas, gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. Disorders of digestive system.

B. Respiratory System: Anatomy of respiratory organs and functions, respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity.

TEXT BOOKS

1. Rohini Agrawal, Neeraj Agrawal; *Anatomy, Physiology And Health Education*; 2012; Elsevier Health Sciences, New Delhi; ISBN:9788131231005

2. Ramesh K Goyal; *Elements Of Human Anatomy Physiology & Health Education*; 2013; ISBN:9788184160079

REFERENCE BOOKS

1. Chatterjee CC; *Human Physiology*; 2003; Medical Allied Agency, Calcutta; ISBN: 9780001600006

2. Jain, NK.; *Health Education And Community Pharmacy A Comprehensive Textbook For Diploma And Degree Students In Pharmacy* ; 2010; 1st edition; CBS Publishers; ISBN:9788123904221

3. John E. Hall; *Guyton and Hall Textbook of Medical Physiology*; 2011; Saunders Elsevier; ISBN: 9788131227039

4. Keele C A, Neil E and Joels N, *Sampson Wright's Applied Physiology*; 1982; 13th edition; Oxford University Press; ISBN: 978-0192632104



BPH-105 PHARMACOGNOSY – I - THEORY

35 Hrs

UNIT – 1: Introduction, Sources and Classification of Drugs

- A. An introduction and scope, impact of natural products in medicine and pharmaceutical industry.
- B. Natural sources of drugs and pharmaceuticals: Biological sources, Biotechnological sources and Mineral sources.
- C. Systems of classification of natural drugs-Alphabetical, Morphological, Taxonomical, chemical and pharmacological.

UNIT – 2: Plant Drug description terminology

- A. General study of cell wall types, tissue systems, ergastic cell contents. Morphology and Anatomy in description of Plant drugs and associated terminology with illustrations.
- B. Framework of description of Plant drugs belonging to various morphological groups such as bark, leaf, flower, fruit, seed, stem, root and rhizome

UNIT – 3: Carbohydrate Drugs

- B. CARBOHYDRATES: – Introduction, structure and nomenclature of monosaccharides, polysaccharides. General chemical tests for Carbohydrates, Introduction to gums, their types, characters and chemical nature.
- C. Study of MONOGRAPH*: Acacia, Tragacanth, Sterculia gum, Guar gum, Agar, Alginate, Starch, Honey and Ispagol

UNIT – 4: Terpenoids

- C. TERPENOIDS: Introduction, Isoprene rule, classification, general chemistry, Composition of volatile oil.
- D. Study of MONOGRAPH*: Cinnamon, Cassia bark, Clove, Eucalyptus, Coriander, Dill, Cardamom, Fennel; Lemon oil, Peppermint oil, Turpentine oil, Lemon grass oil, and Sandal wood oil.

UNIT – 5: Lipids and Tannins

- A. LIPIDS: Introduction, classification, general chemistry and general outline of extraction methods. Study of MONOGRAPH* of Olive oil, Castor oil, Cod-liver oil, Shark-liver oil, Beeswax, Wool fat.
- B. TANNINS: Definition, Classification, general chemistry, properties, General identification tests. Study of MONOGRAPH* of Gambier, Black catechu, Tannic acid and Myrobalan.
- C. Study of Protein Materials such as Gelatin and Papain.

*NOTE: MONOGRAPH includes Definition, Sensory, Morphological, Micro-morphological (wherever applicable); Significant chemical constituents; Pharmacological activity (if any); Uses;

Identification tests (if any); Adulterant/ Substituent (if any).

TEXT BOOKS

1. Williams Charles Evans, Trease and Evans; Pharmacognosy; 16th edition; 2009; Elsevier, London; ISBN: 978-0-7020-2934-9
2. Biren Shah and A.K. Seth; Textbook of Pharmacognosy & Phytochemistry; 1st edition; 2010; Elsevier, New Delhi; ISBN: 978-81-312-2298-0

REFERENCE BOOKS

1. Kokate, CK., Purohit, AP. And Gokhale, SB.; Pharmacognosy; 2010; 46th edition; Nirali Prakashan, Pune; ISBN:978-81-96396-15-2
2. Wallis, TE.; Textbook of Pharmacognosy; 2005; 5th edition; CBS Publishers, New Delhi; ISBN:979-81-23908-86-0
3. Ansari,SH.; Essentials of Pharmacognosy; 2008; 1st edition; Birla Publications, Delhi; ISBN:9788186270288
4. MohmadAli; Pharmacognosy Volume 1; 2011; CBS Publishers and Distributors, New Delhi; ISBN:9788123914381
5. Qadry, JS.; Pharmacognosy; 2010; 16th edition; CBS Publishers and Distributors, New Delhi; ISBN: 978-81-239-1917-1



BPH-105P

PHARMACOGNOSY – I PRACTICAL

35 Hrs

Ex.No-01: Explore some Plant drugs derived from various morphological parts. Morphological description of some Leaves.

Tasks/Skills: Learn terminology involved in describing the plant drug morphology of Leaves. Illustrate the features by necessary diagrams.

Ex.No-02: Explore the Microscope and its usage; Study of important diagnostic tissues; tissue systems.

Tasks/Skills: Simple Compound microscope; Tissues (parenchyma; collenchymas; palisade; sclereids etc.) Tissue systems (trichome; fibre; xylem; phloem; secretory tissues; cork etc.)

Ex.No-03: Learn and Practice the preparation of transverse sections of Bark/ Leaf/ Stem or Root and study them for presence simple tissues.

Tasks/Skills: Learn the technique of section cutting, staining and mounting for studying the micro-morphology of plant drugs.

Ex.No-04: Study of Carbohydrate drugs: Acacia, Tragacanth and Guar gum.

Tasks/Skills: Perform General Chemical tests for carbohydrates and some specific tests for the respective natural gums

Ex.No-05: Study of Carbohydrate drugs: Starch and Honey

Tasks/Skills: Perform Chemical and solubility tests for Starch and Honey including the honey

adulterants.

Ex.No-06: Study of Marine derived carbohydrate materials Agar and Alginates and Animal derived protein material Gelatin.

Tasks/Skills: *Perform Chemical and solubility tests for Agar, Alginates and Gelatin*

Ex.No-07: Study of Volatile oil Drugs: Cinnamon; Fennel;

Tasks/Skills: *Morphological and Microscopical characters of Cinnamon, Fennel. Prepare transverse sections and stain them.*

Ex.No-08: Study of Volatile oil Drugs: Dill; Coriander; Cardamom

Tasks/Skills: *Morphological and Microscopical characters of Dill, Coriander and only Morphological characters of Cardamom*

Ex.No-09: Study of Volatile oil Drugs: Clove; Eucalyptus

Tasks/Skills: *Morphological and Microscopical characters of Clove, Eucalyptus. Prepare transverse sections and stain them*

Ex.No-10: Study of Various Fixed oils: Castor Oil; Olive oil; Cod-liver oil; Sesame oil and Volatile Oils: Turpentine oil; Peppermint oil; Lemon oil

Tasks/Skills: *Compare properties of Fixed and Volatile oils, Simple tests, Solubility; Observing the sensory characters etc.*

Ex.No-11: Study of Tannin Containing drugs: Gambir; Black Catechu; Myrobalan

Tasks/Skills: *Sensory and Morphological characters; General chemical tests for tannins; Applicable specific tests.*

Ex.No-12: Analysis of Powdered drugs: Cinnamom and Cassia.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-13: Analysis of Powdered drugs: Clove; Fennel; Coriander.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-14: Analysis of Unknown Sample of Powdered drug(s).

Tasks/Skills: *Identify the given sample of powdered drug(s) on the basis of systematic sensory, microscopical and chemical tests.*

Ex.No-15: Analysis of Unknown Sample of Powdered drug(s).

Tasks/Skills: *Identify the given sample of powdered drug(s) on the basis of systematic sensory, microscopical and chemical tests.*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the full first year B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Williams Charles Evans, Trease and Evans Pharmacognosy; 16th edition; 2009; Elsevier, London; ISBN: 9780702029349
2. Jackson, BP., Snowdown, DW., Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices; 2005; CBS Publishers, New Delhi; ISBN: 9788123900254
3. Herbal Drug Microscopy; 2003; 1st edition; Yucca Publishing House, Dombivli, Maharashtra;
4. Kokate, CK., Purohit, AP. And Gokhale, SB., Pharmacognosy; 46th edition; 2010; Nirali Prakashan, Pune; ISBN:9788196396152
5. Wallis, TE., Textbook of Pharmacognosy; 5th edition; 2005; CBS Publishers; New Delhi; ISBN: 9798123908860
6. Wallis, TE., Practical Pharmacognosy; 4th edition; 2011; PharmaMed Press; Hyderabad, India; ISBN: 9789381075029



BPH-106 REMEDIAL MATHEMATICS- THEORY 35 Hrs

UNIT – 1: Arithmetic and Algebra

A. Fraction, exponents, power and roots, ratio, proportions and logarithms. Simple Simultaneous linear and quadratic equations.

B. Matrices, definition of special kinds of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, pharmaceutical applications of determinants and matrices.

UNIT – 2: Analytical Plane Geometry

Certain co-ordinates, distance between two points, area of triangle, a locus of point, straight line, slope and intercept form, double-intercept form, normal (perpendicular form), slope-point and two point form, general equation of first degree.

UNIT – 3: Basic Statistics

A. Measures of Central Value: Objectives and pre-requisites of an ideal, measure, mean, mode and median. Range, average deviation, standard deviation.

B. Permutation, Combination, AP GP, Binomial theorem

UNIT – 4: Trigonometry

Angles, degree measure, radian measure, angle relationships, definitions of trigonometric functions, Graphs of the trigonometric functions, reference angles. Trigonometric Identities: the fundamental identities, trigonometric addition formulas.

UNIT – 5: Calculus

A. Differential: Limits and functions, definition of differential coefficient, differentiation of standard functions, Chain rule.

B. Integral: Integration as inverse of differentiation, indefinite integrals of standard forms,

integration by parts, substitution and partial fractions.

TEXT BOOKS

1. Priya Ranjan Dash and Gopabandhu Mishra, *Mathematics and Statistics for Biology, 1st edition, 2011, Vrinda Publications (P) Ltd., Delhi.*
2. Narayanan, S and Manicavachaga Pillay, T.K., *Calculus Vol III, 2009, Viswanathan Printers and Publishers Pvt. Ltd., Chennai.*

REFERENCE BOOKS

1. Gupta S.C., and Kapur, V.K., *Fundament of Mathematical Statistics, 2009, S. Chand and Sons, New Delhi.*
2. Kapoor, J.N., and Singhal, M.K., *An Introduction of Matirces, 1977, R. Chand and Co.*
3. Mathur, K., *Statistical Analysis in Biology, 1972, Chapman and Hall Ltd., London.*
4. Manicavachagam Pillay, T.K., *Analytical Geometry, 1983, Viswanathan Printers and Publishers Pvt. Ltd., Chennai*



BPH-107

REMEDIAL BIOLOGY- THEORY

35 Hrs

UNIT – 1: Plant Cytology

Plant cell and structure; Mitosis & meiosis; Different types of plant tissues, tissue systems & their functions.

UNIT – 2: Morphology & Histology

Morphology & Histology of different parts of the plant such as root, stem, bark, leaf, flower, fruit, and seed. Broad classification of plants.

UNIT – 3: Animal Cell

Structure of animal cell, its components and their functions, Structure of Cell membrane; Mechanism of Transport through the Cell membrane.

UNIT – 4: Vectors of Disease

General Structure and life history of insects like mosquito, housefly, mites, Tse-Tse fly.

UNIT – 5: Parasites

General Survey of Animal Kingdom; Structure and life history of parasites as illustrated by Amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma.

TEXT BOOKS

1. Dutta, AC; *A Class-book of Botany; 7th edition; 2000; Oxford University Press, New Delhi; ISBN: 978-0195653076*
 2. Perker, T.J., William, AH; *A textbook of Zoology, Vol-I & Vol-II; Macmillan & Co., London; ISBN:*
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Ex.No-01: Study of Microscope, its parts and uses.

Ex.No-02: Morphological study of Different type of Leaves, Attachment and Shapes.

Ex.No-03: Morphological study of Different type of Leaf margins, Apex, Base, Venation and texture.

Ex.No-04: Study of Different types of Branching and Inflorescence

Ex.No-05: Study of some simple Flowers and their parts.

Ex.No-06: Study different type of Fruits

Ex.No-07: Taxonomical study of a plant from Apocynaceae (Vinca)

Ex.No-08: Taxonomical study of a plant from Solanaceae (Datura spp)

Ex.No-09: Taxonomical study of a plant from Asteraceae (Tridax spp)

Ex.No-10: Study of Microscopical Characters (TS) of a Stem

Ex.No-11: Study of Microscopical Characters (TS) of a Root

Ex.No-12: Study of Microscopical Characters (TS) of a Leaf

Ex.No-13: Study of Morphology of House fly with specimen/ chart.

Ex.No-14: Study of Morphology of Mosquito with specimen/ chart.

Ex.No-15: Study of Plasmodium and its life cycle with chart.

Ex.No-16: Study of Tape worm and its life cycle with chart.

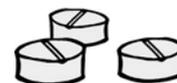
Note: *Though 16 are listed, minimum of 12 Practical Exercises need to be completed during the first semester B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Dutta, AC; *A Class-book of Botany; 7th edition; 2000; Oxford University Press, New Delhi; ISBN: 978-0195653076*

2. Bendre, BM., Kumar, A.; *A Textbook of Practical Botany Vol 2; 2009; Rastogi Publications, Meerut, India; ISBN: 978-81-7133-877-1*





UNIT – 1: Natural Resources

A. Definition, scope and importance of Environmental Science. Need for public awareness.

Renewable and Non-Renewable Resources:

B. Forest resources: Use and over exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people

C. Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems.

D. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies

E. Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

F. Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies,

G. Land resources: Land as a resource, land degradation, man induced Landslides, soil erosion and desertification, .

H. Natural Resources and associated problems; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT – 2: Ecosystem and Biodiversity

A. Concept of ecosystem, Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction - Types, characteristics features, structures and function of the Forest, Grassland, Desert, Aquatic ecosystem.

B. Biodiversity and its Conservation: Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of Biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to Biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of Biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – 3: Environmental Pollution

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear-hazards, Solid waste management. Role of individual in prevention of pollution. Pollution case studies. Disaster management floods, earthquake, cyclone and landslides.

UNIT – 4: Social Issues and the Environment

From unsustainable to Sustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environmental production Act. Air (prevention and control of pollution) Act. Water (prevention and control of pollution) Act. Wild life protection Act, forest conservation Act. Issues involved

in enforcement legislation. Public awareness.

UNIT – 5: Human Population and Environment + Field Work

A. Human Population and Environment: Population growth, variation among nations, population explosion-family welfare programme. Environment and human health. Human rights, Value education. HIV/ AIDS. Women and child welfare. Role of information Technology in environment and human health. Case studies.

B. Field Work: Visit to local area to document environmental assets-river / forest / grassland / hill / mountain. Visit to local polluted site-Urban / Rural / Industrial / Agricultural area. Study of common plants, insects, birds Study of simple ecosystems-pond, river, hill slopes, etc., (Field work equal to 4 Lecturer hours. Assignments may be given based on this work)

TEXT BOOK

1. Environmental Studies, prepared by Periyar E.V.R. College (Autonomous), Trichy



BPH-202

PHARMACEUTICAL CHEMISTRY- II THEORY

40 Hrs

UNIT – 1: Red-Ox titrations & Precipitation titrations

A. Red-Ox Titrations: Relative strength of oxidizing agents and reducing agents through electro chemical series. Nernst equation. Standardisation reactions involving potassium permanganate, potassium dichromate, Ferric ammonium sulphate, sodium thiosulphate, Potassium iodate and potassium bromate. Redox Indicators.

B. Precipitation titrations: Argentometric titrations, solubility product, titration curves. Volhard's method, Mohr's method, Fajan's methods.

UNIT – 2: Pharmacopoeia

A. Parts of a Pharmacopoeial monograph. Classification of Inorganic medicinal compounds according to their use. Source of impurities in pharmaceutical compounds and their control.

B. Limit test for Chloride, Sulphate, Iron, Heavy metals, Lead and Arsenic.

UNIT – 3: Pharmacopoeia & Pharmaceutically important inorganic compounds - I

A. The preparation, assay, and use of the following compounds: Ammonium Chloride, Aluminium Sulphate, Boric Acid, Calcium Gluconate, Hydrogen Peroxide, Iodine, Magnesium Trisilicate, Magnesium Hydroxide, Potassium Iodide, Potassium Permanganate,

B. Study of the following tests: Copper and Silver in Bismuth Sub carbonate, Mono calcium and tri calcium phosphate in Dibasic Calcium Phosphate, Neutralizing capacity of Aluminum Hydroxide Gel.

UNIT – 4: Pharmacopoeia & Pharmaceutically important Inorganic compounds - II

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- A.** The preparation, assay, and use of the following compounds: Silver Nitrate, Sodium Bicarbonate, Sodium Chloride, Compound Sodium Chloride Injection, Sodium Metabisulphite, Sodium Nitrite, Sodium Thiosulphate, Zinc Sulphate.
- B.** Study of the following tests: Sodium dihydrogen phosphate in Sodium Phosphate, Potassium and Aluminum in Sodium Chloride, Aluminum in Adsorbed Vaccines.
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UNIT – 5: Pharmaceutically important Inorganic compounds - II

- A.** Water for Pharmaceutical use, tests for purity of Purified Water.
- B.** Tests for purity, assay and use of: Oxygen, Nitrous Oxide
- C.** Physiological role of essential trace elements
- D.** Inorganic Pharmaceutical excipients.
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TEXT BOOKS

1. *Indian Pharmacopoeia; 2007; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343640.*
2. *Beckett, AH, Stenlake, JB.; Practical Pharmaceutical Chemistry: Part I & II, 2001; 4th edition; CBS; ISBN:9780485113235*
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REFERENCE BOOKS

1. *John H Block, Edward B. Roche, Tait O. Saine and Charles O. Wilson; Inorganic Medicinal and Pharmaceutical chemistry; 1986, Varghese Publishing House; ISBN: 9780812104431*
2. *Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK.; Vogel's Quantitative Chemical Analysis; 2000; 6th edition; Prentice Hall; ISBN:978-0582226289*
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BPH-202P

**PHARMACEUTICAL CHEMISTRY
PRACTICALS**

40 Hrs

NOTE: Reagents used in Analysis Experiments should have **MOLARITY** Units by default as adopted in Pharmacopoeias unless otherwise specified.

Ex.No-01: Introduction to Chemical Laboratory, Safety, Laboratory Equipment and Apparatus, Cleanliness

Tasks/Skills: *Balance: Analytical balance; Electronic Balance; Bunsen burner; Spatulas; Thermometer; Graduated Cylinder; Test tubes; Test tube holder & rack; Pipette; Volumetric flasks; Burette ; Beaker; Conical flask; Funnel; Burette holder; Water bath; Ice bath ; Electrical Hotplate; Heating Mantle; Cleaning Laboratory Apparatus*

Ex.No-02: Basic Operations in Chemical Laboratory: Mass Measuring and Transfer Techniques; Heating techniques; Temperature measurement.

Tasks/Skills: *Transferring solids and liquids; weighing; Volume measurement of Liquids and the use of appropriate apparatus; Bunsen Burner usage; Direct heating (test tube) in a flame, Heating in a Water bath; Measuring Temperature;*

Ex.No-03: Measurements and Metric System, Basic Units and their conversions

Tasks/Skills: *Measurement of mass, volume and length; scaling prefixes such as deca, hecto, kilo, mega, giga, tera; deci, centi, milli, micro, nano, pico etc.*

Ex.No-04: Standardization of hydrochloric acid with primary standard substance sodium carbonate.

Tasks/Skills: *Preparation of primary standard, Titration, Learning Endpoint, Normality Calculations*

Ex.No-05: Assay of Sodium bicarbonate using the standardized Hydrochloric acid.

Tasks/Skills: *Assay concept, Standardize the Hydrochloric acid, Estimate the Sodium bicarbonate in the given sample.*

Ex.No-06: Standardization of sodium hydroxide using primary standard Oxalic acid or Potassium hydrogen phthalate.

Tasks/Skills: *Standardization of secondary alkali using primary standard acid*

Ex.No-07: Assay of Boric acid.

Tasks/Skills: *Estimate the Boric acid in the given sample*

Ex.No-08: Assay of sodium hydroxide with Sodium carbonate impurity using standard Hydrochloric acid.

Tasks/Skills: *Estimate the Sodium hydroxide in the presence of interfering Sodium carbonate impurity.*

Ex.No-09: Assay of Ammonium chloride by back titration using Formaldehyde.

Tasks/Skills: *Concepts of back titration and estimate Ammonium chloride.*

Ex.No-10: Standardization of Potassium permanganate using primary standard Oxalic acid.

Ex.No-11: Assay of Hydrogen peroxide using standardized Potassium permanganate.

Ex.No-12: Assay of Ferrous Sulphate

Ex.No-13: Standardization of Sodium thiosulphate

Ex.No-14: Assay of Iodine solution.

Ex.No-15: Standardization of Silver nitrate with Sodium chloride.

Ex.No-16: Assay of ammonium chloride with Silver nitrate (Mohr's method).

Ex.No-17: Limit test of Chlorides & Sulphates

Ex.No-18: Limit tests for Iron.

Ex.No-19: Determining pK value of a Monocarboxylic acid.

Ex.No-20: Preparing Buffer & determining its capacity.

Ex.No-21: Kinetics exercise involving determination of order of reaction.

Note: *Though about 21 are listed, minimum of 12 Practical Exercises need to be completed during the full first year B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. *Indian Pharmacopoeia; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695*

2. *Beckett, AH, Stenlake, JB.; Practical Pharmaceutical Chemistry: Part I & II, 2001; 4th edition; CBS; ISBN:9780485113235*

3. *Douglas A. Skoog, F. James Holler, Stanley R. Crouch; Principles of Instrumental Analysis; 2006; 6th edition; Brooks Cole; ISBN:978-0495012016*

4. *Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; Fundamentals Of Analytical Chemistry; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286*

5. *Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK.; Vogel's Quantitative Chemical Analysis; 2000; 6th edition; Prentice Hall; ISBN:978-0582226289*

6. *Donald I Pavia, Garry M Lampman and George S Kris; Introduction to Organic Laboratory Techniques; 1987; 3rd edition; Harcourt School; ISBN:9780030148132*



BPH-203

ORGANIC CHEMISTRY - II- THEORY

40 Hrs

UNIT – 1: Benzene:

Benzene: Nomenclature of benzene and derivatives, structure of benzene, Kekule's structure, stability and length of C-C bond of benzene, resonance structure, aromaticity and Huckel rule. Aromatic electrophilic substitution reactions, Mechanism of nitration, sulfonation, halogenation, Friedel Crafts reaction (alkylation and acylation), activating and deactivation groups, theory of reactivity and orientation.

UNIT – 2: Arenes

Arenes: Nomenclature, methods of preparation and reactions of alkyl benzenes, halogenation of alkyl benzenes (ring vs side chain), stability of benzyl cation, benzylic free radical, and triphenylmethyl free radical, method of preparation and reactions of alkenyl and alkynyl benzenes.

UNIT – 3: Aryl Halides

Aryl Halides: Nomenclature, structure, physical properties and chemical reactions, nucleophilic aromatic substitution reaction, low reactivity of aryl and vinyl halides, reactivity and orientation in nucleophilic substitution, benzyne intermediate.

UNIT – 4: Carbonyl Compounds

Carbonyl Compounds: Nomenclature and preparation of aldehydes and ketones; Friedel-Crafts acylation reaction, oxidation of primary alcohols, oxidation of methyl benzenes and reduction of acid chlorides and using organometallic compounds; Reactions of aldehydes and ketones: oxidation, reduction, addition of Grignard reagent, Cannizzaro reaction.

UNIT – 5: Unsaturated Carbonyl Compounds and Reactions involving Carbanions

A. Unsaturated Carbonyl compounds: Structure and properties, preparation, interaction of functional groups, electrophilic and nucleophilic addition, Michael addition, the Diels-Alder reaction (cycloaddition reaction).

B. Reactions involving Carbanions: Acidity of α -hydrogen, acid catalyzed and base promoted

halogenation of ketones, aldol condensation, reactions related to Aldol condensation - Wittig reaction, Claisen condensation, Malonic ester and acetoacetate synthesis.

TEXT BOOKS

1. Morrison RT., Boyd RN.; *Organic Chemistry*; Pearson Publishers; 7th edition; 2011; ISBN:8131704815.
2. Graham Solomons, TW., Craig. B. Fryhle; *Solomons and fryhle organic chemistry*; John Wiley & Sons; 8th edition; 2004; ISBN:9812530592.

REFERENCE BOOKS

1. Finar, IL.; *Organic Chemistry Vol 1 – The fundamental principles*; Longman scientific and technical; 6th edition; 1995; ISBN: 0582277728.
 2. Finar, IL.; *Organic Chemistry Vol 2 – Stereochemistry and the chemistry of natural products*; Addison Wesley longman limited; 5th edition; 1996; ISBN: 0582305594.
 3. Jerry March; *Advanced Organic Chemistry-Reactions, Mechanisms and structure*; John Wiley & Sons; 4th edition; 2005; ISBN: 9971512572.
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BPH-204

ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION-II THEORY

40 Hrs

UNIT – 1:

A. Central Nervous System: Physiological properties of nerve fibres, functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action electroencephalogram, specialized functions of the brain, Cranial nerves and their functions. Cerebrospinal fluid and Blood brain barrier.

B. Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors).

UNIT – 2:

A. Autonomic Nervous System : Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

B. Urinary System: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid-base balance. Diseases of the urinary system.

UNIT – 3:

B. Reproductive System: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis. Pregnancy, its maintenance and parturition.

C. Endocrine System: Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid. Adrenals, Pancreas, Testes and ovary, their hormones and functions.

UNIT – 4:

A. Concepts of health and disease: Disease causing agents and prevention of diseases.

B. Classification of food requirements: Balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.

C. Demography and family planning, Medical termination of pregnancy.

D. First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

UNIT – 5: Health Education

A. Communicable diseases: Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, whooping cough, tuberculosis, poliomyelitis, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea, and AIDS).

TEXT BOOKS

1. Rohini Agrawal, Neeraj Agrawal; *Anatomy, Physiology And Health Education*; 2012; Elsevier Health Sciences, New Delhi; ISBN:9788131231005

2. Ramesh K Goyal; *Elements Of Human Anatomy Physiology & Health Education*; 2013; ISBN:9788184160079

REFERENCE BOOKS

1. Chatterjee CC; *Human Physiology*; 2003; Medical Allied Agency, Calcutta; ISBN: 9780001600006

2. Jain, NK.; *Health Education And Community Pharmacy A Comprehensive Textbook For Diploma And Degree Students In Pharmacy* ; 2010; 1st edition; CBS Publishers; ISBN:9788123904221

3. John E. Hall; *Guyton and Hall Textbook of Medical Physiology*; 2011; Saunders Elsevier; ISBN: 9788131227039

4. Keele C A, Neil E and Joels N, *Sampson Wright's Applied Physiology*; 1982; 13th edition; Oxford University Press; ISBN:978-0192632104

5. Das, AK.; *Medical Physiology*; 2010; 4th edition; Books and Allied Publishers (P) Ltd., Kolkatta; ISBN: 9788187134589



BPH-204P

**ANATOMY, PHYSIOLOGY AND
HEALTH EDUCATION PRACTICAL**

40 HRS

Ex.No-01: Study of compound Microscope.

Tasks/Skills: *Learn the optics of microscope and focusing*

Ex.No-02: Study of artifacts under microscope. And Study of Red blood Cells.

Tasks/Skills: *To know the structure of common artifacts and improve the skill of focusing. Examine a drop of blood under low and high power.*

Ex.No-03: Estimation of haemoglobin content of one's own blood.

Tasks/Skills: *Learn to use Haemometer*

Ex.No-04: Enumerate the number of Erythrocytes present in one cubic mm of one's own blood

Tasks/Skills: *Learn to use Haemocytometer and relevant Calculations*

Ex.No-05: Enumerate the number of Leucocytes present in one cubic mm of one's own blood

Tasks/Skills: *Learn to use Haemocytometer and relevant Calculations*

Ex.No-06: Find out the differential leucocyte count in your blood

Tasks/Skills: *Blood smear Preparation; Staining techniques of WBC.*

Ex.No-07: Find out your blood group.

Tasks/Skills: *Learn the use of antiserum in blood group determination*

Ex.No-08: Determination of the erythrocyte sedimentation rate.

Tasks/Skills: *Learn to use the ESR apparatus.*

Ex.No-09: Determine arterial blood pressure of the given subject provided.

Tasks/Skills: *Learn to use the Stethoscope and Sphygmomanometer.*

Ex.No-10: Study of different systems with the help of charts and models: cardiovascular system, respiratory system, urinary system, endocrine system, reproductive system, special senses.

Ex.No-11: Study of human skeleton.

Ex.No-12: Microscopic Study of different tissues.

Ex.No-13: Study of life cycle of amoeba.

Ex.No-14: Study of life cycle of malarial parasite.

Ex.No-15: Study of various family planning methods.

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the full first year B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Ramesh K Goyal; *Elements Of Human Anatomy Physiology & Health Education*; 2013; ISBN:9788184160079

2. V. G. Ranade, P. N. Joshi & Shalini Pradhan *A Text book of Practical Physiology*; 1982; 3rd edition; P.V.G. Prakashan, Pune; ISBN:

3. Goyal, RK., and Patel, NM.; *Practical Anatomy and Physiology*; 2010; 14th edition; B.S. Shah Prakashan; ISBN:8184160496

4. Ghai, CL; *A Textbook of Practical Physiology*; 2007; 7th edition; Jaypee Brothers Medical Pub; ISBN: 9788184481419



UNIT – 1:

- A. RESINS: Definition, General chemical characters, properties and classifications.
- B. Study of MONOGRAPHS*: Colophony, Myrrh, Asafoetida, Benzoin, Balsam of Tolu, Balsam of Peru, Capsicum, Ginger, Podophyllum, Jalap, Turmeric and Cannabis.

UNIT – 2: Glycosides - I

- A. GLYCOSIDES: (Heterosides) Definition, Chemical nature and Classification.
- B. Saponin Glycosides and their properties. Study of MONOGRAPHS*: Liquorices, Ginseng, Dioscorea, Centella (Brahmi) and Senega.
- C. Miscellaneous Glycosides. Study of MONOGRAPHS*: Wild cherry bark, Picrorrhiza, Vanilla and Gentian.

UNIT – 3: Glycosides - II

- A. Anthracene Glycosides: Study of MONOGRAPHS*: Aloe, Senna leaf, Cascara bark, Rhubarb.
- B. Cardiac glycosides, their structural features. Study of MONOGRAPHS*: Cardiac Glycosides: Digitalis, Squill, Strophanthus.

UNIT – 4: Alkaloids - I

- A. ALKALOIDS: Definition, Chemical nature, Properties, Classification of Alkaloids, General methods of isolation and general identification tests.
- B. Study of MONOGRAPHS*: Lobelia, Black pepper, Belladonna, Datura, Stramonium, Coca and Tea.

UNIT – 5: Alkaloids - II

- A. Study of MONOGRAPHS*: Cinchona, Ipecac, Opium, Vasaka, Ergot (with lifecycle), Rauwolfia, Nux-vomica, Vinca, Kurchi, Ephedra, Pilocarpus, Colchicum.

***NOTE:** MONOGRAPH includes Definition, Sensory, Morphological, Micro-morphological (wherever applicable); Significant chemical constituents; Pharmacological activity (if any); Uses; Identification tests (if any); Adulterant/ Substituent (if any).

TEXT BOOKS

1. Williams Charles Evans, Trease and Evans; *Pharmacognosy; 16th edition; 2009; Elsevier, London; ISBN: 978-0-7020-2934-9*
2. Biren Shah and A.K. Seth; *Textbook of Pharmacognosy & Phytochemistry; 1st edition; 2010; Elsevier, New Delhi; ISBN: 978-81-312-2298-0*

REFERENCE BOOKS

1. Kokate, CK., Purohit, AP. And Gokhale, SB.; *Pharmacognosy; 2010; 46th edition; Nirali Prakashan, Pune; ISBN:978-81-96396-15-2*
2. Wallis, TE.; *Textbook of Pharmacognosy; 2005; 5th edition; CBS Publishers, New Delhi;*

ISBN:979-81-23908-86-0

3. Ansari,SH.; *Essentials of Pharmacognosy*; 2008; 1st edition; Birla Publications, Delhi; ISBN:9788186270288

4. MohmadAli; *Pharmacognosy Volume 1*; 2011; CBS Publishers and Distributors, New Delhi; ISBN:9788123914381

5. Qadry, JS.; *Pharmacognosy*; 2010; 16th edition; CBS Publishers and Distributors, New Delhi; ISBN: 978-81-239-1917-1



BPH-205P

PHARMACOGNOSY – II
PRACTICAL

40 Hrs

Ex.No-1: Study of Resin drugs: Colophony, Benzoin and Asafoetida

Tasks/Skills: *Sensory and Morphological studies; Chemical identification tests.*

Ex.No-2: Study of Resin containing drugs: Capsicum, Ginger and Turmeric

Tasks/Skills: *Morphology and Microscopical examination; staining Transverse sections. Only morphological examination of Turmeric.*

Ex.No-3: Study of Glycoside Containing drugs: Senna, Liquorice and Digitalis

Tasks/Skills: *Morphology and Microscopical examination of Senna and Liquorice. Prepare transverse sections and stain them. Morphology of Digitalis.*

Ex.No-4: Study of Alkaloid Containing drugs: Cinchona; Kurchi; Black Pepper

Tasks/Skills: *Morphology and Microscopical examination of Cinchona; Kurchi. Prepare transverse sections and stain them Morphology of Black Pepper.*

Ex.No-5: Study of Alkaloid Containing drugs: Rauwolfia and Ipecac

Tasks/Skills: *Morphology and Microscopical examination of Rauwolfia, and Ipecac*

Ex.No-6: Study of Alkaloid Containing drugs: Datura and Nux-vomica

Tasks/Skills: *Morphology and Microscopical examination of Datura and Nux-vomica*

Ex.No-7: Study of Alkaloid Containing drugs: Vasaka; Ephedra; Vinca

Tasks/Skills: *Morphology and Microscopical examination of Vasaka and Ephedra. Only Morphology of Vinca aerial parts.*

Ex.No-9: Analysis of Powdered drugs: Cinchona; Kurchi.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-10: Analysis of Powdered drugs: Senna and Digitalis.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-11: Analysis of Powdered drugs: Vasaka and Datura.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-11: Analysis of Powdered drugs: Liquorice and Rauwolfia.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-12: Analysis of Powdered drugs: Ipecac and Ginger.

Tasks/Skills: *Learn to recognize the characteristic powder elements of the above drugs with and without staining. Perform simple chemical tests wherever applicable.*

Ex.No-13: Analysis of Unknown Sample of Powdered drug(s).

Tasks/Skills: *Identify the given sample of powdered drug(s) on the basis of systematic sensory, microscopical and chemical tests.*

Ex.No-14: Analysis of Unknown Sample of Powdered drug(s).

Tasks/Skills: *Identify the given sample of powdered drug(s) on the basis of systematic sensory, microscopical and chemical tests.*

Ex.No-15: Study of some significant Indigenous drugs: Amla; Aswagandha; Gokhru; Leshun; Ashoka bark; Ajowan; Tulsi; Neem; Bramhi;

Tasks/Skills: *Learn to recognize the indigenous drugs, their morphological characters; constituents and uses.*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the full first year B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Williams Charles Evans, Trease and Evans Pharmacognosy; 16th edition; 2009; Elsevier, London; ISBN: 9780702029349
2. Jackson, BP., Snowdown, DW., Atlas of Microscopy of Medicinal Plants, Culinary Herbs and Spices; 2005; CBS Publishers, New Delhi; ISBN: 9788123900254
3. Herbal DrugMicroscopy; 2003; 1st edition; Yucca Publishing House, Dombivli, Maharashtra;
4. Kokate, CK., Purohit, AP. And Gokhale, SB., Pharmacognosy; 46th edition; 2010; Nirali Prakashan, Pune; ISBN:9788196396152
5. Wallis, TE., Textbook of Pharmacognosy; 5th edition; 2005; CBS Publishers; New Delhi; ISBN: 9798123908860
6. Wallis, TE., Practical Pharmacognosy; 4th edition; 2011; PharmaMed Press; Hyderabad, India; ISBN: 9789381075029





BPH-301 /
BPL-301

PHYSICAL PHARMACY – I- THEORY

40 Hrs

UNIT – 1: States of matter

Ideal gas law, liquefaction of gases - application of liquefaction of gases in aerosols, crystalline solids – polymorphism, liquid crystals, phase rule – phase diagram for water; phenol in water

UNIT – 2: Solution of non-electrolytes

Ideal and real solution – Raoult's law, distillation of binary mixtures – azeotropic distillation, lowering of vapour pressure, elevation of boiling points (problems), freezing point depression, osmotic pressure – methods to determine

UNIT – 3: Buffer

The buffer equation, buffer capacity, buffers in pharmaceutical systems, preparation of pharmaceutical buffer solutions, buffered isotonic solutions, measurement of tonicity and methods of adjusting tonicity

UNIT – 4: Surface and interfacial phenomena

Surface and interfacial tensions, surface free energy, measurements of surface tensions, surface active agents – HLB classification, adsorption of solid-gas interface – isotherms, electrical properties of interface

UNIT – 5: Rheology

Newtonian systems of fluids, Non-Newtonian systems – plastic flow, pseudoplastic flow and dilatant flow, thixotropy – application in pharmaceutical sciences, determination of viscosity by capillary and falling sphere viscometers, rotational viscometers

TEXT BOOKS

1. Sinko P.J.; *Martin's Physical Pharmacy and Pharmaceutical Sciences; 2010; 6th Edition; Lippincott Williams & Wilkins; ISBN:9780781797665*
2. Ramasamy, C., Manavalan, R.; *Physical Pharmaceutics; 2011; 2nd edition; Vignesh Publishers, Chennai;*
3. Michael E., Kevin M.G. Taylor; *Aulton's Pharmaceutics: The Design and Manufacture of Medicines; 2007; 3rd Edition; Churchill Livingstone; ISBN:9780443101083*

REFERENCE BOOKS

1. Shotton, E.; *Physical Pharmaceutics; 2008; 1st edition; Oxford University Press; ISBN:9780195696165*
2. Carter S.J.; *Cooper Gunn's Tutorial Pharmacy; 2005; 6th edition; CBS Publishers; ISBN:9788123909042*
3. Subrahmanyam, CVS.; *Textbook Of Physical Pharmaceutics; 2010; 2nd edition; Vallabh Prakashan Publications; ISBN: 9788185731087*
4. Allen Loyd V., Jr; *Remington: The Science and Practice of Pharmacy; 2012; 22nd Edition; Pharmaceutical Press; ISBN:9780857110626*
5. Rawlins EA; *Bentley's Text Book of Pharmaceutics; 2010; 8th Edition; Elsevier India Private*

Limited; ISBN:9788131224816

6. Alexander T Florence, David Attwood; *Physicochemical Principles of Pharmacy*; 2011; 5th edition; Pharmaceutical Press; ISBN: 9780853699842

7. Bahl BS, Tuli GD, Bahl A; *Essentials of Physical Chemistry*; 2009; 1st edition; S Chand and Company Ltd; ISBN:9788121929783



**BPH-302 /
BPL-302**

ORGANIC CHEMISTRY – III THEORY

40 Hrs

UNIT – 1: Stereochemistry – Static aspects

A. Stereoisomerism: Classification, enantiomers, diastereomers, optical activity, polarimetry, chirality, tests for chirality, chiral center or stereogenic center, configuration, conformation; Projection formulae: Wedge formula, Fischer projection, Newman projection, Sawhorse projection. Application of each projection formulae.

B. Enantiomerism: Molecules with single chiral center, Assigning absolute configuration (R- & S-), sequence rule, relative configuration (D-, L-), stereo-descriptors (-), and (+)-, and obsolete stereochemical notations, racemic modification, properties of racemic mixtures and their enantiomers; Optical activity, resolution, enantiomeric excess, molecules with two chiral centers, meso-structures, erythro- and threo-notations; molecules with multi-chiral centers. Atropisomerism (Introduction to chirality in biaryl and allene systems)

C. Cis-trans Isomerism: Geometrical isomers, structural requirements, Nomenclature system (cis-, trans, E- and Z-), Cis-trans isomerism in (i) Double bonded carbon-carbon system, (ii) Double bonded carbon-heteroatom systems (oximes & azo) and (iii) cyclic systems.

D. Conformational Isomerism: Conformational isomers, conformational analysis of acyclic systems (ethane, n-butane) and cyclic system (cyclohexane).

UNIT – 2: Carboxylic acids and their functional derivatives

A. Carboxylic acids: Nomenclature, preparation, physical properties, chemical reactions, ionization of carboxylic acids, structure of carboxylate ions, conversion to acid chlorides, esters, amides, reduction to alcohols, halogenation of aliphatic carboxylic acids (Hell-Volhard-Zenisky reaction), dicarboxylic acids.

B. Functional derivatives of carboxylic acids: Nomenclature, structure, physical properties and chemical reactions, nucleophilic substitution, acyl substitution. Preparation of acid chlorides and conversion to acid anhydrides, amides and esters, hydrolysis of these derivatives, transesterification, reaction of esters with Grignard reagents, reduction of esters, functional derivatives of carbonic acids.

UNIT – 3: Amines, Diazonium salts and Phenols

A. Amines: Nomenclature, physical properties, salts of amines, stereochemistry of nitrogen, preparation methods including reduction of nitro compounds, ammonolysis of halides, reductive amination, Hoffman degradation of amides, Hofmann rearrangement, preparation of secondary and tertiary amines

Basicity - effect of structure on basicity, reactions of amines, Hoffman elimination, conversion to substituted amides, sulfonation of aromatic amines, sulfa drugs, reaction with nitrous acids.

B. Diazonium salts: Preparation, reactions, replacement with halogens (Sandmeyer reaction), replacement with -CN (synthesis of carboxylic acids), replacement with -OH (synthesis of phenols), replacements with -H, synthesis using diazonium salts, Sandmeyer reaction, coupling reactions and synthesis of azo-compounds, analysis of amines (Hinsberg test), analysis of

substituted amines.

UNIT – 4: Phenols, Polycyclic Aromatics and Heterocyclics

A. Phenols: Nomenclature, structure, physical properties, salts of phenols, preparation, rearrangement of hydroperoxides, acidity, Fries rearrangement, Kolbe reaction, Riemer-Tiemann reaction, formation and reactions of aryl ethers, analysis of phenols.

B. Polycyclic Aromatics: Nomenclature, methods of preparation and chemical reaction of Naphthalene, Anthracene and Phenanthrene.

C. Heterocyclics: Nomenclature, structure, chemistry and synthesis of different heterocyclic systems: Pyrrole, furan, thiophene, pyridine, pyrazole, imidazole, oxazole, thiazole, quinoline, isoquinoline, phenothiazine and acridine.

UNIT – 5: Stereochemistry – Dynamic aspects

Introduction to Dynamic Stereochemistry.

A. Addition reaction: Hydrogenation, bromination and hydroxylation.

B. Elimination reactions: Dehydrobromination, dehalogenation reaction.

C. Substitution reactions: S_N1 and S_N2 reactions.

D. Stereoselective and stereospecific reactions.

E. Enantioselective synthesis: An introductory discussion on various approaches viz. enantioselective catalysis, chiral auxiliaries, biocatalysis, and chiral pool synthesis.

TEXT BOOKS

1. Morrison RT., Boyd RN.; *Organic Chemistry*; Pearson Publishers; 7th edition; 2011; ISBN:8131704815

2. Graham Solomons, TW., Craig. B. Fryhle; *Solomons and fryhle organic chemistry*; John Wiley & Sons; 8th edition; 2004; ISBN:9812530592.

REFERENCE BOOKS

1. Finar, IL.; *Organic Chemistry Vol 1 – The fundamental principles*; Longman scientific and technical; 6th edition; 1995; ISBN: 0582277728.

2. Finar, IL.; *Organic Chemistry Vol 2 – Stereochemistry and the chemistry of natural products*; Addison Wesley longman limited; 5th edition; 1996; ISBN: 0582305594.

3. Jerry March; *Advanced Organic Chemistry-Reactions, Mechanisms and structure*; John Wiley & Sons; 4th edition; 2005; ISBN: 9971512572.

4. Ernest Eliel; *Stereochemistry of Carbon Compounds*; Tata McGraw-Hill; 1975; ISBN:0070992908

5. Kurt Mislow; *Introduction to Stereochemistry*; Benjamin; 1965.



**BPH-302P/
BPL-302**

**PHARMACEUTICAL ORGANIC CHEMISTRY
PRACTICAL**

40 Hrs

Ex.No-01: Preparation of Acetanilide from aniline

Tasks/Skills: Acetylation; Gravity filtration, crystallization and melting point determination.

Ex.No-02: Preparation of p-nitroacetanilide from acetanilide

Tasks/Skills: Nitration; Suction filtration, crystallization and melting point determination.

Ex.No-03: Preparation of p-bromoacetanilide from acetanilide

Tasks/Skills: Bromination; Suction filtration, crystallization and melting point determination.

Ex.No-04: Preparation of benzamide, phenyl benzoate

Tasks/Skills: Benzoylation; Suction filtration, crystallization and melting point determination

Ex.No-05: Synthesis of salicylic acid from methyl salicylate

Tasks/Skills: Alkaline hydrolysis; Refluxing, suction filtration, crystallization and melting point determination.

Ex.No-06: Establishing isomeric relationships and learning to use stereo models

Tasks/Skills: Stereo models (Ball & Stick, Feiser and space filling models)

Ex.No-07: Learning to draw projection formulae (Fisher, Newman and Sawhorse projection) and transform one projection to another

Tasks/Skills: Ball & stick molecular model set

Ex.No-08: Test for chirality using stereomodels and symmetry elements

Tasks/Skills: Ball & stick molecular model set

Ex.No-09: Assigning absolute configuration (R/S system) to simple chiral molecules

Tasks/Skills: Ball & stick molecular model set

Ex.No-10: Conformational analysis of alicyclic compounds (ethane and butane)

Tasks/Skills: Feiser molecular model research kit and Ball & stick molecular model set

Ex.No-11: Identification of organic compounds and derivatization – 1

Tasks/Skills: Gross examination, ignition test, saturation/unsaturation test

Ex.No-12: Identification of organic compounds and derivatization – 2

Tasks/Skills: Classification of organic compounds by solubility

Ex.No-13: Identification of organic compounds and derivatization – 3

Tasks/Skills: Detection of extra elements (nitrogen, sulfur and halogens)

Ex.No-14: Identification of organic compounds and derivatization – 4

Tasks/Skills: Systematic analysis of solubility class and perform chemical tests to identify functional groups

Ex.No-15: Identification of organic compounds and derivatization – 5

Tasks/Skills: Perform systematic organic qualitative analysis on known simple organic compounds

Ex.No-16: Identification of organic compounds and derivatization – 6

Tasks/Skills: Perform systematic organic qualitative analysis on unknown simple organic

compounds – Drill I

Ex.No-17: Identification of organic compounds and derivatization – 7

Tasks/Skills: Perform systematic organic qualitative analysis on unknown simple organic compounds – Drill II

Ex.No-18: Identification of organic compounds and derivatization – 8

Tasks/Skills: Perform systematic organic qualitative analysis on unknown simple organic compounds – Drill III

Ex.No-19: Identification of organic compounds and derivatization – 9

Tasks/Skills: Perform systematic organic qualitative analysis on unknown simple organic compounds – Drill IV

Ex.No-20: Identification of organic compounds and derivatization – 10

Tasks/Skills: Perform systematic organic qualitative analysis on unknown simple organic compounds – Drill V

Note: Though 20 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included

BOOKS FOR REFERENCE

1. Furniss BS, Hannaford Aj, Smith PWG, Tatchell AR.; Vogel'S Textbook of Practical organic Chemistry, Pearson Education Limited; 1996; 5th edition; ISBN:8129702636.

2. Mann FG, Saunders BC.; Practical Organic Chemistry; 2009; 4th edition; Pearson publishers; ISBN:8131727106



**BPH-303/
BPL-303**

PHARMACEUTICAL ANALYSIS - I THEORY

40 Hrs

UNIT – 1: Titrimetric Methods

A. Non aqueous titration: Principle - solvents & need for non aqueous titration, concept of levelling & differentiating effect, indicators. Pharmaceutical Applications. 1] Assay & Standardisation involving Perchloric acid. 2] Assay & Standardisation involving Potassium, lithium methoxide, tetra butyl ammonium hydroxide.

B. Complexometric titrations with EDTA: principle, factors influencing stability of complexes, titration curves, metal ion indicators, types of EDTA titrations, titration of mixtures – selectivity, masking & demasking agents.

C. Miscellaneous methods of analysis: Diazotization titrations. Kjeldahl nitrogen estimation. Karl Fisher titrations. Determination of alcohol content in liquid Galenicals. Oxygen flask combustion method.

UNIT – 2: Photometric methods I

A. Ultraviolet & Visible Spectrophotometry: Principle, electronic transitions, Beer- Lambert laws, quantitative analysis, Understanding of terms such as absorbance, transmittance, absorptivity, molar absorptivity, A 1% 1 cm, λ max, effect of solvent & pH on λ maximum, chromophores, auxochromes, Instrumentation & working of [single & double beam] spectrophotometer, sources of radiations, sample cells, monochromators [filter, prism,

diffraction gratings], detectors. Quantitative Applications in Pharmacy.

B. Turbidimetry & Nephelometry, Principle, Tyndall effect, instrumentation and applications.

UNIT – 3: Photometric methods II

A. Spectrofluorimetry: Principle, definitions & types of luminescence, Mechanism of fluorescence & phosphorescence. Singlet & triplet states & intersystem crossing. Fluorescence yield & factors affecting it. Quenching of fluorescence & fluorescence quenchers. Factors affecting the fluorescence, instrumentation, Applications of fluorimetry in pharmacy.

B. Polarimetry & Refractometry, Principle, instrumentation and applications.

C. Sampling for quantitative analysis: Obtaining representative samples of Pharmaceuticals as per pharmacopeia for Raw materials and Pharmaceutical dosage forms.

UNIT – 4: Basics of Chromatography

A. Definition, History, Classification of Chromatography: Principles of adsorption, partition, Ion-exchange and Gel Permeation chromatography. Preparation of column, sample; solvents & their property, running the chromatogram, detection, applications.

B. TLC: Preparation of TLC plate, running the chromatogram, two dimensional chromatography, detection, RF values, and applications. Brief introduction to HPTLC.

UNIT – 5: Sources of Error, Significant figures and Calibration

A. Sources of error & types in analytical chemistry, error minimisation & estimation, definition of Accuracy, Precision. Significance of Mean, Standard deviation in expressing analytical results, Normal distribution curve and its importance. Significant Figures: Definition, rules for retaining significant digits in experiments.

B. Calibration: absolute & relative methods of analysis, external, internal standard calibration, standard addition methods. Method of least squares, selectivity, sensitivity and detection limit. Problems & Calculation workout to be introduced to students in understanding above concepts.

TEXT BOOKS

1. Beckett, AH, Stenlake, JB.; *Practical Pharmaceutical Chemistry: Part I & II, 2001; 4th edition; CBS; ISBN:9780485113235*

2. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; *Fundamentals Of Analytical Chemistry; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286*

REFERENCE BOOKS

1. David G. Watson; *Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists; 3rd edition; 2012; Churchill Livingstone; ISBN:9780702046216*

2. John Kenkel; *Analytical Chemistry for Technicians; 3rd edition; 2002; CRC Press; ISBN:9781566705196*

3. Miguel Valcarcel; *Principles of Analytical Chemistry: A Textbook; 2000; Springer; ISBN:9783540640073*

4. Parimoo, P.; *Pharmaceutical Analysis; 2012; CBS Publisher & Distributors P Ltd; ISBN:9788123906270*

5. Day, RA., Underwood, AL.; *Quantitative Analysis; 1991; 6th edition; Prentice Hall; ISBN:9780137471553*

6. Donald I Pavia, Garry M Lampman and George S Kris; *Introduction to Organic Laboratory*



**BPH-303P/
BPL-303P**

**PHARMACEUTICAL ANALYSIS – I
PRACTICAL**

40 Hrs

NOTE: Reagents used in Analysis Experiments should have **MOLARITY** Units by default as adopted in Pharmacopeias unless otherwise specified.

Ex.No-01: Determination of sulphates in borax by Nephelometry.

Ex.No-02: Preparation & standardization of EDTA solution.(Complexometric titration)

Ex.No-03: Determination of % purity of calcium gluconate injection. (Complexometric titration)

Ex.No-04: Determination of % purity of magnesium sulphate. (Complexometric titration)

Ex.No-05: Determination of % purity of Drug (non aqueous titration).

Ex.No-06: Estimation of Drug (non aqueous titration)

Ex.No-07: Diazotization titrations of sulpha drugs

Ex.No-08: . Experiments using colorimeter in estimation of drugs

Ex.No-09: Estimation of Dextrose in I.V fluid by Polarimetry

Ex.No-10: Refractive index measurement of some volatile oil

Ex.No-11: Determination of lambda max of Paracetamol & computing $A_{1\%}^{1\text{cm}}$, absorptivity, molar absorptivity, Transmittance for the absorbance determined at lambda max.

Ex.No-12: Determination of percentage purity Paracetamol sample using $A_{1\%}^{1\text{cm}}$.

Ex.No-13: Determination of Streptomycin sulphate by colorimetry

Ex.No-14: Determination of a Drug by fluorimetry. A standard curve constructed & drug estimated graphically and also by regression using method of least squares.

Ex.No-15: Determination of active drug from formulation (tablets, liquid orals, capsules by UV spectrophotometry).

Note: Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included

BOOKS FOR REFERENCE

1. Indian Pharmacopoeia; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695

2. Beckett, AH, Stenlake, JB.; Practical Pharmaceutical Chemistry: Part I & II, 2001; 4th edition; CBS; ISBN:9780485113235

3. Douglas A. Skoog , F. James Holler, Stanley R. Crouch; Principles of Instrumental Analysis; 2006; 6th edition; Brooks Cole; ISBN:9780495012016

4. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; Fundamentals Of Analytical Chemistry; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286

5. Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK.; *Vogel's Quantitative Chemical Analysis*; 2000; 6th edition; Prentice Hall; ISBN:9780582226289

6. Donald I Pavia, Garry M Lampman and George S Kris; *Introduction to Organic Laboratory Techniques*; 1987; 3rd edition; Harcourt School; ISBN:9780030148132



**BPH-304/
BPL-304**

PATHOPHYSIOLOGY- THEORY

40 Hrs

UNIT – 1: General Pathophysiology

A. Historical aspects; definition of terms; introduction to pathology and its Applications. Cellular responses to stress & noxious stimuli, cellular adaptation of growth & differentiation (hyperplasia, hypertrophy, atrophy & metaplasia ; Cell injury and cell death (cause & mechanism of reversible & irreversible injury)

B. Morphology of cell injury (reversible & necrosis), examples of cell injury and necrosis (ischaemic , hypoxic, reperfusion and chemical injuries); Apoptosis and sub-cellular responses to injury; Intracellular accumulation, calcification & cellular aging; (Lipid, protein, glycogen and pigment accumulation; pathologic calcification; ageing).

UNIT – 2: Inflammation

A. Introduction to body's immune response (innate & adaptive immunity; cells and tissues of immune system; cytokines; structure & function of HLA); General features of inflammation; history; stimuli for acute inflammation; vascular events; cellular events – leucocyte adhesion and transmigration, Continuation of cellular events (chemotaxis, phagocytosis, defects of leucocyte function); termination of acute inflammatory response; outcome of acute inflammation; morphological patterns of acute inflammation.

B. Chemical mediators (vaso-active amines; plasma proteins; AA metabolites; PAF; cytokines; chemokines; leucotrienes; NO; free radicals & neuropeptides) Chronic inflammation (cause, morphological features; cells of chronic inflammation; granuloma; systemic effects of inflammation; consequences of excessive/ defective inflammation); Repair (healing; scar formation; cutaneous wound healing; healing at special sites; factors affecting wound healing).

UNIT – 3: Cardiovascular Pathophysiology

A. RBC & BLEEDING DISORDERS: Development of haematopoietic cells, bone marrow, classification of anaemia, Anaemia of blood loss, Nutritional anaemias Anemia of chronic disease, aplasia, other forms of impaired production Haemolytic anaemia – classification, membrane defects, enzyme defects Acquired haemolytic anaemia, polycythaemia, Haemoglobinopathies – Hb S, E, C & Thalassaemia; Bleeding disorders – classification, disorders of platelets, coagulation disorders.

B. WBC, LYMPH NODE, SPLEEN: Non-neoplastic quantitative and qualitative disorders of leucocytes; Leukaemia – classification, aetiology, acute leukaemias Chronic leukaemias, MDS, other chronic myelo-proliferative disorders including myelofibrosis; Non – neoplastic disorders of lymph node, spleen & thymus; classification of lymphoma; Hodgkin Lymphoma, Non-Hodgkin lymphoma, Plasma cell dyscrasias; Blood banking.

C. BLOOD VESSELS: Atherosclerosis and Hypertension; Vasculitis, Congenital anomalies, aneurysms and tumours.

D. THE HEART: Ischaemic heart disease & myocardial infarction; Rheumatic fever, Infective endocarditis; diseases of the pericardium; Congenital heart disease, diseases of the myocardium, tumours of the heart.

UNIT – 4: Pathophysiology of Digestive, Respiratory & Endocrine System

A. GIT: Oesophagus – Congenital anomalies, motor dysfunction, GERD and tumours; Gastritis and Peptic ulcer; Tumours of stomach; Congenital anomalies of intestine, Malabsorption syndromes & Enterocolitis; IBD – Crohn's & Ulcerative colitis; Tumours of small & large intestine, diseases of appendix & peritoneum.

B. THE LUNG: Atelectasis, acute lung injury, ARDS, acute interstitial pneumonia, COPD – emphysema, bronchial asthma, bronchiectasis; Diffuse interstitial diseases (infiltrative, restrictive) – fibrosing diseases (mainly pneumoconiosis), sarcoidosis, pulmonary eosinophilia, smoking related diseases; Pulmonary infections – Pneumonias; Tumours of lung & Diseases of pleura.

C. ENDOCRINE SYSTEM: Diseases of pituitary gland, parathyroid, pineal gland; Benign & malignant lesions of thyroid; Diseases of Adrenals; Diabetes mellitus.

UNIT – 5: Pathophysiology of Infection & Cancer

A. INFECTIOUS DISEASES: General principles (categories, transmission & dissemination of microbes, mechanisms of microbial disease, immune evasion, infections in immunosuppressed hosts, tissue response to microbes); Pathology of common viral & bacterial infections (CMV, EBV, HPV, hepatitis viruses, gram positive & negative bacterial infections); Mycobacterial infections – Tuberculosis, Leprosy, syphilis and others; Fungal & parasitic infections.

B. NEOPLASIA: Definition, nomenclature, biology of tumour growth, differences between benign & malignant tumours, tumour spread & epidemiology Molecular basis of neoplasia (essential alterations for malignant transformation, oncogenes, suppressor genes); Evasion of apoptosis; defects in DNA repair, telomerase and angiogenesis; invasion & metastasis; dysregulation of genes); Carcinogenesis (carcinogenic agents, molecular basis of carcinogenesis); Host defense, tumour immunity, clinical features, and laboratory diagnosis.

TEXT BOOKS

1. Mohan Harsh; *Textbook of Pathology*; 2010; 6th edition; Jaypee Brothers Medical Publishers (P) Ltd.; ISBN: 9788184487022.

2. Marya, RK.; *Pathophysiology*; 2012; 3rd edition; CBS Publishers & Distributors, Delhi; ISBN: 9788123913445

REFERENCE BOOKS

1. Vinay Kumar, Abul K. Abbas, Jon C. Aster; *Robbins Basic Pathology*; 2012; 9th edition; W B Saunders Company; ISBN: 9781437717815

2. James C. E. Underwood, Simon S Cross; *General and Systematic Pathology*; 2009; 5th edition; Churchill Livingstone; ISBN: 9780443068881

3. Carie A. Braun, Cindy M. Anderson; *Pathophysiology - A Clinical Approach*; 2010; 2nd edition; Lippincott Williams & Wilkins; ISBN: 9781605473048



**BPH-305/
BPL-305**

MATHEMATICS & BIostatISTICS- THEORY

40 Hrs

UNIT – 1: Matrices and Differential Calculus

A. Matrices and Determinants: definition of matrix, types, arithmetic operations on matrices, determinants and its expansion, important properties of determinants, solutions of simultaneous equations by Cramer's rule.

B. Differentiation: Concept of functions, limits and differentiation; differentiation of standard functions (without using first principle), including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation.

UNIT – 2: Integration and Differential Equations

A. Integration: integration as inverse of differentiation, indefinite integrals of standard functions, integration- by parts and substitution methods, formal evaluation of definite integrals.

B. Differential equations: definition, formation and solution of ordinary differential equations of first order and first degree (variable separable technique only).

UNIT – 3: Statistics – Basics, Correlation and Regression

A. Measures of central tendency and dispersion: requisites of an ideal measure, arithmetic mean, median, mode, range, mean deviation, standard deviation, coefficients of variation.

B. Linear correlation: bivariate data, scatter diagrams, correlation, types of correlation, Karl Pearson's and Spearman's methods, coefficients of correlation and its important properties (without proof).

C. Linear regression: regression, method of least squares, lines of regression, regression coefficients and their important properties (without proof).

UNIT – 4: Statistics - Probability

A. Probability: events, classical and statistical definitions of probabilities, addition and multiplication laws of probability, conditional probability, Baye's theorem (statement only) and its applications.

B. Standard probability distribution: definitions, important properties (without proof) and applications of binomial, Poisson and normal distribution/ normal curves. Central limit theorem (statement only)

UNIT – 5: Statistics - Statistical Inference

Statistical inference: concepts of parameter, statistic, sampling distribution, standard error, hypothesis, type-I and type-II errors; testing of hypothesis, t-test (paired and unpaired), Z-test (for means only). Note:- Emphasis on Pharmaceutical applications, wherever possible, of the above-mentioned concepts and results (without proof).

TEXT BOOKS

1. Priya Ranjan Dash and Gopabandhu Mishra; *Mathematics and Statistics for Biology*; 2011; 1st edition; Vrinda Publications (P) Ltd., Delhi.

2. Narayanan, S and Manicavachaga Pillay, TK.; *Calculus Vol III*; 2009; Viswanathan Printers and Publishers Pvt. Ltd., Chennai.

REFERENCE BOOKS

1. Gupta SC., and Kapur, VK.; *Fundament of Mathematical Statistics*; 2009; S. Chand and Sons, New Delhi.

2. Kapoor, JN. and Singhal, MK.; *An Introduction of Matirces*; 1977; R. Chand and Co.

3. Mathur, K.; *Statistical Analysis in Biology*; 1972; Chapman and Hall Ltd., London.

4. Manicavachagam Pillay, TK.; *Analytical Geometry*; 1983, Viswanathan Printers and Publishers Pvt. Ltd., Chennai.



**BPH-306P/
BPL-306P**

COMPUTER SKILLS PRACTICAL

40 Hrs

Ex.No-01: Introduction to Computer systems, Devices and Operating Systems

Tasks/Skills: *Input and Output devices , Secondary storage units, Memory ROM and RAM, and CPU, Classification of Computers. Purpose of the OS, Management functions of OS, Types of OS, User interfaces.*

Ex.No-02: Exploring the Windows Operating System

Tasks/Skills: *Starting and Shutdown of PC, Various Windows Components, Windows Explorer and its usage. Exploring the various features of Windows OS*

Ex.No-03: Document / File Creation in Windows

Tasks/Skills: *Creating text document in WordPad and saving the files. Text selection, Formatting, Copy and Past Operations. Using MS Paint to create a drawing, formats of image files, Resizing the image files.*

Ex.No-04: File Management in Windows

Tasks/Skills: *Creation of files and folders, moving files, copying files, My Documents, My Computer, Recycle bin, Finding Files and Folders, Exploring the Folder and Files organization structure in Windows*

Ex.No-05: Microsoft Word as a Productivity tool

Tasks/Skills: *Exploring various menu options in MS Word, Creation of a basic Rich Text document, Spell Check, Various Formatting options: Alignment; font, Bullets, Paragraph, Page setup etc..*

Ex.No-06: Using Microsoft Word Additional Features

Tasks/Skills: *Creation of Tables and filling data, Inserting rows and columns, merging cells, Table borders manipulations; Inserting Images and their manipulation: crop, resize, gray scale etc. Using various inbuilt Drawing tools.*

Ex.No-07: Exploring and Learning to make Presentation using MS PowerPoint

Tasks/Skills: *Create new PowerPoint presentation from templates; Adding, copying and deleting Slides; Layout choices of Slides and their selection; Bullets; Lists; Embedding images, Clip Arts; Choosing colors; Font themes; Using Drawing elements, etc.; Slide Transitions and effects; Choice of Themes.*

Ex.No-08: Creating simple PowerPoint Presentation on a topic of Choice.

Tasks/Skills: *Students should enter the lab with some idea on at least 10 sheets of A4 paper (each acting as a slide) based on which they should create a presentation with a theme of their choice.*

Ex.No-09: Exploring MS Excel and Basic Operations

Tasks/Skills: *Worksheet basics, Rows and Columns and Cell address; Inserting and deleting rows/columns; Row Height, column width adjustments; Data Entry; Types of data and its formatting; Cut, Copy and Paste/Special Paste operations; Referencing of Cells; Entering some basic math formulas.*

Ex.No-10: Creating Graph Plots and Charts and Simple Statistical Operations

Tasks/Skills: Enter the data in a given table and learn to make some statistical operations such as mean; median, mode; std. deviation, minimum; maximum; Plot different type of Graph Charts with the given data.

Ex.No-11: Problem Solving Using Excel

Tasks/Skills: Solve a given problem associated with the supplied data. Do some basic data analysis. Plot a chart if applicable.

Ex.No-12: Concepts of Computer Networks, Internet, Web and Web Browsers; Search Engines; Search Techniques

Tasks/Skills: Basics of Web; URL; Domain names; Google and Yahoo search engines; Various Web Browsers; Concepts of Bookmark; History; Safety etc. Webpage concepts such as hyperlinks; forms etc.

Ex.No-13: Email Accounts; Chatting and Cloud Services

Tasks/Skills: Email ID creation; Passwords their complexity and choice; Major Web based email service provider; Online Storage services.

Ex.No-14: Social Networking and Online Services

Tasks/Skills: Introduction to Face book; Twitter; Google Plus; Safety precautions online; Online Banking services; Online Railway Reservation Service etc.

Ex.No-15: Safety and Security of Computer Systems

Tasks/Skills: Antivirus and Internet Security Software and their uses. Updating the Antivirus database; Popular Antivirus Software; Phishing; etc.

Note: Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS & Websites FOR REFERENCE

1. Gary B. Shelly, Misty E. Vermaat; *Discovering Computers & Microsoft Office 2010: A Fundamental Combined Approach*; 2011; Course Technology; ISBN:9780538473934
2. Jennifer T. Campbell; *Computer Literacy Basics: Microsoft Office 2007 Companion*; 2008; Course Technology; ISBN:9781423904311
3. Free Online Learning(Computer basics, Windows, Word, Excel, PowerPoint, Email, Social Networking etc): <http://www.gcfllearnfree.org/computers>
4. Stephen Moffat; *Word 2007 Introduction Part -1*;2011; The Mouse Training Company & Ventus Publishing ApS; ISBN:9788776818401. <http://bookboon.com/en/textbooks-ebooks>
5. Stephen Moffat; *Word 2007 Introduction Part -2*;2011; The Mouse Training Company & Ventus Publishing ApS; ISBN:9788776818418. <http://bookboon.com/en/textbooks-ebooks>
6. *Word, Excel, PowerPoint Basics*: <http://www.baycongroup.com/tutorials.htm>
7. Stephen Moffat; *Excel 2007 Introduction Part -2*; 2012; The Mouse Training Company & Bookboon.com; ISBN:9788740300321. <http://bookboon.com/en/textbooks-ebooks>
8. Stephen Moffat; *PowerPoint 2007 Part -1*; 2012; The Mouse Training Company & Ventus Publishing ApS; ISBN: 9788740300291. <http://bookboon.com/en/textbooks-ebooks>
9. Stephen Moffat; *PowerPoint 2007 Part -2*; 2012; The Mouse Training Company & Ventus

Publishing ApS; ISBN: 9788740300307. <http://bookboon.com/en/textbooks-ebooks>

10. Tutorials on social Networking: <http://www.socialbrite.org/sharing-center/tutorials/>

11. Social Networking-Facebook: <http://www.facebook.com/help>

12. <http://modernlessons.com/course-catalog/>



B. Pharm. IV Semester

**BPH-401/
BPL-401**

PHYSICAL PHARMACY-II- THEORY

40 Hrs

UNIT – 1: Colloids

Electrical and optical properties of colloids, sedimentation, stokes law, stability of colloidal dispersions, protective colloids, sensitization of colloids, application of colloids in pharmaceutical sciences

UNIT – 2: Suspensions and emulsions

Interfacial properties of suspended particles, settling in suspensions, formulations of suspensions, sedimentation of flocculated particles, theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological considerations of emulsions

UNIT – 3: Complexation

Metal complexes, organic molecular complexes, inclusion compounds, methods of analysis, protein binding, factors affecting drug complexation and protein binding

UNIT – 4: Micromeritics

Particle size and distribution, methods for determining particle size, particle shape and surface area, methods for determining surface area, derived properties of powders

UNIT – 5: Drug stability

Physical degradation of pharmaceutical products – loss of volatile constituents, loss of water, absorption of water, polymorphism; factors influencing chemical degradation – hydrolysis, oxidation, isomerisation, polymerization, decarboxylation; methods of reducing degradations; accelerated stability testing.

TEXT BOOKS

1. Sinko P.J.; *Martin's Physical Pharmacy and Pharmaceutical Sciences*; 2010; 6th Edition; Lippincott Williams & Wilkins; ISBN:9780781797665

2. Ramasamy, C., Manavalan, R.; *Physical Pharmaceutics*; 2011; 2nd edition; Vignesh Publishers, Chennai; ISBN:???

3. Michael E., Kevin M.G. Taylor; *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*; 2007; 3rd Edition; Churchill Livingstone; ISBN:9780443101083

REFERENCE BOOKS

1. Shotton, E.; *Physical Pharmaceutics*; 2008; 1st edition; Oxford University Press;

ISBN:9780195696165

2. Carter SJ; Cooper Gunn's Tutorial Pharmacy; 2005; 6th edition; CBS Publishers;
ISBN:9788123909042

3. Subrahmanyam, CVS.; Textbook Of Physical Pharmaceutics; 2010; 2nd edition; Vallabh
Prakashan Publications; ISBN: 9788185731087

4. Allen Loyd V., Jr; Remington: The Science and Practice of Pharmacy; 2012; 22nd Edition;
Pharmaceutical Press; ISBN:9780857110626

5. Rawlins EA; Bentley's Text Book of Pharmaceutics; 2010; 8th Edition; Elsevier India
Private Limited; ISBN:9788131224816

6. Alexander T Florence, David Attwood; Physicochemical Principles of Pharmacy; 2011; 5th
edition; Pharmaceutical Press; ISBN: 9780853699842

7. Bahl BS, Tuli GD, Bahl A; Essentials of Physical Chemistry; 2009; 1st edition; S Chand and
Company Ltd; ISBN:9788121929783



**BPH-401P/
BPL-401P**

PHYSICAL PHARMACY PRACTICAL

40 Hrs

Ex.No-01: Determination of critical solution temperature of phenol-water system

Tasks/Skills: Phase rule, phase diagram for phenol water system

Ex.No-02: Determination of particle size distribution of a powder material by sieve analysis

Tasks/Skills: Sieve, Sieve numbers and particle size distribution

Ex.No-03: Determination of particle size distribution of a powder material by microscopic method

Tasks/Skills: Particle size distribution, frequency distribution, average particle size

Ex.No-04: Determination of true density of powder samples

Tasks/Skills: Pycnometer, density of powder

Ex.No-05: Determination of bulk density and porosity of a powder sample

Tasks/Skills: Derived properties of powders, Percent porosity

Ex.No-06: Determination of angle of repose of a powder sample

Tasks/Skills: Flow properties of powder

Ex.No-07: Determination of surface tension of a liquid by drop count method

Tasks/Skills: Stalagmometer method, surface and interfacial tension

Ex.No-08: Determination of viscosity of a liquid by using Ostwald viscometer

Tasks/Skills: Newtonian fluid, Poiseuille equation, resistance to flow

Ex.No-09: Determination of partition coefficient of benzoic acid between water and benzene

Tasks/Skills: Partition (or Distribution) law and its limitation, application

Ex.No-10: Determination of pKa of a weakly acidic drug substance

Tasks/Skills: *Henderson- Hasselbalch equation, Ionization constant*

Ex.No-11: Determination of critical micellar concentration of a surfactant

Tasks/Skills: *Surfactant, CMC of a surfactant*

Ex.No-12: Effect of viscosity on the sedimentation rate of a suspension

Tasks/Skills: *Rate of sedimentation and sedimentation volume*

Ex.No-13: Determination of HLB of a non-ionic surfactant

Tasks/Skills: *Hidrophile-Lipophile Balance (HLB) of surfactant*

Ex.No-14: Studies on adsorption of acetic acid on charcoal

Tasks/Skills: *Freundlich adsorption isotherm*

Ex.No-15: Determination of degree of flocculation of a suspension

Tasks/Skills: *Flocculation, controlled flocculation and flocculating agents*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. More HN, Hajare, AA.; *Practical Physical Chemistry*; 2008; Career Publication; ISBN:9788188739462
2. Sinko PJ.; *Martin's Physical Pharmacy and Pharmaceutical Sciences*; 2010; 6th Edition; Lippincott Williams & Wilkins; ISBN:9780781797665
3. Michael E., Kevin M.G. Taylor; *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*; 2007; 3rd Edition; Churchill Livinstone; ISBN:9780443101083
4. Rawlins EA; *Bentley's Text Book of Pharmaceutics*; 2010; 8th Edition; Elsevier India Private Limited; ISBN:9788131224816
5. Allen Jr. LV.; *Remington: The Science and Practice of Pharmacy*; 2010; 22nd edition; Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626
6. Guru Prasad Mohanta and Prabal Kumar Mann; *Physical Pharmacy Practical Text*; 2012; 2nd edition; PharmaMed Press, Hyderabad; ISBN:9788178002668



**BPH-402/
BPL-402**

**PHARMACEUTICAL UNIT OPERATIONS – I -
THEORY**

40 Hrs

UNIT – 1: Basic Principles and Fluid flow

A. BASIC PRINCIPLES: Unit Operations—Unit Processes; Unit Operations—Scientific Foundations; Dimensions, Units, Systems and Inter-Conversions; Dimensions—Formulae, Equations and Analysis

B. FLOW OF FLUIDS: Fluid Statics; Fluid Dynamics; Reynolds's Number; Bernoulli's Theorem; Measurement of Pressure; Measurement of Rate of Flow of fluids

UNIT – 2: Transportation of Fluids and Solids

A. TRANSPORTATION OF FLUIDS: Valves; Pumps; Reciprocating Pumps; Rotary Pumps; Transportation of Gases; Fans; Compressors; Blowers

B. TRANSPORTATION OF SOLIDS: Belt conveyor; Screw Conveyors; Pneumatic Conveyors; Chain Conveyors; Selection of Solid Transportation Equipment; Storage of Solids

UNIT – 3: Flow of Heat, Materials of Construction & Corrosion

A. FLOW OF HEAT: Conduction; Convection; Radiation; Heat Exchanger and Heat Interchangers; Steam as a Heating Medium

B. MATERIALS OF CONSTRUCTION: Factors Influencing the Selection of Materials; Classification of Materials for Plant Construction; Ferrous Metals; on Ferrous Metals; Non-metals —Inorganic and Organic

C. CORROSION: Theories of Corrosion; Factors Influencing Corrosion; Types of Corrosion; Prevention and Control of Corrosion

UNIT – 4: Filtration and Centrifugation

A. FILTRATION: Mechanisms of Filtration; Theories of Filtration; Factors Influencing Filtration; Filter Media and Filter Aids; Classification of Filtration Equipment; Industrial Equipment

B. CENTRIFUGATION: Theory of Centrifugation; Classification of Centrifuges; Industrial Equipment

UNIT – 5: Humidity, Refrigeration, Industrial Hazards & Safety

A. HUMIDITY, REFRIGERATION AND AIR CONDITONING: Definitions; Measurement of Humidity; Humidity Charts and Its Utility; Humidification; Dehumidification; Air Conditioning; Refrigeration;

B. INDUSTRIAL HAZARDS AND PLANT SAFETY : Accidents; Mechanical Hazards – Prevention; Electrical Hazards – Prevention; Chemical Hazards; Management of Over-exposure of Chemicals; Gas Hazards and Handling of Gases; Dust Explosion and its Control; Fire and Explosion Hazards; Control of Fire and Explosion; Safety Management; Elements of Safety Programmes

TEXT BOOK

1. *Subrahmanyam, CVS., Thimma Setty, J., Sarasija Suresh and Kusum Devi, V; Pharmaceutical Engineering(Unit Operations-I); 2011; 2nd edition; Vallabh Prakashan, New Delhi; ISBN:9788185731636*

2. *Sambamurthy, K; Pharmaceutical Engineering, 1998; 1st edition; New Age international (P) limited, New Delhi; ISBN: 812241169X*

3. *Carter SJ (Ed), Copper and Gunn's Tutorial Pharmacy; 2000; 6th edition; CBS Publishers and Distributors Private Limited, New Delhi;*

REFERENCE BOOK

1. *Green, Don W.; Perry, Robert H; Perry's Chemical Engineers' Handbook; 2008; 8th edition; McGraw-Hill; ISBN: 978-0071422949*

2. *Warren Lee McCabe, Julian Cleveland Smith, Peter Harriott; Unit Operations of Chemical Engineering; 2005; McGraw-Hill Professional; ISBN:9780072848236*



**BPH-403/
BPL-403**

PHARMACEUTICAL ANALYSIS – II THEORY

40 Hrs

UNIT – 1: Chromatography Theory

Theory of chromatography: Definition & classification of chromatography, chromatograms, migration rates of solutes [distribution constants, retention times, retention factor, selectivity factor], quantitative descriptions of column efficiency [plate height H, plate count N], variables that affect column efficiency [mobile flow rate, theory of band broadening – van deemter equation. Methods for reducing band broadening].

UNIT – 2: HPLC & GAS Chromatography

A. High Performance Liquid chromatography [HPLC] working, Principle, Columns, pumps, detectors, mobile phase solvents, gradient & isocratic elution, normal, reverse phase, ion exchange, gel permeation chromatography. Applications.

B. GAS chromatography working, principle, columns, pumps, detectors, mobile phase gases, Applications

C. High Performance Thin Layer Chromatography [HPTLC]: principle & applications.

UNIT – 3: Electrochemical methods

A. Potentiometry: Electrochemical cells, theoretical concepts, single electrode potential, Nernst equation, standard hydrogen & calomel electrode; working principle & construction of: PH meter, indicator & reference electrodes, silver-silver, membrane-glass, ion sensitive electrodes. Potentiometric titrations, titration curves, biosensors.

B. Conductometric titrations: basic concepts, apparatus used, different types of conductometric titrations, applications.

C. Electrophoresis: principle, supporting media, paper, gel, cellulose acetate – techniques low & high voltage electrophoresis, Applications. Capillary electrophoresis: Principle & applications.

UNIT – 4: Atomic Absorbance Spectroscopy & Emission spectroscopy

A. Atomic absorbance spectroscopy: Principle, instrumentation & working, atomisers, plasma sources [inductively coupled plasma], line sources, detectors. Applications.

B. Flame emission (flame photometry) spectroscopy: Principle, instrumentation & working, atomisers, plasma sources, detectors. Applications.

UNIT – 5: Polarography – Radiochemical methods – X ray diffraction

A. Polarography: Polarography basic principles, current – voltage curve, features of polarogram, working - dropping mercury electrode, ilkovic equation, amperometry, applications.

B. Radiopharmaceuticals & Radiochemical methods of analysis:

Nuclear reactions, radiation types & properties, units, radiochemical purity, radionuclide purity. Measurement of radio activity & Detection instruments: Geiger muller counter, Scintillation counters, applications [isotope dilution technique, radio immunoassay, ELISA [Enzyme Linked Immuno - Sorbant Assay] technique.

C. X ray diffraction: Principle, Bragg's law, Instrumentation, applications.

TEXT BOOKS

1. Beckett AH., Stenlake, JB.; *Practical Pharmaceutical Chemistry: Part I & II; 2001; 4th edition; CBS; ISBN:978-0485113235*

2. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; *Fundamentals Of Analytical Chemistry; 2013; 9th edition.; Brooks/Cole Cengage Learning; ISBN:9780495558286*

REFERENCE BOOKS

1. David T Harvey; *Modern Analytical Chemistry*; 2000; 1st edition; McGraw-Hill Science; ISBN:978-0072375473
2. Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK. ; *Vogel's Quantitative Chemical Analysis*; 2000; 6th edition; Prentice Hall; ISBN:978-0582226289
3. John Kenkel, J.; *Analytical Chemistry for Technicians*; 3rd edition; CRC Press; ISBN:978-1566705196
4. Arun Bahl , Tuli GD.; *Essentials of Physical Chemistry*; 2010; S.Chand & Co Ltd; ISBN 9788121929783
5. Clarke, EGC., Moffat, AC.; *Clarke's Isolation and Identification of Drugs: In Pharmaceuticals, Body Fluids and Post Mortem Material*; 1986; 2nd edition; Pharmaceutical Press; ISBN:978-0853691662
6. Donald I Pavia, Garry M Lampman and George S Kris; *Introduction to Organic Laboratory Techniques*; 1987; 3rd edition; Harcourt School; ISBN:9780030148132



**BPH-403P/
BPL-403P**

PHARMACEUTICAL ANALYSIS-II

40 Hrs

NOTE: Reagents used in Analysis Experiments should have **MOLARITY** Units by default as adopted in Pharmacopeias unless otherwise specified.

Ex.No-01: Experiments involving UV-VIS spectrometry: The assays of different dosage forms such as tablets, capsules, injections, suspensions, gels [official / unofficial]. Calculation of drug content using A 1% 1cm, calibration curves, & reference standards.

Ex.No-02: Experiments involving UV-VIS spectrometry: Determination of linearity range, Determination of limit of detection [LOD] & limit of quantification [LOQ].

Ex.No-03: Use of Paper & TLC techniques in qualitative analysis. Calculation of R_f value. Use of reference standard in identification of unknown compound. Demonstration of preparative TLC technique & its usefulness in qualitative & quantitative analysis.

Ex.No-04: Demonstration of separation of proteins by electrophoresis. Determination of ion-exchange capacity of resins

Ex.No-05: Potentiometric titrations to construct titration curves & determine end points.

Ex.No-06: Conductimetric titration.

Ex.No-07: Polarographic assays.

Ex.No-08: Quantitative Determination of sodium, potassium & calcium by flame photometry.

Ex.No-09: Experiments using colorimeter in estimation of drugs, sugars, amino acids, proteins.

Ex.No-10: Karl Fisher method to estimate water content using dead stop end point technique.

Ex.No-11: Calculations involved in theory of chromatography – Drill 1

Tasks/Skills: Study of chromatograms, and calculation of various parameters relevant to HPLC such as distribution constants, retention times, retention factor, selectivity factor, plate height H, plate count N, mobile flow rate, theory of band broadening – van deemter equation.

Ex.No-12: Perform Calculations involved in Theory of chromatography– Drill 2. &

Demonstration of HPLC assay

Tasks/Skills: Calculation of various parameters relevant to HPLC as listed above.

Ex.No-13: Experiments on Fluorimetry. Determination of Eex & Eem. Quantitative estimations of drugs.

Ex.No-14: Experiments on fluorimetry. Quantitative estimations of drugs.

Ex.No-15: Demonstration of column chromatographic technique in qualitative analysis.

Ex.No-16: Experiments using colorimeter in estimation of drugs.

Note: Though 16 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included

BOOKS FOR REFERENCE

1. David G. Watson; *Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists*; 2012; 3rd edition; Churchill Livingstone; ISBN-13:978-0702046216
2. *Indian Pharmacopoeia*; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695
3. Beckett, AH, Stenlake, JB.; *Practical Pharmaceutical Chemistry: Part I & II*, 2001; 4th edition; CBS; ISBN:9780485113235
4. Douglas A. Skoog, F. James Holler, Stanley R. Crouch; *Principles of Instrumental Analysis*; 2006; 6th edition; Brooks Cole; ISBN:978-0495012016
5. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; *Fundamentals Of Analytical Chemistry*; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286
6. Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK.; *Vogel's Quantitative Chemical Analysis*; 2000; 6th edition; Prentice Hall; ISBN:9780582226289
7. Donald I Pavia, Garry M Lampman and George S Kris; *Introduction to Organic Laboratory Techniques*; 1987; 3rd edition; Harcourt School; ISBN:9780030148132



**BPH-404/
BPL-404**

BIOCHEMISTRY -I- THEORY

40 Hrs

UNIT – 1: Introductory metabolism

Basic concepts of free energy, entropy and enthalpy. Standard free energy change. Exergonic and endergonic reactions. Bioenergetics: high energy phosphate compounds, the ATP/ADP cycle. Synthesis, utilization and breakdown of ATP. Biological oxidation: Redox reactions and oxidoreductases. Electron transport chain: components, role in energy capture, respiratory control. Oxidative phosphorylation- mechanism (Chemiosmotic theory), inhibitors, uncouplers and ionophores. Introduction to metabolism- anabolism and catabolism.

UNIT – 2: Enzymes

Enzymes: Definition, nomenclature and classification. Enzyme units. Factors affecting enzyme activity- substrate, pH, and temperature. Michaelis-Menten equation and Lineweaver Burk plot. Enzyme inhibition- competitive, non-competitive and uncompetitive (derivation of rate equation not required), allosteric enzymes, feedback inhibition. Coenzymes, multienzyme complexes, metalloenzymes and isoenzymes. Mechanism of enzyme action. Enzymes as diagnostic aids.

Therapeutic uses of enzymes (thrombolytic agents and digestive aids). Elementary details of ribozymes, abzymes and extremozymes.

UNIT – 3: Carbohydrates

Classification and general properties of carbohydrates. Biologically important monosaccharides and disaccharides. Homopolysaccharides- structure and biological functions of starch, glycogen, and cellulose. Heteropolysaccharides- biological role of glycosaminoglycans. Carbohydrate metabolism - glycolysis, citric acid cycle, gluconeogenesis, pentose phosphate (HMP shunt) pathway, glycogen metabolism.

UNIT – 4: Amino acids & Proteins

Amino acids: classification and general properties. The peptide bond. Biologically important peptides. Proteins: classification, functions, acid-base properties and denaturation. Orders of protein structure: Primary, secondary (α -helix, β -pleated sheet), supersecondary, tertiary, and quaternary structures. Protein metabolism: Catabolism of amino acid nitrogen- transamination, deamination, ammonia formation, urea cycle, catabolism of carbon skeletons (overview only). Conversion of amino acids to specialized products.

UNIT – 5: Lipids

Classification of lipids. Fatty acids. Eicosanoids: biological functions of thromboxanes, prostaglandins, and leucotrienes. Phospholipids and sphingolipids- biological functions. Structure and functions of cholesterol. Brief account of lipoproteins. Lipid metabolism: oxidation of fatty acids, biosynthesis of saturated and unsaturated fatty acids, biosynthesis of ketone bodies and their utilization.

TEXT BOOKS

1. Robert K Murray, Daryl K Granner, Peter A Mayes; *Harper's Illustrated Biochemistry*; 2006; 27th edition; Tata McGraw - Hill Education, Mumbai; ISBN: 9780071253017
2. Nagini, S.; *Textbook of Biochemistry: Molecular and Clinical Aspects*; 2008; 2nd edition; SciTech Publishers, Chennai; ISBN:81-87328-09-6

REFERENCE BOOKS

1. David L. Nelson, Michael M. Cox, *Lehninger Principles of Biochemistry*, 6th edition, 2012, W.H. Freeman, New York; ISBN: 9781429234146
2. Richard A. Harvey, Denise Ferrier; *Lippincott's Illustrated Reviews: Biochemistry*; 2012; 5th edition; Lippincott Williams & Wilkins; ASIN: B008RDQK9M
3. Koolman, J., Roehm, KH.; *Color Atlas of Biochemistry*; Georg Thieme Verlag; 2012; 3rd edition; ISBN: 9783131003737
4. Satyanarayana U., Chakrapani, U., *Biochemistry*, 3rd edition, 2008, Books and Allied Publishers (P)Ltd. ; ISBN: 9788187134800
5. Philip W. Kuchel, Gregory R. Ralston, *Schaum's Outlines Biochemistry*, 2nd edition, 2011, Mc Graw Hill; ISBN: 9780071779685



**BPH-405/
BPL-405**

**PHARMACEUTICAL MICROBIOLOGY-
THEORY**

40 Hrs

UNIT – 1: Fundamentals of Microbiology

- A. Introduction to Microbiology: Prokaryotes and Eukaryotes, Dimensions in microbial world.
 - B. Viruses: structure, classification, reproduction cultivation, bacteriophages, oncogenic viruses.
 - C. Bacteria: Morphology, anatomy, classification, cultivation, reproduction
 - D. Fungi: Morphology, classification, cultivation, reproduction
- Eubacteria: A brief overview on Rickettsiae, Chlamydiae, Mycoplasmas, Actinomycetes

UNIT – 2: General bacteriological techniques

- A. Methods of identification of Bacteria: Morphology, Staining, Cultural characters, Biochemical reactions Rapid Identification Systems, Serological tests, Phage typing.
- B. Methods of counting of Bacteria: Methods for total count, Methods for viable count.
- C. Methods of isolation of pure Bacterial culture: Pour plate, Streak plate, Micro manipulation, use of Selective media and Enrichment media, Heat differentiation, Motility.

UNIT – 3: Action of physical and chemical agents on microorganisms

- A. Kinetics of cell inactivation: D value, Z value, Inactivation Factor [IF], F and Fo values, Thermal Death Time [TDT], Thermal Death Point [TDP]
- B. Anti microbial effects of moist heat and dry heat. Resistance of microorganisms towards moist and dry heat, factors affecting thermal resistance of microorganisms.
- C. Ionizing radiations: Particulate, electromagnetic radiations, UV rays, factors affecting radiation resistance of microorganisms.
- D. Gases: Ethylene oxide, factors affecting the activities of ethylene oxide, Formaldehyde, Peracetic acid, Hydrogen peroxide, Chlorine dioxide, Propylene oxide, Methyl bromide, Gas plasmas.

UNIT – 4: Sterilization methods, their validation

- A. Need for sterility in Pharmaceutical products and Principle, instrumentation, merits, demerits, limitations and uses of sterilization processes recommended by various pharmacopeias viz., Moist heat sterilization, Dry heat sterilization, Ionizing radiation sterilization, Gaseous (Ethylene oxide) sterilization and sterilization by Filtration.
- B. Validation of sterilization processes: i) Process indicators: Physical, Chemical and Biological, ii) Testing filtration efficiency, iii) sterility testing
- C. Microbiological quality control of non-sterile products: i) Environment monitoring, ii) Microbial count of Pharmaceutical products like aqueous solutions, insoluble solids, oils and hydrophobic ointments, creams and lotions, iii) Detection of specific hazardous organisms, iv) Microbiological assay of B-group vitamins.

UNIT – 5: Antiseptics, Disinfectants, Preservatives

- A. Study of the following chemicals used as antiseptics, disinfectants and preservatives (including their mechanism of action and uses)
Inorganic acids, Alkalis, Halogens and their derivatives, Phenols, Alcohols, Aldehydes, Organic acids, Esters, Quaternary Ammonium compounds, Biguanides, Amidines, Metals, Acridines.
- B. Factors affecting the action of disinfectants and antiseptics.
- C. i) Methods of determination of Minimum Inhibitory Concentration (MIC) for disinfectants. ii) Methods of evaluation of disinfectants iii) Challenge tests for preservatives.
- D. Microbiological Assays of Antibiotics and Vitamins.

TEXT BOOKS

1. Michael E., Kevin M.G. Taylor; *Aulton's Pharmaceutics: The Design and Manufacture of*

Medicines; 2007; 3rd Edition; Churchill Livinstone; ISBN:9780443101083

2. Carter SJ; Cooper Gunn's Tutorial Pharmacy; 2005; 6th edition; CBS Publishers; ISBN:9788123909042

REFERENCE BOOKS

1. Alan H Linton, Heather M Dick; Topley & Wilson's Principles of Bacteriology, Virology and immunity Vol-I: General Microbiology and Immunity; 1990; 8th edition; Edward Arnold, Great Britai; ISBN:9780713145892

2. Jain, NK.; Pharmaceutical Microbiology; 2010; 2nd edition; Vallabh prakashan, New Delhi; ISBN: 9788185731254



**BPH 405P/
BPL-405P**

**PHARMACEUTICAL MICROBIOLOGY
PRACTICAL**

40 Hrs

Ex.No-01: Introduction to Pharmaceutical Microbiology Laboratory

Tasks/Skills: *Understanding the principles and operation (including precautions) of various instruments/apparatuses used in a pharmaceutical microbiology lab.*

Ex.No-02: Preparation and sterilization of culture media

Tasks/Skills: *It is essential for a student to know about the preparation of culture media and its sterilization In this experiment students will prepare and sterilize bacteriological and fungal culture media as broth and as agar .*

Ex.No-03: Inoculation of culture media(cultural methods)

Tasks/Skills: *Developing the skill of aseptic transfer of microorganisms*

Ex.No-04: Isolation of pure culture by pour plate method

Tasks/Skills: *i) Serial dilution of mixed culture ii) aseptic plating the dilutions iii) counting(plate count)of microorganisms(as "colony forming Units")*

Ex.No-05: Isolation of pure culture by streak plate(spreading or looping-out) method)

Tasks/Skills: *Learning various streaking and spreading methods for isolation of a colony of a microorganism)*

Ex.No-06: Determination Bacterial Motility by hanging drop technique.

Tasks/Skills: *i) preparation of hanging drop of a culture ii) observation of motility under reduced illumination in a compound microscope*

Ex.No-07: Study of bacterial morphology by Simple stain

Tasks/Skills: *Learning i)The preparation and staining of bacterial smear for microscopic observation ii) observation of morphology under various objectives of compound microscope*

Ex.No-08: Identification of bacteria by differential stain (Gram stain).

Tasks/Skills: *Determination of Gram character of bacteria*

Ex.No-09: Demonstration of presence of Bacterial capsule by Relief stain(Negative stain).

Tasks/Skills: *Observation of bacteria under dark background in a microscope*

Ex.No-10: Comparison of bactericidal effects of disinfectants(a qualitative evaluation of disinfectants)

Tasks/Skills: *i) Preparation of dilutions of various disinfectants ii) determination of extinction time of the disinfectants iii) comparison of their extinction times*

Ex.No-11: Dry heat sterilization by hot air oven

Tasks/Skills: *Understanding the i) design and operation of hot air oven ii) packing and loading of materials in hot air oven for sterilization.*

Ex.No-12: Moist heat sterilization by Autoclave

Tasks/Skills: *Understanding the i) design and operation of a laboratory Autoclave ii) packing and loading of materials in autoclave for sterilization*

Ex.No-13: Gaseous sterilization (fumigation) using formaldehyde vapours

Tasks/Skills: *Understanding the principle and method sterilization by formaldehyde*

Ex.No-14: Sterilization by membrane filtration

Tasks/Skills: *Understanding the principle,method and precautions of sterilization by bacteria-proof membrane*

Ex.No-15: Sterility testing of Parenterals

Tasks/Skills: *Understanding the principle, methodology, test protocol and interpretation of results as per I.P*

Ex.No-16: Preservation of cultures

Tasks/Skills: *Understanding and implementing the long term preservation of culture on lab scale, research level and industrial scale.*

Ex.No-17: Estimation of Potency of Erythromycin by microbiological assay (using calibration curve)

Tasks/Skills: *Understanding the principle, methodology, test protocol and interpretation of results as per I.P*

Note: *Though 17 are listed, minimum of 12 Practical Exercises need to be completed during the full first year B.Pharm program. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Carter SJ; Cooper Gunn's Tutorial Pharmacy; 2005; 6th edition; CBS Publishers; ISBN:9788123909042

2. Carter, S.J.; Cooper and Gunn s Dispensing for Pharmaceutical Students; 2008; 12th edition CBS Publisher and Distributors, Delhi; ISBN: 9788123909028

3. Indian Pharmacopoeia; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695





BPH-501/
BPL-501

HOSPITAL AND COMMUNITY PHARMACY-
THEORY

40 Hrs

UNIT – 1: Organization & Committees

- A. Organization of Hospitals: Health Care System and the Hospitals, Types of Hospitals, Organizational structure.
- B. Organization of Hospital Pharmacy: Operating a Hospital Pharmacy – Legal Requirements, Functions of Hospital Pharmacy Department, Operational Areas, Organizational structure.
- C. Committees in Hospital: Pharmacy and Therapeutic Committee – Constitution, Function and Pharmacist's Role; Infection Control Committee and the Pharmacists' role.
- D. Hospital Formulary: Concept of Formulary and Developing a Formulary for Hospitals.

UNIT – 2: Medicine Management

- A. Procurement: Procurement methods followed in public and private hospitals, Tendering Process, Pooled Procurement VS Individual procurement, Good Procurement Practices: Quantifying Requirements, Ordering, Receiving and Storing.
- B. Medicine Distribution and Dispensing: Distribution of Medicines to various wards, operating theatre, casualty and out-patient department; Handling of Narcotic and Psychotropic Substances, Cytotoxic Substances.
- C. Managing store/warehouse: Construction and Routine warehouse maintenance.

UNIT – 3: Radio Pharmacy & Clinical Services

- A. Radio Pharmacy: Concept of radio pharmaceuticals and their use, Facilities required for storage and handling, Radiation hazards and protection of operators.
- B. Disposal of Biomedical wastes and expired medicines: Government and institutional guidelines.
- C. Expanded Hospital Pharmacy Services (basic concepts only): Clinical Pharmacy Services, Medicine and poison information service – need of such services, sources of information; Adverse Drug Reactions Monitoring.

UNIT – 4: Community Pharmacy

- A. Concept of Community Pharmacy and Retail Sale of Medicines; Legal Requirements of establishing and operating a community pharmacy: Licensing requirements, conditions of license, maintenance of records and compliance with regulatory issues.
- B. Procurement and Inventory Management: Selection of medicines and their quantities to order, Receiving and checking the orders, Storage of medicines, Stock recording system, reordering and use of computers.
- C. Dispensing and Patient Counselling: Dispensing process, Handling of prescriptions, Handling of prescription and non-prescription medicines, Avoiding dispensing errors;
- D. Patient Counselling and Compliance: Purpose of patient counselling, Modes of providing information to the patient, Barriers in patient counselling and overcoming them, Minimum information necessary to be given to the patient or buyer, understanding the patient non-compliance and methods to promote compliance (adherence).

UNIT – 5: Rational Use of Medicines

- A. Promoting rational use of medicines: concept and pharmacists' role; antimicrobial resistance: contributing factors and the pharmacists' role in containment of resistance.
- B. Responding to common symptoms: Cold and Cough, Indigestion and Hyperacidity,

Constipation, Diarrhoea, Acne, Eczema, Scabies, Lice infestation; Understanding the symptoms, recognizing the warning signs requiring medical attention, non-pharmacological and pharmacological treatments (with non-prescription medicines only).

TEXT BOOKS

1. Revikumar, KG. and Miglani, BD.; *A Textbook of Pharmacy Practice*; 2009; 1st edition; Career Publications, Pune; ISBN:978-81-88739-50-9

2. Ramesh K. Goyal and Parikh, RK.; *Merchant's & Goyals's A Text – Book of Hospital Pharmacy*; 2011; 11th edition; B.S. Shah Prakashan, Ahmedabad; ISBN:81-8416-008-9.

REFERENCE BOOKS / MATERIAL

1. Jonathan D. Quick, et al.; *Managing Drug Supply*; 1997; 2nd edition; Kumarian Press Inc. USA; ISBN:1-56549-047-9.

2. Indian Pharmaceutical Association, Central Drug Standard Control Organization and WHO; *Good Pharmacy Practice Training Manual –A Training Manual for Community Pharmacists in Indian Settings*; 2005; ISBN:???

3. Allen Jr. LV. Remington: *The science and practice of pharmacy*, 22nd Edition. Lippincott Williams & Wilkins, Philadelphia, 2010. ISBN:9780857110626

4. William E. Hasan; *Hospital Pharmacy*; 1986; 5th edition; Lea & Febiger, Philadelphia, USA; ISBN:0812110145.

5. Allwood, MC. and Fell, JT.; *Textbook of Hospital Pharmacy*; 2010; 1st Indian Reprint; CBS Publishers and Distributors, New Delhi; ISBN:978-81-239-1876-1.



**BPH-501P/
BPL-501P**

**HOSPITAL AND COMMUNITY PHARMACY
PRACTICAL**

40 Hrs

Ex.No-01: Pharmaceutical calculation – 1

Tasks/Skills: Application of % strength and ratio strength

Ex.No-02: Pharmaceutical calculation – 2

Tasks/Skills: Allegation methods.

Ex.No-03: Pharmaceutical calculation – 3

Tasks/Skills: Various Proof strengths of alcohol (overproof, underproof)

Ex.No-04: Pharmaceutical calculation – 4

Tasks/Skills: Calculation of dosage using house hold measure. Reducing and Enlarging given prescription formula

Ex.No-05: Pharmaceutical calculation – 5

Tasks/Skills: Pediatric and Geriatric dose calculation, BMI calculations.

Ex.No-06: Pharmaceutical calculation – 6

Tasks/Skills: Calculations for isotonicity.

Ex.No-07: Development of Monograph for Hospital Formulary

Tasks/Skills: The student will learn how to collect and collate information and develop

hospital formulary.

Ex.No-08: Quantification of Medicine Requirements – 1

Tasks/Skills: *The student will learn to calculate the requirement of medicine for the next year based on morbidity data.*

Ex.No-09: Quantification of Medicine Requirements – 2

Tasks/Skills: *The student will learn to calculate the requirement of medicine for the next year based on consumption data.*

Ex.No-10: ABC Analysis

Tasks/Skills: *The student will learn to perform ABC analysis and apply the result in the medicine management.*

Ex.No-11: VEN Analysis

Tasks/Skills: *The student will learn to perform VEN analysis and apply the result in prioritising medicines in procurement.*

Ex.No-12: Designing of Indent Form

Tasks/Skills: *The student will learn developing indenting form and documenting the medicine received and issued.*

Ex.No-13: Medicine Management Practices in Hospitals

Tasks/Skills: *The student will visit a Hospital Pharmacy in the locality and write a report on procedures followed: Medicine procurement and receipt, distribution within the hospital and storage practices.*

Ex.No-14: Medicine Information Queries

Tasks/Skills: *The student will learn how handle medicine information queries: receiving, documenting and referring the information resources and preparing a reply.*

Ex.No-15: Dispensing of Medicines – 1: Prescription Monitoring (Drug – Drug Interaction)

Tasks/Skills: *The students will role play to receive the prescription, examine it for drug-drug interaction and dispense medicines.*

Ex.No-16: Dispensing of Medicines – 2: Patient counseling (Dispensing of Non-prescription Cold and Cough Medicines)

Tasks/Skills: *The student will learn about Non-prescription cold and cough products and what information required to be given while dispensing them.*

Ex.No-17: Dispensing of Medicines – 3: Prescription Monitoring (Different types of Medication Errors)

Tasks/Skills: *The student will be asked to look at the prescription and check for medication errors.*

Ex.No-18: Dispensing of Medicines – 4: Patient Counseling (Dispensing of ORS)

Tasks/Skills: *The student will learn about ORS and what information required to be given while dispensing ORS.*

Ex.No-19: Dispensing of Medicines – 5: Prescription Monitoring (Different types of Medication Errors)

Tasks/Skills: *The student will be asked to look at the prescription and check for medication errors.*

Ex.No-20: Dispensing of Medicines – 6: Prescription Monitoring (Different types of Medication Errors)

Tasks/Skills: *The student will be asked to look at the prescription and check for medication errors.*

Note: *Though 20 are listed, minimum of 15 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included*

BOOKS FOR REFERENCE

1. Revikumar, KG. and Miglani, BD.; *A Textbook of Pharmacy Practice*; 2009; 1st edition; Career Publications, Pune; ISBN:978-81-88739-50-9.
2. Ramesh K. Goyal and Parikh, RK.; *Merchant's & Goyals's A Text – Book of Hospital Pharmacy*; 2011; 11th edition; B.S. Shah Prakashan, Ahmedabad; ISBN:81-8416-008-9.
3. Ansel HC.; *Pharmaceutical calculations*; 2010; 14th edition, Lippincott Williams & Wilkins, Philadelphia; ISBN:1451120362
4. Sangeeta Sharma, Usha Gupta, Gurbani, NK., and Parameswar, R.; *Drug Store Management- Standard Operating Procedure*; 2006; 1st edition; Ane Books India, New Delhi;



**BPH-502/
BPL-502**

**PHARMACEUTICAL UNIT OPERATIONS –II -
THEORY**

40 Hrs

UNIT – 1: Size Reduction, Separation & Mixing.

A. SIZE REDUCTION: Mechanisms of Size Reduction; Classification of Size Reduction Equipment; Size Reduction—Equipment; Selection of a Mill; Theories of Comminution

B. SIZE SEPARATION: Official Standards for Powders; Sieves; Sieve Analysis-Testing of Powder; Equipment for Size Separation; Settling Behaviour of Solids Methods; Elutriation Methods

C. MIXING: (i)Mixing of Solids - Interparticle Interactions—Segregation; Mechanism of Mixing in Solids; Degree of Mixing and Statistical Evaluation; Factors Influencing Mixing; Equipment; (ii)Mixing of Liquids

Mechanisms of Liquid Mixing; Mixing Vessels or Tanks; Liquid Mixing Devices (iii)Mixing of Semisolids Equipment

UNIT – 2: Extraction & Ion Exchange

A. EXTRACTION: Principles; Galenicals; Leaching; Factors Influencing the Extraction; Solid Liquid Extraction – Equipment, Liquid Liquid Extraction Equipment

B. ION EXCHANGE: Ion Exchange Resins; Ion Exchange Resins Applications; Mechanism of Ion Exchange; Industrial Equipment

UNIT – 3: Distillation & Evaporation

A. DISTILLATION: Theory; Classification of Methods; Simple Distillation; Flash Distillation; Fractional Distillation; Azeotropic and Extractive Distillation; Distillation under Reduced Pressure; Steam Distillation

Molecular Distillation

B. EVAPORATION: Factors Influencing Evaporation; Classification of Evaporators; Equipment; Multiple Effect Evaporator

UNIT – 4: Crystallization & Drying

A. CRYSTALLIZATION: Characteristics of Crystals; Theory of Crystallization; Equipment; Caking of Crystals

B. DRYING: Theory of Drying; Classification; Equipment

UNIT – 5: Environmental Pollution & Pharmaceutical Industry

A. ENVIRONMENTAL POLLUTION & CONTROL: Water Pollution and Control; Air Pollution and Control; Thermal Pollution and Control; Noise Pollution and Control

B. PHARMA. INDUSTRY—ESTABLISHMENT: Pharmaceutical Industry Location; Pharmaceutical Plant Layout; Utilities and Services

TEXT BOOK

1. C.V.S. Subrahmanyam, ; Thimma Setty, J., Sarasija Suresh and Kusum Devi, V.; *Pharmaceutical Engineering(Unit Operations-I)*; 2nd edition; 2011; Vallabh Prakashan, New Delhi; ISBN: 978-81-85731-63-6

2. K. Sambamurthy, *Pharmaceutical Engineering, First Edition, 1998, New Age international (P) limited, New Delhi, ISBN: 81-224-1169-X*

3. Carter SJ (Ed), *Copper and Gunn's Tutorial Pharmacy, 6th Edition (Indian Reprint 2000), CBS Publishers and Distributors Private Limited, New Delhi*

REFERENCE BOOK

1. Green, Don W.; Perry, Robert H; *Perry's Chemical Engineers' Handbook*; 2008; 8th edition; McGraw-Hill; ISBN: 978-0071422949

2. Warren Lee McCabe, Julian Cleveland Smith, Peter Harriott; *Unit Operations of Chemical Engineering*, McGraw-Hill Professional, 2005, ISBN 0072848235, 9780072848236



**BPH-502P/
BPL-502P**

**PHARMACEUTICAL UNIT OPERATIONS
PRACTICAL**

40 Hrs

Ex.No-01: Variation of pressure head with fluid velocity

Tasks/Skills: To study the relationship between pressure head and fluid velocity and gain skill in the use of manometer and compute the pressure heads by using basic principles of manometry

Ex.No-02: Determination of humidity by psychrometric method

Tasks/Skills: The student will learn the concepts of measurement of dry bulb and wet bulb temperature, use of humidity chart and the measurement of humidity. He will be able to find the precise relationship between humidity and the prevailing atmospheric conditions.

Ex.No-03: Determination of humidity by dew point method

Tasks/Skills: The student will learn the concepts of dew and dew point, use of humidity chart and the measurement of humidity. He will be able to find the precise relationship between humidity and the prevailing atmospheric conditions.

Ex.No-04: Determination of Type of Flow (Reynolds Number)

Tasks/Skills: *The student will learn the concepts of fluid flow pattern, use simple techniques to measure the flow rates, gain familiarity with flow patterns and understand concepts of dimensionless groups and their significance in pharmaceutical systems*

Ex.No-05: Study Rate Factors in Filtration

Tasks/Skills: *The student will learn the concepts of filtration, use simple techniques filtration, and understand effect of different parameters that control the filtration rate, graphically present the results.*

Ex.No-06: Determination of viscosity (Stoke's law)

Tasks/Skills: *The student will learn the concepts of viscosity, use sedimentation techniques, acquaint with Stoke's equation and compare the viscosities of different liquids of pharmaceutical importance*

Ex.No-07: Construction of Solubility curve for a given substance

Tasks/Skills: *The student will learn the concepts of solubility; learn the technique of preparation of saturated solution. Apply the gravimetric method for solubility determination, establish the relationship between solubility and temperature and construct solubility curve.*

Ex.No-08: Study of Ball Mill and its Operation

Tasks/Skills: *The student will learn the concepts of size reduction, develop operating skill of a laboratory scale ball mill, find out the time requirement for grinding solids to a predetermined size level*

Ex.No-09: Determination of Standards for Wire Mesh Sieves

Tasks/Skills: *The student will learn the concepts of size separation, get an idea about the standards of wire mesh sieve and its significance in powder grading*

Ex.No-10: Particle size determination by sieve analysis

Tasks/Skills: *The student will learn the concepts of size separation, get skills in grading powder, make a statistical interpretation of particle size distribution and construct the graphical plots depicting the size distribution of particles*

Ex.No-11: Rate of drying curves

Tasks/Skills: *The student will learn the concepts of drying, get skills in dryer operation, establish the time temperature relationships for drying, and construct the graphical plots depicting the rate of drying and the various phases of drying.*

Ex.No-12: Uniformity index (solid mixing)

Tasks/Skills: *The student will learn the concepts of mixing, get skills in planetary mixer operation, establish the time –degree of mixing relationships for powder blends, and optimize the mixing operation.*

Ex.No-13: Rate factors in evaporation

Tasks/Skills: *The student will learn the concepts of evaporation, use simple techniques evaporation, and understand effect of different parameters that control the evaporation rate, graphically present the results.*

Ex.No-14: Instantaneous rate of drying

Tasks/Skills: *The student will learn the concepts of drying, get skills in dryer operation,*

establish the time temperature relationships for drying, report on the instantaneous rate of drying for different solids at different temperatures

Note: Though 14 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Jeevan jyothi, B.; Practical manual of pharmaceutical engineering; 4th edition; 2008, Nirali Prakashan, New Delhi; ISBN: 9788185790640

2. Sudhakara Reddy Pondugula; Gopal rao M., Govinda Rajan Gudala, Vamsi Krishna, R.; Pharmaceutical engineering- Practical Manual; 1st edition; 2007; Pharma Book Syndicate; ISBN: 9788188449309



**BPH-503/
BPL-503**

BIOCHEMISTRY -II- THEORY

40 Hrs

UNIT – 1: Nutrition

A. Elements of nutrition: Basal metabolic rate, nitrogen balance. Essential amino acids and essential fatty acids. Protein quality. Protein energy malnutrition: marasmus and kwashiorkor. Obesity: causes and consequences.

B. Vitamins: classification. Sources, requirements, biological actions and clinical significance of fat-soluble (A, D, E, and K) and water-soluble (thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, biotin, folic acid and vitamin B12) vitamins. Minerals: Distribution, biological functions and clinical significance of calcium, phosphate, magnesium, iron, zinc, copper, manganese, iodine, selenium and fluoride.

UNIT – 2: Biochemical basis of Diseases

Biochemical basis of diseases: Inborn errors of metabolism- fundamental concept with phenylketonuria as an example. Diabetes mellitus: classification, metabolic alterations, diagnosis, management, complications. Atherosclerosis: risk factors, biochemical findings and management. Jaundice: Bilirubin metabolism, classification, diagnosis and management of jaundice.

UNIT – 3: DNA & RNA

A. Nucleic acids: purine and pyrimidine bases, nucleosides and nucleotides. Biologically important nucleotides. Biosynthesis and catabolism of purines and pyrimidines.

B. DNA structure- Watson and Crick model. A, B, and Z forms of DNA. DNA denaturation. Differences between DNA and RNA. Major classes of RNA- structure and biological functions. Minor classes of RNA.

UNIT – 4: DNA Transcription

A. The central dogma of molecular biology. Organization of the prokaryotic and eukaryotic genome. Gene concept. DNA replication- enzymes, basic mechanism and inhibitors. DNA damage by physical and chemical mutagens.

B. DNA repair- photoreactivation, excision repair. Transcription- RNA polymerase, overview of steps, inhibitors. Brief account of post-transcriptional modifications. Reverse transcription (concept only).

UNIT – 5: Genetic code Translation & applications

A. Genetic code- general features. Translation- steps. Inhibitors. Post-translational modifications. Regulation of gene expression- levels of regulation, constitutive and inducible genes. Jacob and Monod lac operon model.

B. Recombinant DNA technology: Basic steps in cloning. Restriction endonucleases, cloning vectors (pBR322), phages (□ phage), cosmids. Introduction of rDNA into host cells by calcium phosphate coprecipitation, electroporation, lipofection, microinjection. Screening of recombinants by marker inactivation. Applications of rDNA technology.

TEXT BOOKS

1. Robert K Murray, Daryl K Granner, Peter A Mayes; *Harper's Illustrated Biochemistry*, 27th edition, 2006, Tata McGraw - Hill Education, Mumbai, ISBN: 9780071253017

2. Nagini, S., *Textbook of Biochemistry: Molecular and Clinical Aspects*. 2nd edition, 2008, SciTech Publishers, Chennai. ISBN: 8187328096

REFERENCE BOOKS

1. David L. Nelson, Michael M. Cox, *Lehninger Principles of Biochemistry*, 6th edition, 2012, W.H. Freeman, New York; ISBN: 9781429234146

2. Richard A. Harvey, Denise Ferrier; *Lippincott's Illustrated Reviews: Biochemistry*; 2012; 5th edition; Lippincott Williams & Wilkins; ASIN: B008RDQK9M.

3. Koolman, J., Roehm, KH.; *Color Atlas of Biochemistry*; Georg Thieme Verlag; 2012; 3rd edition; ISBN: 978-3131003737

4. Satyanarayana U., Chakrapani, U., *Biochemistry*, 3rd edition, 2008, Books and Allied Publishers (P)Ltd. ; ISBN: 9788187134800

5. Philip W. Kuchel, Gregory R. Ralston, *Schaum's Outlines Biochemistry*, 2nd edition, 2011, Mc Graw Hill; ISBN: 9780071779685



**BPH-503P/
BPL-503P**

BIOCHEMISTRY PRACTICALS

40 Hrs

Ex.No-01: Comparative study of natural and processed food grain with respect to nutritional aspects. Basal metabolic rate & calculating calorific requirement for various walks of people. Various forms of Exercises & calorie expenditure.

Tasks/Skills: *Study of nutritional value of food materials, Calorie expenditure for various physical activities.*

Ex.No-02: Preparation of buffers & Measuring buffer capacity.

Ex.No-03: Determination of reducing sugars using 3, 5-dinitrosalicylic acid

Ex.No-04: Determination of Glucose by enzyme glucose oxidase.

Ex.No-05: Determination of optimum pH for any enzyme such as Amylase/Catalase/Phosphatase.

Ex.No-06: Quantitative estimation of cholesterol, triglycerides, HDL, LDL.

Ex.No-07: Estimation of protein by Biuret/Lowry et al method./Separation of Serum protein by electrophoresis

Ex.No-08: Isolation of DNA from coconut Endosperm & estimation

- Ex.No-09:** Assay of Some Enzyme.
- Ex.No-10:** Isolation of RNA from yeast & assay by Orcinol method.
- Ex.No-11:** Estimation of urea & Assay of serum AST/ALT.
- Ex.No-12:** Estimation of Uric acid
- Ex.No-13:** Optical rotation of carbohydrates
- Ex.No-14:** Estimation of Creatinin
- Ex.No-15:** Analysis of normal and abnormal constituents of urine.

Note: Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Keith Wilson, John Walker; *Principles and Techniques of Biochemistry and Molecular Biology*; 2010; 7th edition; Cambridge University Press; ISBN:9780521178747
2. Rodney Boyer; *Modern Experimental Biochemistry*; 2002; 3rd edition; Pearson Education; ISBN:9788177588842
3. Beedu Sashidhar Rao and Vijay Deshpande; *Experimental Biochemistry: A Student Companion*; 2005; 1st edition; IK International Publishing House; ISBN:9788188237418



**BPH-504/
BPL-504**

PHARMACOLOGY – I - THEORY

40 Hrs

Note: Mechanism of action, pharmacological actions, adverse drug reactions, precautions, contraindications, preparations, drug interactions, therapeutic uses/indications are required to be studied wherever necessary.

UNIT – 1: General Pharmacology – Part 1

- A. Introduction to Pharmacology, scope, various divisions and terminologies. Drug nomenclature (chemical name, non – proprietary name, brand name) Essential drug concept, Orphan drugs, National drug policy.
- B. Routes of drug administration – A survey, advantages and disadvantages.
- C. Special drug delivery systems: Transdermal, ocusert, implants, osmotic pump, liposome encapsulation, drug targeting, nano-drug delivery systems and pro-drugs.
- D. Pharmacokinetics: Detailed study of the principles, processes of Absorption, Bioavailability, Distribution, Biotransformation, Elimination of drugs including the structure and function of membranes/organs.

UNIT – 2: General Pharmacology – Part 2

- A. Pharmacodynamics: Principles and mechanisms of drug action, Competitive and non – competitive antagonism. Receptor types, structure and function. Agonist, antagonist, partial agonist, inverse agonist, ligand, affinity, intrinsic activity (efficacy), drug action, drug effect. Transducer mechanisms. Regulation of receptors.
- B. Dose-response relationship - Potency, efficacy, selectivity. Therapeutic index and therapeutic window, combined effect of drugs – synergism (additive, Supraadditive), antagonism (physical, chemical, physiological, receptor) – Definitions with examples. Fixed

drug combination – advantages, disadvantages with examples. Factors modifying drug action, tolerance (cross tolerance, tachyphylaxis,) drug resistance, cumulation.

C. Adverse drug reactions: Classification, side effects, secondary effects, toxic effects, intolerance, idiosyncrasy, drug allergy, (types, treatment, examples) photosensitivity, drug toxicity – p glycoprotein, drug dependence, drug withdrawal reactions, teratogenicity, carcinogenicity, mutagenicity, drug induced diseases (Iatrogenic disease) – definitions with examples.

D. Drug interactions: Drug – Drug interactions, pharmacological basis of drug interactions, clinical Significance of drug interactions. Identifying potential drug interactions (outside the body, at site of absorption, during distribution, on receptors, during metabolism, drug excretion), drug food interactions and drug and body tissue interaction.

E. Bioassay: Definition, principles of bioassay and types of bioassay.

F. Clinical pharmacology and rational drug use Principles of drug therapy Principles of prescription writing: Prescribing drugs, drug history, p-drug concept, cost – containment. Prescriptions, warnings and consent, compliance (patient and doctor), placebo medicines and self - medication. Prescription of common disorders, Drugs in children and pregnancy Drugs in geriatrics Clinical uses of drugs in hepatic and renal failure.

G. Adverse drug reaction monitoring and reporting Drug discovery and drug development – clinical drug development (techniques of discovery, models, preclinical studies in animals), ethics, informed consent, phases of clinical development (Phase 1, Phase 2, Phase 3, Phase 4), types of clinical trials, design of trials, pharmacoepidemiology, pharmacovigilance and pharmacoconomics.

UNIT – 3: Drugs acting on ANS, Skeletal Muscle and Local Anaesthetics

A. General considerations- Differences between somatic and autonomic nervous system, sympathetic and parasympathetic system, general outlay of autonomic nervous system, steps in neurohumoral transmission, co-transmission.

B. Cholinergic system- cholinergic transmission, characteristics of muscarinic receptors, nicotinic receptors and cholinergic responses mediated. cholinergic drugs-classification, cholinergic agonists - cholinomimetic alkaloids, anticholinesterase (reversible and irreversible), pharmacological actions and uses. Pharmacotherapy of glaucoma and myasthenia gravis and anticholinesterase (organophosphorous compounds) poisoning.

C. Anticholinergic drugs-classification, atropine (prototype), atropine substitutes (mydriatics, antisecretory-antispasmodics, antiparkinsonian), atropine poisoning

D. Drugs acting on autonomic ganglia-clinically important ganglionic stimulants and ganglion blockers.

E. Adrenergic transmission and its modification by drugs.

Adrenergic receptors & adrenergic responses mediated

Adrenergic drugs- classification, (Catecholamines, (adrenaline, nor adrenaline, dopamine) and non catecholamines, β agonists), pressor agents, cardiac stimulants, bronchodilators, nasal decongestants, CNS stimulants, anorectics, uterine relaxants and vasodilators.

F. Anti-adrenergic drugs - classification, α blockers - (Phenoxybenzamine as prototype), β blockers - (Propranolol as prototype) α & β blockers - (Labetalol) mechanism of action, pharmacological actions, adverse drug reactions, precautions, contraindications, preparations, drug interactions, therapeutic uses/indications.

G. Skeletal Muscle Relaxants: Peripheral neuromuscular blockers - classification; Centrally acting muscle relaxants; Directly acting muscle relaxants.

H. Local Anaesthetics: Classification, mechanism and actions of local anaesthetics, synergism with vasopressors, adverse effects, indications, contraindications and complications of different routes of administration of local anaesthetics

UNIT – 4: Drugs Acting on CNS – Part 1

A. Physiological role of neuro transmitters (excitatory, inhibitory), principles of neuronal regulation and basis of drug action in the CNS.

B. General anaesthetics– Definition, mechanism of action, stages of anesthesia, classification, properties of inhalational anaesthetics, advantages and disadvantages. Intravenous anaesthetics – (inducing agents, slower acting drugs) Dissociative anesthesia (ketamine), neuroleptanalgesia. Preanaesthetic medication.

C. Aliphatic alcohol – Pharmacological actions, interactions, toxicity, clinical uses. Disulfiram, treatment of alcoholism and treatment of methyl alcohol poisoning.

D. Sedative - hypnotics. Definition, classification – barbiturates, benzodiazepines, Non- Benzodiazepine hypnotics, benzodiazepine antagonist. Treatment of barbiturates poisoning.

E. Antiepileptic drugs – Classification of drugs Pharmacotherapy of epilepsy, Management of status epilepticus.

F. Non steroidal anti – inflammatory drugs –classification, Aspirin (prototype), non-selective and selective cyclooxygenase inhibitors. Drugs used for rheumatoid arthritis and gout.

G. Drugs for CNS degenerative disorders.

H. Drugs for Parkinsonism – classification of drugs, pharmacotherapy of alzheimer’s disease, huntington’s disease, motor neuron disease.

UNIT – 5: Drugs Acting on CNS – Part 2

A. Antipsychotic drugs – Classification (chlorpromazine prototype) Atypical Antipsychotics Pharmacotherapy of Schizophrenia. Antianxiety drugs – Classification Sedating, non sedating antianxiety drugs, Pharmacotherapy of anxiety. Antidepressant drugs – Classification (Imipramine prototype) MAO inhibitors Selective serotonin reuptake inhibitors (SSRI’s) Antimanic drugs – Lithium and others.

B. Opioid Analgesics – Classification (Morphine prototype) Management of acute morphine poisoning, Other opioids, partial agonists, agonist – Antagonists, Pure antagonists, Management of opium dependence

C. CNS stimulants - Classification, Cognition enhancers (Nootropics) – uses with examples.

D. Therapeutic Gases – Oxygen, Nitrous oxide, Carbon dioxide and their uses.

TEXT BOOKS

1. Satooskar, RS., Bhandarkar, SD., Ainaipure, SS.; *Pharmacology and Pharmacotherapeutics*; 2006; 19th edition; Popular Prakashan Pvt Ltd; ISBN: 9788179912515

2. Tripathi, KD.; *Essentials of Medical Pharmacology*; 2008; 6th edition; Jaypee Brothers Medical Publishers (P) Ltd; ISBN:8184480857

REFERENCE BOOKS

1. Bertram G. Katzung; *Basic Clinical Pharmacology*; 2011; 12th edition; McGraw-Hill Medical; ISBN: 978-0071764018

2. Richard A. Harvey, Pamela C. Champe; *Lippincott's Illustrated Reviews: Pharmacology*; 2005; 4th edition; Lippincott Williams & Wilkins; ISBN: 9780781741187

3. Humphrey P. Rang, Maureen M. Dale, James M. Ritter, Rod J. Flower, Graeme Henderson; *Rang & Dale's Pharmacology*; 2011; 7th edition; Churchill Livingstone; ISBN: 9780702034718

4. David Grahame-Smith, Jeffrey Aronson; *Oxford Textbook of Clinical Pharmacology and Drug Therapy*; 2002; 3rd edition; Oxford University Press, USA; ISBN: 9780192632340

5. Sharma, HL., Sharma, KK.; *Principles Of Pharmacology*; 2013; 2nd edition; Paras Publications; ISBN: 9788181913562



**BPH-505/
BPL-505**

**PHARMACEUTICAL BIOTECHNOLOGY-
THEORY**

40 Hrs

UNIT – 1: Introduction, Immunology and Immunological Products

- A. Biotechnology: Introduction, Definition and scope
- B. Immunology: Principles, Antigen, Antibodies and haptens, Immune system (T cells & B cells), Types of Immunity: Cellular and Humoral immunity, Active and Passive Immunity, Hybridoma Technology.
- C. Immunological Products: Preparation, standardization and storage of the following:
 - 1)Toxoids: Diptheria and tetanus
 - 2)Vaccines: BCG ,Typhoid cholera and Rabies, Polio,
 - 3)Sera- Diptheria, Tetanus and antivenoms
 - 4)Monoclonal Antibodies

UNIT – 2: Bioprocess technology & Microbial biotransformation

- A. Bioprocess: Definition, stages & Unit operations involved in a Bioprocess.
- B. Screening and Strain improvement of microorganisms, Media formulation, development of bioprocess.
- C. Types, design and automation of bioreactor (Fermenter)
- D. Microbial biotransformation: Stages, types of reaction mediated by microorganisms

UNIT – 3: Products of bioprocess technology

- Biosynthetic Pathway, Fermentative Production, Isolation and storage of the following:
- A. Organic compounds: Ethanol, Citric acid, Dextran, Vitamin B12,
 - B. Antibiotics: Penicillin, Streptomycin, Tetracycline, Rifampicin.
 - C. Enzymes: Amylase, Protease, Hyaluranidase, Streptokinase and Streptodornase.

UNIT – 4: Immobilization techniques

- A. Definition, advantages, limitations and applications of immobilization,.
- B. Detailed study of methods of immobilization for enzymes and cells: Adsorption, Covalent coupling, Entrapment, Cross-linking. Advantages and disadvantages of each method.
- C. Reactors for immobilized systems.

UNIT – 5:Genetic Engineering

- A. Recombinant DNA (rDNA), technology: i) Requirements, Steps involved in rDNA technology, Identification methods for recombinants or transformants, Expression of cloned genes, Application of r-DNA technology in the production of Humulin, Hepatitis-B Vaccine,

Interferons, Clotting factors.

B. Polymerase Chain Reaction: Types, Steps and Application

C. DNA sequencing: Maxam and Gilbert technique, Sanger's process and Automated computer method. Gene library.

TEXT BOOKS

1. Jain, NK.; *Pharmaceutical Microbiology*; 2010; 2nd edition; Vallabh Prakashan, New Delhi; ISBN:9788185731254

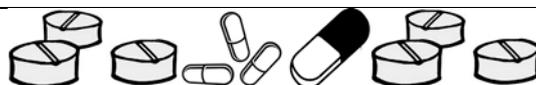
2. Nagori, BP., Roshan Issarani; *Foundations in Pharmaceutical Biotechnology*; 2007; Pharma Book Syndicate; ISBN:8188449296

3. Dubey, RC., *A Text Book of Biotechnology*; 2007; 4th edition; S. Chand & Co, New Delhi; ISBN:9788121926089

REFERENCE BOOKS

1. Anjali Shukla; *Handbook of Biotechnology*; 2007; 3rd edition, Academic(India) Publishers, New Delhi; ISBN:9788185185262

2. Trehan, Keshav, *Biotechnology*; 2013; 1st edition(reprint); New Age International Publishers, New Delhi; ISBN:9788122401295



B. Pharm. VI Semester

**BPH-601 /
BPL-601**

**PHARMACEUTICAL DOSAGE FORMS - I
THEORY**

40 Hrs

UNIT – 1: Preformulation Studies

A. Goals of preformulation studies, Bulk characterization: crystallinity, polymorphism, crystal purity, hygroscopicity, particle characterization, fine powder flow properties

B. Solubility analysis: solubility, partition coefficient, dissolution; drug and product stability, thermal effects, pKa, stability and compatibility studies.

UNIT – 2: Solutions

Advantages and disadvantages of solutions as an oral dosage form, Choice of solvents – aqueous and non-aqueous solutions, Additives used in liquid orals. Types of liquid preparations, Preparation of solutions, Sucrose and non-sucrose based syrups, Dry syrups.

UNIT – 3: Disperse systems

A. Suspensions: Reasons for suspensions, Pharmaceutical applications of suspensions, Formulation of suspensions, viscosity modifiers.

B. Emulsions: Purpose of emulsions and of emulsification, Types of emulsions, Formulation of emulsions, preservation and stability of emulsions.

UNIT – 4: Pharmaceutical Aerosols

Advantage and disadvantage of aerosols, Components of aerosol package, Types of propellants, Aerosol systems, Aerosol formulations, Selection of components, Aerosol filling, Quality control of pharmaceutical aerosols

UNIT – 5: Packaging of pharmaceuticals

Containers and closures: compendium terms applying to types of containers, factors influence choice of containers, Protective functions of pack, Types of pack – tamper resistant packaging, Packaging materials – glass, plastics, rubbers.

TEXT BOOKS

1. Aulton ME. *Aulton's Pharmaceutics: The design and manufacture of medicines*, 3rd Edition, Churchill Livingstone, New York, 2007. ISBN-13: 9780443101083
2. Allen Jr. LV, Popovich NG, Ansel HC. *Ansel's pharmaceutical dosage forms and drug delivery systems*. 9th Edition. Philadelphia: Lippincott Williams & Wilkins, 2010. ISBN-13: 9788184733914

REFERENCE BOOKS

1. Allen Jr. LV. *Remington: The science and practice of pharmacy*, 22nd Edition. Lippincott Williams & Wilkins, Philadelphia, 2010. ISBN-13: 9780857110626.
2. Lachman L, Lieberman HA. *The theory and practice of industrial pharmacy*, 3rd Edition, CBS Publisher, New Delhi, 2009. ISBN-13: 9788123916798
3. Florence AT, Siepmann J. *Modern Pharmaceutics*, 5th Edition (2 volumes), CRC Press, USA. 2009. ISBN-13: 9781420065701
4. Collett DM, Aulton ME. *Pharmaceutical practice*, 1st edition, Churchill Livingstone, New York, 1990. ISBN-13: 9780443036446



**BPH-601P/
BPL-601P**

**PHARMACEUTICAL DOSAGE FORMS –I
PRACTICAL**

40 Hrs

Ex.No-01: Preparation and evaluation of Syrup IP

Tasks/Skills: *Sugar based aqueous solution for formulating liquid oral dosage forms*

Ex.No-02: Development and preparation of Disodium hydrogen citrate syrup

Tasks/Skills: *Organoleptically acceptable liquid for internal use*

Ex.No-03: Development and preparation of Vitamin B Complex Syrup

Tasks/Skills: *Stable and soluble liquid vitamin preparation*

Ex.No-04: Development and preparation of a cough syrup

Tasks/Skills: *Liquid oral dosage form in a viscous palatable medium*

Ex.No-05: Preparation and evaluation of Povidone Iodine solution BPC

Tasks/Skills: *Monophasic lotion*

Ex.No-06: Preparation and evaluation of Aluminium Hydroxide Gel IP

Tasks/Skills: *Suspension for oral use and its settling rate*

Ex.No-07: Formulation and evaluation of paracetamol suspension

Tasks/Skills: *Palatable effective oral suspension*

Ex.No-08: Formulation and evaluation of Amoxicillin Oral Suspension

Tasks/Skills: *Antibiotic oral liquid and its stability*

Ex.No-09: Development and evaluation of liquid paraffin oral emulsion

Tasks/Skills: *Emulsion for oral administration and selection of a suitable emulsifying agent*

Ex.No-10: Test for hydrolytic resistance IP of glass containers

Tasks/Skills: *Alkalinity test for containers for parenteral preparation*

Ex.No-11: Rubber closure test IP/ Plastic container test IP

Tasks/Skills: *Validation of pharmacopoeial specifications of containers for injectable dosage forms*

Ex.No-12: Effect of pH on the partition coefficient of a model drug (paracetamol)

Tasks/Skills: *Partitioning of a drug between organic and aqueous phases*

Ex.No-13: Microscopical evaluation, rheology and sedimentation rate studies of an official suspension dosage form

Tasks/Skills: *Physical stability of a suspension*

Ex.No-14: Aerosol formulation development

Tasks/Skills: *Role of aerosol propellants and pressurized containers*

Ex.No-15: Study of a typical Drug-Excipient compatibility

Tasks/Skills: *Drug excipient interactions*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.*

BOOKS FOR REFERENCE

1. Mithal BM; *A Text Book of Pharmaceutical Formulation*; 2010; 6th edition, VallabhPrakashan, New Delhi; ISBN:9788185731049

2. Allen Jr. LV.; *Remington: The science and practice of pharmacy*; 2010; 22nd edition; Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626

3. Collett DM, Aulton ME.; *Pharmaceutical practice*; 1990; 1st edition; Churchill Livingstone, New York; ISBN: 9780443036446

4. Allen Jr. LV, Popovich NG, Ansel HC.; *Ansel's pharmaceutical dosage forms and drug delivery systems*; 2010; 9th Edition. Philadelphia: Lippincott Williams & Wilkins; ISBN:9788184733914



**BPH-602/
BPL-602**

MEDICINAL CHEMISTRY - I- THEORY

40 Hrs

UNIT – 1: Drug design Principles I

A. Drug distribution: Oral administration, Parenteral administration, Protein Binding, Tissue depots. Drug metabolism, excretion,

B. Acid-Base properties: Acid/Base-Conjugate Acid/Conjugate Base pairs, Acid strength, % Ionization, Drug distribution and pKa, Henderson-Hasselbach equation

C. Receptor: Receptor theories, Forces involved in drug receptor interaction

Guidelines for Unit 2 to 5: The following topics shall be treated covering chemical naming, structure activity relationship, physicochemical and stereochemical aspects, mode of action and uses. The emphasis would be only on B.P. and I.P. compounds. Synthesis of only those drugs given in parentheses under each topic would be covered

UNIT – 2: Drug design Principles II

A. Stereochemical aspects of drug Action: Stereochemical definitions, Easson-Stedman model, enantiomerism and pharmacological action, Geometrical isomerism and pharmacological action, conformational flexibility and multiple mode of action.

B. Drug Metabolism: Introduction: General pathways of drug metabolism; Phase I (Functionalization) and Phase II (Conjugation) reactions. Phase I and Phase II pathways will be restricted to the following representative model drugs: Amphetamines, Phenobarbitone, Chlorpromazine, Lidocaine, Isoniazid and Paracetamol

UNIT – 3: Adrenergic and cholinergic drugs

A. Adrenergic Hormones and Drugs including biosynthesis, storage, release and metabolism of catecholamines (Adrenaline, Isoprenaline, Salbutamol, Amphetamine, Naphazoline)

B. Cholinergics and Anticholinesterases including biosynthesis, storage and metabolism of acetylcholine (Methacholine Chloride, Neostigmine Bromide).

UNIT – 4: Antimycobacterial & Antifungal agents

A. Antimycobacterial agents: Introduction to mycobacterium, development of antimycobacterium agents and their use in therapeutics (Dapsone, Sulfoxone Sodium and Solapson, Isonicotinic acid hydrazide, para-amino salicylic acid, Pyrazinamide and Ethionamide).

B. Antifungal agents: Antibiotics, Griseofulvin, Amphotericin, Candicidine, Nystatin, Synthetic antifungal agents, Flucosine, Dithranol, (Salicylic acid, Miconazole, Tolnaflate and Econazole).

UNIT – 5: Thyroid Hormones and Diuretics

A. Thyroid Hormones, SAR of thyroid Hormones, (L- Thyroxine, 6-Propylthiouracil, Methyl thiouracil, Carbimazole).

B. Diuretics: Introduction, classification of Diuretics (Aminophylline, Ethacrynic acid, Acetazolamide, chlorthiazide, Hydrochlorthiazide)

TEXT BOOKS

1. Thomas. L. Lomke, David. A. William, Victoria. F. Roche, S. William. Zito; *Foye's principles of medicinal chemistry*; Wolters Kluwer, Lippincott Williams & Wilkins; 6th edition; 2008; ISBN:9788189960308

2. John. M. Beale Jr, John. M. Block, Wilson and Griswold's *Textbook of organic medicinal and pharmaceutical chemistry*; Wolters Kluwer, Lippincott Williams & Wilkins; 12th edition; 2011; ISBN:9788184733969

REFERENCE BOOKS

1. Singh, H. and Kapoor, VK.; *Medicinal and Pharmaceutical Chemistry*; VallabhPrakashan; 3rd edition; 2012; ISBN:9788185731773.

2. Wolff, ME. Ed., *Burger's Medicinal Chemistry Drug discovery and Development*; John Wiley and Sons; 7th edition; 2010; ISBN: 0470278153.

3. *Indian Pharmacopoeia*; 2010; Government of India, *The Indian Pharmacopoeia*

Commission; ISBN: 9788190343695

4. Richard B Silverman; *The organic Chemistry of Drug design and Drug action*; 2004; 2nd edition; Elsevier; ISBN: 8181474503.



**BPH-602P/
BPL-602P**

MEDICINAL CHEMISTRY PRACTICAL - I

40 Hrs

Ex.No-01: Preparation of Acetyl salicylic acid

Tasks/Skills: *Acetylation; refluxing, suction filtration, crystallization*

Ex.No-02: Preparation of 1,4-naphthoquinone

Tasks/Skills: *Oxidation; vacuum filtration, crystallization*

Ex.No-03: Synthesis of Acetanilide from nitrobenzene

Tasks/Skills: *Reduction and acetylation; refluxing, vacuum filtration, crystallization*

Ex.No-04: Synthesis of p-nitroaniline from acetanilide

Tasks/Skills: *Acetylation and nitration; suction filtration, crystallization*

Ex.No-05: Preparation of 2,4,6-trinitrophenol (picric acid)

Tasks/Skills: *Nitration; magnetic stirring, suction filtration*

Ex.No-06: Synthesis of benzoic acid from benzyl chloride or toluene

Tasks/Skills: *Side chain oxidation (Permanganate oxidation); refluxing, suction filtration, crystallization.*

Ex.No-07: Synthesis of phenacetin

Tasks/Skills: *Acetylation; gravity filtration*

Ex.No-08: Preparation of cyclic amide (Phthalimide)

Tasks/Skills: *Ammonolysis; refluxing (air condenser)*

Ex.No-09: Preparation of phenytoin from benzil

Tasks/Skills: *Benzylic acid rearrangement; refluxing, suction filtration, crystallization*

Ex.No-10: Determine the percentage purity of given isoniazid tablets

Tasks/Skills: *Redox reaction; arrangement for titration*

Ex.No-11: Determine the percentage purity of given Ibuprofen tablets

Tasks/Skills: *Acid-base titration; arrangement of titration*

Ex.No-12: Conformational analysis of cyclohexane and comment on its stability

Tasks/Skills: *Conformational analysis; Fieser molecular model research kit*

Ex.No-13: Study conformational flexibility and multiple mode of action of acetyl choline

Tasks/Skills: *Conformational isomerism; Ball and stick molecular model set – Drill 1*

Ex.No-14: Study conformational flexibility and multiple of mode of action of histamine

Tasks/Skills: Conformational isomerism; Ball and stick molecular model set – Drill 2

Ex.No-15: Construct molecular model of selected chiral drugs, assign absolute configuration as per CIP and comment on its biological activity

Tasks/Skills: Chirality (center of chirality); Ball and stick molecular model set

Ex.No-16: Preparation of 2,4,6-tribromophenol

Tasks/Skills: Bromination; gravity filtration

Ex.No-17: Preparation of phenylurea by condensation of aniline and urea

Tasks/Skills: Condensation; gravity filtration, refluxing, cooling mixture

Ex.No-18: Preparation of catechol from salicylamide

Tasks/Skills: Dakins oxidation; Evaporation, reduced pressure and vacuum filtration

Ex.No-19: Preparation of chalcone from benzaldehyde and acetophenone

Tasks/Skills: Claisen Schmidt condensation; Water bath, vacuum filtration, crystallization

Ex.No-20: Preparation of succinic anhydride from succinic acid

Tasks/Skills: Dehydration; Refluxing (air condenser), vacuum filtration

Note: Though 20 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Furniss BS, Hannaford AJ, Smith PWG, Tatchell AR.; *Vogel's Textbook of Practical organic Chemistry*; Pearson Education Limited; 5th edition; 1996; ISBN: 81297026312.

2. Mann FG, Saunders BC.; *Practical Organic Chemistry*; Pearson Education Limited; 4th edition; 2009; ISBN:8131727106.



**BPH-603/
BPL-603**

**PHARMACEUTICAL MANAGEMENT-
THEORY**

40 Hrs

UNIT – 1: Basic Concepts

A. Concepts of Management: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale).

B. Principles of Management: Motivation, Communication, Decision-making, leadership, Innovation, Creativity, Delegation, Responsibility, Record Keeping.

UNIT – 2: Economics and Accountancy

A. Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.

B. Accountancy: Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet.

UNIT – 3: Production and Material Management

A. Production Management: A brief exposure of the different aspects of Production Management-Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Knowhow, Maintenance Management.

B. Materials Management: Basic principles of materials management, major areas, scope, purchase, stores, inventory control and evaluation of materials management.

UNIT – 4: Marketing Management

A. Pharmaceutical Marketing: Meaning and functions, The Product Concept, What is a brand, Product positioning, Product strategy. Marketing communication, Principles of Medical advertising.

B. Market Research: Measuring & Forecasting Market Demands-Major concept in demand measurement, Estimating current demand, Estimating industry sales, Market share & Future demand.

UNIT – 5: Distribution and Sales Management

A. Distribution: Channels of distribution, wholesale, retail, departmental store, Chain stores. Transportation and storage.

B. Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing. Recruitment, training, evaluation, compensation to the pharmacist.

TEXT BOOKS

1. *Biren N Shah, Bhavesh S Nayak, Vineet C Jain; Textbook Of Pharmaceutical Industrial Management; 2010; 1st edition; Elsevier India; ISBN: 9788131225394*

2. *Sachin Itkar; Pharmaceutical Management; 2007; 3rd edition; Nirali Prakashan; ISBN: 9788185790398*

REFERENCE BOOKS

1. *Subba Rao Chaganti; Pharmaceutical Marketing In India Concepts Strategy Cases; 2013; Pharma Book Syndicate, Hyderabad; ISBN: 9788188449255*

2. *Kumardatt, A. Ganjre; Pharmaceutical Marketing: Strategies And Practices; 2011; 1st edition; International Book House; ISBN: 9789381335024*

3. *Sampath, K; Pharmaceutical Industrial Management; 2009; 1st edition; Birla Publications; ISBN:9798189747489*

4. *Uday Raj Sharma, Divakar Goli; Pharmaceutical Marketing Management; 2012; 1st edition; Nirali Prakashan; ISBN: 9789381962886*



**BPH-604/
BPL-604**

PHARMACOLOGY – II- THEORY

40 Hrs

Note: Mechanism of action, pharmacological actions, adverse drug reactions, precautions, contraindications, preparations, drug interactions, therapeutic uses/indications are required to be studied wherever necessary

UNIT – 1: Drugs acting on Cardiovascular System

A. Drugs therapy of heart failure – classification, Cardiac glycosides, digitalis

toxicity. Newer inotropic agents, role of vasodilators, beta blockers, ACE inhibitors and diuretics in heart failure.

B. Drug therapy of arrhythmias – Classification, preparations, classes, mechanism of action, indications.

C. Lipid lowering drugs for the treatment of hypercholesterolemia – Classification, Mechanism of action, pharmacological actions, adverse effects, contraindications drug interactions and uses.

D. Drug therapy of Hypertension – Classification, angiotensin converting enzyme inhibitors, angiotensin receptor antagonist, calcium channel blockers, diuretics, beta blockers, alpha blockers, vasodilators, central sympatholytics. Management of hypertensive emergencies

E. Drugs for myocardial ischaemia – Classification, rationale of combination therapy in angina pectoris, role of antiplatelet drugs . Drug treatment of myocardial infarction.

F. Drugs used in peripheral vascular diseases.

mechanism of action, pharmacological actions, adverse drug reactions, precautions, contraindications, preparations, drug interactions, therapeutic uses/indications.

UNIT – 2: Drugs Acting on Blood and Blood forming Organs

A. Hematinics (Iron, vitamin B12 & folic acid), minerals (trace elements) and vitamins and clinical significance, preparations, uses, treatment of iron deficiency anemia, disadvantages of shotgun antianemic preparations, megaloblastic anemia, iron poisoning. Erythropoietin and other growth factors.

B. Coagulants – Vitamin K, fibrinogen and styptics.

C. Anticoagulants – Classification thrombolytics, antifibrinolytics and sclerosing agents

D. Plasma expanders and blood transfusion - Chemistry, pharmacokinetics, preparations, dosage and uses, adverse effects.

E. Drugs induced blood dyscrasias.

F. Drugs used in the management of Shock.

UNIT – 3: Drugs Acting on Respiratory System and Antihistaminics

A. Drugs for cough – Classification Principles of choosing appropriate cough remedies, expectorants, mucolytics, antitussives, preparations and uses.

B. Drugs for bronchial asthma – Classification, Principles governing the selection of drugs in bronchial asthma, inhaled asthma medication, precautions to be taken during their use. Management of acute attacks, prophylaxis and status asthmaticus. Management of COPD.

C. Histamine actions, releasers, anaphylaxis, clinical significance of histamine, betahistine. Conventional H1 antihistamines - Classification, Second generation H1 antihistamines, Drug therapy of vertigo and motion sickness

UNIT – 4: Drugs acting on Renal function, Electrolytes and Autocoids

A. DRUGS ACTING ON RENAL SYSTEM:

1. Water and electrolytes – Transport, imbalance, effects and management.

2. Nutritional supplementation – Enteral and parenteral therapy.

3. Diuretics – Classification, Role of diuretics in acute renal failure and

forced alkaline diuresis, site of action pattern of electrolyte excretion, short term and long term side effects and therapeutic uses.

4. Antidiuretics - Vasopressin (antidiuretic hormone) and other drugs.

B. AUTOCOIDS and RELATED DRUGS: Definition, the various autacoids, their physiological and pathological actions and effects.

1. 5HT (serotonin) – 5HT agonists and antagonists (pharmacological actions, preparations and therapeutic uses). Ergot alkaloids - preparations and uses. Pharmacotherapy of migraine.

2. Bradykinin and their antagonists.

3. Angiotensin and ACE inhibitors and angiotensin receptor antagonist.

4. Lipid derived autacoids – Eicosanoids (prostaglandins, leukotrienes) and platelet activating factor, PAF antagonists – clinical significance, preparations and uses.

UNIT – 5: Immunomodulatory and Dermal and Miscellaneous Drugs

A. DRUGS USED FOR IMMUNOMODULATION:

1. The immune response: General principles of immunosuppressive therapy, immunosuppressants, Immunostimulants – BCG, Peptides, Immunoglobulins, Cytokines (Interferon - α , Interleukin-2, Levamisole).

2. Immune mechanism and drug allergy.

B. DERMATO PHARMACOLOGY: Skin and mucous membrane (dermatological pharmacology) Systemic treatment – Corticosteroids, antibiotics, antihistamines, Immunosuppressants – indications.

Topical treatment: Calamine lotion, creams, emollients, antifungal agents, Sunscreens - reflectors, absorbents – indication, advantages, disadvantages, Pharmacotherapy of scabies and Pediculosis.

C. GENE THERAPY - principles and uses.

D. MISCELLANEOUS DRUGS: 1. Enzymes in therapy.

2. Antiseptics and disinfectants, definition, indications, advantages and disadvantages with examples in different groups.

3. Physiological functions, symptoms and signs of deficiency, preparations, hypervitaminosis, side effects, therapeutic uses Vitamins and food supplements: Vitamin B-complex – (B1, B2, B3, B6, B12, Biotin) Vitamin C, Vitamin A, Vitamin E, Vitamin K, Zinc, Spirulina, - Indications.

4. Vaccines and Sera, typhoid vaccine, hepatitis A, B vaccine, rabies vaccine, varicella vaccine, indications, dosage and administration, adverse effects, interactions, contraindications, special precautions.

TEXT BOOKS

1. Satoşkar, RS., Bhandarkar, SD., Ainaşure, SS.; *Pharmacology and Pharmacotherapeutics*; 2006; 19th edition; Popular Prakashan Pvt Ltd; ISBN: 9788179912515

2. Anita A Mehtal, Goyal, RK., Balaraman R.; *Elements of Pharmacology*; 2013; 21st edition; BS Shah Publishers; ISBN: 9788184160314

REFERENCE BOOKS

1. Salil K Battacharya; *Pharmacology*; 2003; 2nd edition; Elsevier India; ISBN: 9788181470096

2. Richard A. Harvey, Pamela C. Champe; *Lippincott's Illustrated Reviews: Pharmacology*; 2005; 4th edition; Lippincott Williams & Wilkins; ISBN: 9780781741187

3. Humphrey P. Rang, Maureen M. Dale, James M. Ritter, Rod J. Flower, Graeme

Henderson; Rang & Dale's Pharmacology; 2011; 7th edition; Churchill Livingstone; ISBN-13: 978-0702034718

4. Bertram G. Katzung; Basic Clinical Pharmacology; 2011; 12th edition; McGraw-Hill Medical; ISBN: 978-0071764018.

5. Bennett, P.N. and Brown, M.J.; Clinical Pharmacology; 2003; 9th edition; McGraw-Hill Medical; ISBN: 9780443064807



**BPH-604P/
BPL-604P**

PHARMACOLOGY PRACTICAL

40 Hrs

Ex.No-01: Study experimental animals by using charts.

Tasks/Skills: Learn about the various animals used in experimental pharmacology. Understanding the difference between the human and animal species. Different animals models used in the drug discovery.

Ex.No-02: Study of various equipments used in pharmacology experiments

Tasks/Skills: Learn the various equipments, apparatus and instruments used and their applications in different pharmacological experiments.

Ex.No-03: Understanding the ethics followed in animal experiment and anaesthetic used in animal experiments and approved animal sacrificing techniques.

Tasks/Skills: Understanding euthanasia and humane method of conducting animals experiment, blood withdrawal and animal disposal. Various anaesthetics used in experiment.

Ex.No-04: Demonstrate the effect of various drugs on rabbit eye by using the computer simulated experiment.

Tasks/Skills: Observe the effects of Miotics and mydriatics on rabbit eye. Local anaesthetic effect on corneal reflex of rabbit eye.

Ex.No-05: Demonstrate the effect of various drugs on isolated frog heart by using the computer simulated experiment.

Tasks/Skills: Observe the effect of cardiac stimulants and cardiac depressants and study their site of action by selecting suitable agonists and antagonists

Ex.No-06: Demonstrate the effect of various drugs on ciliary movement of oesophagus of frog by using the computer simulated experiment.

Tasks/Skills: Understand the action of autocooids. Effect of cholinergic agonist and antagonist on ciliary movement.

Ex.No-07: Demonstrate the concentration response curve of acetylcholine on frog rectus abdominus muscle by using the computer simulated experiment.

Tasks/Skills: Record the concentration response curve and plot the log dose versus response curve and its importance. Calculation of PD_2

Ex.No-08: Demonstrate the antagonism effect on frog rectus muscle by computer simulated experiment.

Tasks/Skills: Learn and perceive the importance of drug interaction effect of agonist in presence of different antagonists; calculation of PA_2 value

Ex.No-09: Demonstrate the potentiating effect on frog rectus muscle by computer simulated

experiment

Tasks/Skills: *Learn and perceive the importance of drug interaction – understand the additive & potentiative effect and their difference.*

Ex.No-10: Understanding the Mechanism of action of drugs using chart.

Tasks/Skills: *Understand the importance of drug effects and mechanism through different graph*

Ex.No-11: Determine the unknown concentration of drug by matching bioassay method by using computer simulated experiments and charts.

Tasks/Skills: *Learn bioassay techniques: drug administration cycle, calculation of drug concentration and confidence limit*

Ex.No-12: Determine the unknown concentration of drug by interpolation bioassay method by using computer simulated experiments and charts.

Tasks/Skills: *Learn bioassay technique: drug administration cycle, calculation of drug concentration and confidence limit*

Ex.No-13: Determine the unknown concentration of drug by three point bioassay method by using computer simulated experiments and charts.

Tasks/Skills: *Learn bioassay technique: drug administration cycle, calculation of drug concentration and confidence limit*

Ex.No-14: Determine the unknown concentration of drug by four point bioassay method by using computer simulated experiments and charts.

Tasks/Skills: *Learn bioassay technique: comparative knowledge on different bioassay methods*

Ex.No-15: Identifying the drugs from charts showing their effects and explain the principle.

Tasks/Skills: *Understand the principle and mechanism of drug action.*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.*

BOOKS FOR REFERENCE

1. Kulkarni S.K.; *Handbook of Experimentals Pharmacology*; 2009; 3rd edition; Vallabh Prakashan, Delhi; ISBN:9788185731124
2. Ramesh goya; *Handbook of Experimentals Pharmacology*; 2010; 9th edition; B.S.Shah Publication, Ahamadabad; ISBN:8184160194
3. Vogel, Hans; *Drug Discovery and Evaluation: Pharmacological Assays*; 2008; 3rd edition; Springer; ISBN:9783540714200
4. Kulkarni SK., *Practical Pharmacology and Clinical Pharmacy*; 2008; 1st Edition; Vallabh Prakashan, Delhi; ISBN:9788185731438
5. Gupta, SK.; *Drug Screening Methods*; 2009; 2nd edition; Jaypee Brothers Medical Publishers(P) Ltd., New Delhi; ISBN:9788184486186



**BPH-605/
BPL-605**

PHARMACOGNOSY – III THEORY

40 Hrs

UNIT – 1: Biosynthesis of Secondary metabolites – General aspects

A. Primary versus Secondary Metabolism and Metabolites, Some important building blocks of Secondary metabolites and their origins with illustrations, Storage and Significance of secondary metabolism. General techniques of elucidating the biosynthetic pathways.

B. Generalized study typical reactions catalyzed by following classes of Enzymes in secondary metabolism with illustration: Oxidoreductases (Oxidases, Dehydrogenases, Oxygenases); Transferases (Phosphotransferases, CoenzymeA Transferases, Carboxyltransferases, Methyltransferases, Aminotransferases); Hydrolases (Phosphatases, Glycosidases, Esterases); Lyases (Decarboxylases, Dehydratases, Synthases); Isomerases (racemases, epimerases, mutases, tautomerases); Ligases (Acid-Thiol Ligases, Synthetases)

UNIT – 2: Biosynthesis of Specific Secondary metabolites

A. Acetate-Malonate Pathway: Biosynthesis of fatty acids such as Oleic acid, Linoleic acid. Shikimic acid pathway: Biosynthesis of Shikimic acid, Phenylalanine, Tyrosine, Tryptophan, Cinnamic acid.

B. Acetate-Mevalonate Pathway: Biosynthesis of Mevalonate, Squalene, and Terpenoids such as Menthol, Citral.

C. Biosynthesis of Nicotine, Ephedrine, Hyoscyamine, Morphine, Codeine, Lysergic acid, Ergotamine, Quinine and Digitoxigenin.

UNIT – 3: Plant tissue and cell culture Biotechnology

A. Plant tissue culture – Introduction, Totipotency principle, Laboratory Facilities, Equipment, Nutrition media and role of Plant Growth Regulators, Methods and Precautions in Plant cell culture, Aseptic techniques and Sterilization, Explants and its surface sterilization.

B. Types of plant cell cultures, Callus cultures, Hairy root cultures, Cell suspension cultures, Production of secondary metabolites, Biotransformation, Immobilized plant cells. Applications of Plant Cell cultures.

UNIT – 4: Production of Some Natural products / Phytoconstituents

A. Industrial production of essential oils - principles, major methods, equipment, fractionation and rectification of essential oils. Production of Mentha oil, Menthol, Sandalwood oil, Rose products, Clove oil and Thymol.

B. Production and Utilization of phytoconstituents such as Agar, Gelatin, Starch and its derivatives, Medicinal Castor oil., Papain, Quinine, Sennosides, Podophyllotoxin, Diosgenin, Tropane alkaloids, Capsicum oleoresin.

UNIT – 5: Nutraceuticals, Herbal Cosmetics and Indigenous Dosage Forms

A. Nutraceuticals: Introduction and Classification, Health benefits; Carotenoids and non-carotenoids, Polyphenolics, Catechins, Phenolic acids, Glucosinolates, Phytosterols, Anthraquinones, Glucosamine, Chondroitin, Carnitine, Resveratrol, Lycopene, Capsaicin, Piperine, Flax lignans, Aloe vera preparations, Omega-3-fatty acids, Grape seed Extract.

B. Herbal Cosmetics: Cosmetic potential of herbal extracts /products, Survey of some extracts and derivatives used in cosmetics. Herbal Skin and Hair care preparations, Pigment based beautifying preparations and Perfume products.

C. Ayurvedic and Siddha dosage forms: Introduction to preparations such as Arishta, Asava, Gutika, Taila, Churna, Lehya and Bhasma.

TEXT BOOKS

1. Williams Charles Evans; Trease and Evans Pharmacognosy; 2009; 16th edition; Elsevier, London; ISBN:978-0-7020-2934-9

2. Kokate, CK., Purohit, AP. And Gokhale, SB.; *Pharmacognosy*; 2010; 46th edition; Nirali Prakashan, Pune; ISBN:978-81-96396-15-2

REFERENCE BOOKS

1. Ashutosh Ka;, *Pharmacognosy and Pharmacobiotechnology*; 2008; 2nd edition; New Age International Publishers, New Delhi; ISBN:978-81-224-2915-2
2. Agrawal, SS., Paridhavi, M.; *Herbal Drug Technology*; 2009; 1st edition; University Press, Hyderabad; ISBN:978-81-7371-579-2
3. Lockwood, B., *Nutraceuticals*; 2007; 2nd edition; Pharmaceutical Press, London; ISBN:978-0-85369-659-9
4. Paul M Dewick; *Medicinal Natural Products – A biosynthetic approach*; 2009; 3rd edition; John Wiley & Sons, West Sussex, UK; ISBN:978-0-470-74167-2
5. Panda, H.; *Herbal Cosmetics Handbook*; 2004; National Institute Of Industrial Research, New Delhi; ISBN:978-81-78330-80-8



**BPH-605P/
BPL-605P**

PHARMACOGNOSY – III PRACTICAL

40 Hrs

Ex.No-01: Phytochemical screening of plant materials for important classes of phytoconstituents.

Tasks/Skills: *Tests for Alkaloids, Carbohydrates, Tannins, Phenolic compounds etc.]*

Ex.No-02: Isolation of Starch from Potato tubers

Tasks/Skills: *Weigh, Peel & mince potatoes, Isolate starch, wash, dry and report yield*

Ex.No-03: Isolation of Citric acid from Lemon juice as Calcium citrate

Tasks/Skills: *Collect juice, measure, isolate by precipitation, filter, dry and report yield.*

Ex.No-04: Isolation of Pectin from Orange peels

Tasks/Skills: *Isolate Pectin from orange peels using acid-aqueous extract, dry it and report yield.*

Ex.No-05: Isolation of Podophyllotoxin resin from Podophyllum roots.

Tasks/Skills: *Extraction followed by precipitation, drying, and reporting yield.*

Ex.No-06: Isolation of Caffeine from Tea leaves / dust. Perform TLC of isolate.

Tasks/Skills: *Aqueous extraction and purification; perform TLC of isolate.*

Ex.No-07: Extraction of Essential oil from fresh leaves by distillation method.

Tasks/Skills: *Extract volatile oil by distillation method from fresh Eucalyptus/Mentha leaves.*

Ex.No-08: Isolation of Capsicum oleoresin from Capsicum fruit powder. Perform TLC of isolate.

Tasks/Skills: *Extraction and TLC of Capsaicin by an appropriate method.*

Ex.No-09: Isolation of Piperine from Black pepper.

Tasks/Skills: *Extraction and TLC of Piperine by an appropriate method*

Ex.No-10: Isolation of Ginger oleoresin from Ginger rhizomes. Perform TLC of isolate.

Tasks/Skills: *Hot extraction to obtain Ginger oleoresin. Carryout TLC of oleoresin.*

Ex.No-11: Extraction of Tannins from Myrobalan

Tasks/Skills: *Carry out the hot extraction of tannins and perform the chemical tests.*

Ex.No-12: Extraction of Hesperidin from Orange peel

Tasks/Skills: *Use Orange peel to extract the crude flavanoids and purify hesperidin*

Ex.No-13: Isolation of Cholesterol from Egg Yolk. Perform TLC of isolate

Tasks/Skills: *Isolate Cholesterol from hard Boiled eggs and perform TLC of isolate.*

Ex.No-14: Extraction of Sennosides from Senna leaf. Perform TLC of isolate.

Tasks/Skills: *Extract glycosides from Senna leaves, Perform TLC, and Tests.*

Ex.No-15: Isolation of fatty acids from the given fixed oil

Tasks/Skills: *Reflux, Saponification, Hydrolysis*

Ex.No-16: Preparation and Surface sterilization of explant for tissue culture

Tasks/Skills: *Observe the process involved in the surface sterilization of explant sample – an important step in plant tissue culture.*

Ex.No-17: Preparation of Herbal Antiseptic Cream.

Tasks/Skills: *Learn the ingredients, Emulsification, Techniques in preparation of cream.*

Ex.No-18: Preparation of Herbal shampoo

Tasks/Skills: *Learn the composition of a shampoo, blending of ingredients, precautions and basic evaluation of shampoo.*

Ex.No-19: Preparation of Herbal Hair dye.

Tasks/Skills: *Learn the ingredients in the preparation of hair dye and method of preparation, packing and any precautions.*

Ex.No-20: Preparation of Herbal Tooth paste / Powder

Tasks/Skills: *Learn to powder the ingredients to required fineness and blend them.*

Note: *Though 20 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.*

BOOKS FOR REFERENCE

1. Raphael Ikan; *Natural Products, A Laboratory Guide*; 1991; 2nd edition; Academic Press; ISBN:9780123705518

2. Biren Shah and A.K. Seth; *Textbook of Pharmacognosy & Phytochemistry*; 2010; 1st edition; Elsevier, New Delhi. ISBN:978-81-312-2298-0

3. Agrawal, SS., Paridhavi M.; *Herbal Drug Technology*; 2009; 1st edition; University Press, Hyderabad; ISBN:978-81-7371-579-2

4. Saraf Shailendra, Saraf Swarnlata; *Cosmetics - A Practical Manual*; 2009; PharmMed Press, Hyderabad; ISBN:9788188449705



B. Pharm. VII Semester



BPH-701 /
BPL-701

PHARMACEUTICAL DOSAGE FORMS – II
THEORY

40 Hrs

UNIT – 1: Tablets

Types of tablets, Advantages and disadvantages of tablets, quality attributes of tablets, Tablet excipients, Properties of compressed tablets, Compressed tablet manufacture – wet and dry granulation and direct compression, problems in tablet manufacture.

UNIT – 2: Evaluation of Tablets

Compendial requirements: Weight variation, Hardness and Friability, Disintegration, Dissolutions tests, Evaluation of compression behavior: Tablet volume and applied pressure profiles, evaluation of die wall friction during compression, factors affecting the strength of tablets

UNIT – 3: Tablet Coating

Types of coating process, Reasons for coating, sugar coating tablets, film-coating tablets, formulation of coating solution, process equipment, Standard for coated tablets: evaluation of coated tablets, recent developments

UNIT – 4: Capsules

A. Hard gelatin capsules: Materials for production of hard gelatin capsules, manufacture of hard gelatin capsule shell, capsule sizes, capsule filling, formulation, storage of capsules, HPMC capsules.

B. Soft gelatin capsules: Advantages and disadvantages of softgels, Rationale for the selection of softgels as a dosage form, Formulation softgels, soft processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules

UNIT – 5: Parenterals

Parenteral routes of administration, selection of vehicles (aqueous and non-aqueous), added substances, selection of containers, production-facilities, environmental control, personnel, cleaning of containers and closures, method of sterilization, compounding the product (aseptic and non-aseptic processing), filtration of solutions, filling and sealing procedures, sterilization of products, various quality control tests for parenteral products.

TEXT BOOKS

1. Allen Jr. LV, Popovich NG, Ansel HC.; *Ansel's pharmaceutical dosage forms and drug delivery systems*; 2010; 9th edition; Lippincott Williams & Wilkins, Philadelphia; ISBN:9788184733914

2. Aulton ME; *Aulton's Pharmaceutics: The design and manufacture of medicines*; 2007; 3rd edition, Churchill Livingstone, New York; ISBN:9780443101083.

REFERENCE BOOKS

1. Allen Jr. LV.; *Remington: The science and practice of pharmacy*; 2010; 22nd edition; Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626.

2. Lachman L, Lieberman HA.; *The theory and practice of industrial pharmacy*; 2009; 3rd edition, CBS Publisher, New Delhi; ISBN:9788123916798.
3. Florence AT, Siepmann J.; *Modern Pharmaceutics*, (2 volumes); 2009; 5th edition, CRC Press, USA; ISBN:9781420065701.
4. Ranade VV, Hollinger MA.; *Drug delivery systems*; 2004; 2nd edition; CRC Press, USA; ISBN:9780849314339



BPH-701P/ BPL-701P	PHARMACEUTICAL DOSAGE FORMS - II PRACTICAL	40 Hrs
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Ex.No-01: Formulation of Compound sodium bicarbonate tablets IP

Tasks/Skills: *Wet granulation*

Ex.No-02: Development and manufacture of chewable antacid tablets

Tasks/Skills: *Wet granulation and palatability*

Ex.No-03: Development and manufacture Acetyl Salicylic Acid 325 mg tablets

Tasks/Skills: *Dry granulation*

Ex.No-04: Development and manufacture Ascorbic Acid 250 mg tablet

Tasks/Skills: *Direct compression manufacturing technique*

Ex.No-05: Effect of additives on the physical properties of granules ready for compression

Tasks/Skills: *Flow-ability and compressibility characteristics*

Ex.No-06: Hardness and Friability tests for official/and or commercial compressed tablets

Tasks/Skills: *Strength of tablet and in vitro availability of API*

Ex.No-07: Weight variation test IP and its interpretation for compendial requirement

Tasks/Skills: *Uniformity of dosage*

Ex.No-08: Disintegration test IP for coated, uncoated, soluble, and enteric coated commercial tablets

Tasks/Skills: *Compliance to official specifications*

Ex.No-09: Dissolution test for tablets official in IP and their statistical inference

Tasks/Skills: *Use of Paddle and Basket types apparatuses and various dissolution media*

Ex.No-10: Effect of granule particle size on the dissolution of (e.g. paracetamol) tablets

Tasks/Skills: *Rate of dissolution and its effect on granule size and hydrophobic lubricant concentration*

Ex.No-11: Sugar and film coating of compressed tablets

Tasks/Skills: *Stages of coating with coating material formulations*

Ex.No-12: Demonstration of capsule filling using hand-operated laboratory scale machine

Tasks/Skills: *Capsule filling and sealing*

Ex.No-13: Formulation and preparation/filling of capsules of a model drug official in IP

Tasks/Skills: *Formulation and calculation of capsule fill in an optimum capsule size*

Ex.No-14: Development and formulation of Calcium gluconate/Atropine tartrate injection

Tasks/Skills: *Filling and sealing of ampoules*

Ex.No-15: Manufacture of Sterile Water for Injection (SWFI) IP

Tasks/Skills: *Design of distillation still that prevent entrainment of water droplets and terminal sterilisation technique*

Note: *Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.*

BOOKS FOR REFERENCE

1. Mithal BM, *A Text Book of Pharmaceutical Formulation*; 1997; 6th edition; VallabhPrakashan, New Delhi; ISBN:9788185731049
2. Allen Jr. LV, Popovich NG, Ansel HC.; *Ansel's pharmaceutical dosage forms and drug delivery systems*; 2010; 9th edition. Lippincott Williams & Wilkins, Philadelphia; ISBN:9788184733914
3. Aulton ME.; *Aulton's Pharmaceutics: The design and manufacture of medicines*; 2007; 3rd edition; Churchill Livingstone, New York; ISBN:9780443101083
4. . Lachman L, Lieberman HA.; *The theory and practice of industrial pharmacy*; 2009; 3rd edition; CBS Publisher, New Delhi; ISBN:9788123916798.
5. Allen Jr. LV.; *Remington: The science and practice of pharmacy*; 2010; 22nd edition; Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626



**BPH-702/
BPL-702**

**BIOPHARMACEUTICS &
PHARMACOKINETICS - THEORY**

40 Hrs

UNIT – 1: Introduction to Biopharmaceutics

- A. Introduction to Biopharmaceutics, Pharmacokinetics and Clinical Pharmacokinetics and their role in formulation development and clinical setting.
- B. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
- C. Factors influencing absorption – Physicochemical, biological and Pharmaceutical factors.
- D. Drug distribution in the body (Introduction, types of drug distribution, factors affecting drug distribution, Concept of apparent volume of distribution)
- E. Plasma protein binding. (Significance of drug-protein binding and drug displacement interactions.)

UNIT – 2: Pharmacokinetics – 1

- A. Significance of plasma drug concentration measurement.
- B. Compartment Model : Definition and scope.
- C. Pharmacokinetics of drug absorption – zero order and first order absorption rate constant using Wagner – nelson and Loo – Riegelman method.
- D. Volume of distribution and distribution co-efficient.
- E. Compartment kinetics – one compartment and two compartment models Determination of

Pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.

UNIT – 3: Pharmacokinetics – 2

- A. Curve fitting (method of Residual), regression procedures.
- B. Clearance concept, Mechanism of renal clearance, Clearance Ratio, Determination of renal clearance.
- C. Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.
- D. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration. Michaelis Menten equation, detection of non-linearity (saturation mechanism).

UNIT – 4: Clinical Pharmacokinetics

- A. Definition and scope
- B. Dosage adjustment in patients with and without renal and hepatic failure.
- C. Design of single dose bio-equivalence study and relevant statistics.
- D. Pharmacokinetic drug interactions and their significance in combination therapy.
- E. Variability-Body weight, age, sex and genetic factors. Pharmacokinetic variability-diseases. Pharmacokinetic variability-drug interactions. Individualization and optimization of drug dosing regimens.

UNIT – 5: Bioavailability and Bioequivalence

- A. Bioavailability and Bioequivalence.
- B. Measures of bioavailability, C_{max}, t_{max} and area under the curve (AUC).
- C. Significance, Design of single dose bioequivalence study and relevant Statistics. Statistical analysis of bioequivalence studies.
- D. Overview of regulatory requirements for conducting bioequivalent studies.
- E. Development, scale up & post approval changes [SUPAC] & in vitro [dissolution] in vivo [plasma concentration profile] correlation or IV / IV correlation (IVIVC).

TEXT BOOKS

1. Madan PL.; *Biopharmaceutics and Practical Pharmacokinetics*; 2000; 1st edition; Jaypee Brothers Medical Publications, New Delhi; ISBN: 9781576040775
2. Brahmankar, DM. and Sunil B. Jaiswal; *Biopharmaceutics and Pharmacokinetics – A Treatise*; 2012; 2nd edition; Vallabh Prakashan, New Delhi; ISBN:9788185731476

REFERENCE BOOKS

1. Sunil S Jambhedkar and Philip J Breen; *Basic Pharmacokinetics*; 2012; 2nd edition; Pharmaceutical Press, London; ISBN: 9780853699804
2. Leon Shargel , Alan H. Mutnick, Paul F. Souney , Larry N. Swanson; *Comprehensive Review of Pharmacy*; 2009; 7th edition; Lippincott Williams & Wilkins; ISBN: 978-1582557113
3. Milo Gibaldi; *Bio Pharmaceutics and Clinical Pharmacokinetics*; 2011; 4th edition; Pharma Book Syndicate, Hyderabad; ISBN: 9788188449064
4. Peter G. Welling, Francis L. S. Tse; *Pharmacokinetics Regulatory, Industrial and Academic Prospectives (Vol. 57)*; 1988; Marcel Dekker, USA; ISBN: 978-0824779450
5. Welling and TSE, *Pharmaceutical Bioequivalence (Vol. 48)*; 1991; Marcel Dekker, USA; ISBN: 9780824784843



**BPH-702P/
BPL-702P**

**BIOPHARMACEUTICS AND
PHARMACOKINETICS - PRACTICAL**

40 Hrs

Ex.No-01: Influence of Polymorphism and solubility and Dissolution of Drugs

Tasks/Skills: Comparison of solubility and Dissolution of two different forms (crystalline and amorphous) of the same drug (eg. Novobiocin).

Ex.No-02: Determination of Partition coefficient of Drugs for prediction of GI permeability and distribution.

Tasks/Skills: Partition coefficient of a drug between a lipophilic solvent (e.g. n-octanol, chloroform, n-heptane) and an aqueous phase (water or a suitable buffer) e.g. chloroform – water, octanol- pH 7.4 buffer

Ex.No-03: Study the influence of drug pKa on drug absorption

Tasks/Skills: Find pKa value of very weak base/ acid, moderately weak acid/ base and strong acid/base. Predict the site of drug absorption from its pKa value.

Ex.No-04: Dissolution studies of enteric coated tablets (marketed product)

Ex.No-05: Drug release studies of sustained release tablets/capsules

Ex.No-06: Drug release studies from ointments made with different ointment bases (Four different bases of drug: aspirin.)

Ex.No-07: Protein binding studies of highly protein bound drug and poorly protein bound drug.

Ex.No-08: Absorption studies in inverted intestine of a BCS-I and BCS-II

Ex.No-09: Calculation of AUC and $t_{1/2}$ from the given data

Ex.No-10: Determination of elimination rate constant using urinary excretion data following: (i) excretion rate method and (ii) sigma minus method from the given data

Ex.No-11: Determination of absorption rate constant and elimination rate by methods of residuals

Ex.No-12: Determination of steady state drug blood level from data of single IV dose study and calculation of loading dose

Ex.No-13: Bioequivalence study of two drugs from the given data

Ex.No-14: Determination of renal clearance from the given data

Ex.No-15: Dose adjustment in renal failure patient from the given data

Ex.No-16: Dose adjustment in hepatic failure patient from the given data

Note: Though 16 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

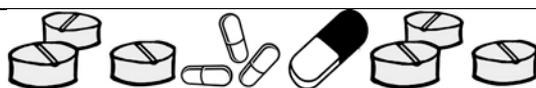
BOOKS FOR REFERENCE

1. Madan PL.; *Biopharmaceutics and Practical Pharmacokinetics*; 2000; 1st edition; Jaypee Brothers Medical Publications, New Delhi; ISBN: 9781576040775

2. Sunil S Jambhedkar and Philip J Breen; *Basic Pharmacokinetics*; 2012; 2nd edition; Pharmaceutical Press, London; ISBN: 9780853699804

3. Leon Shargel , Alan H. Mutnick, Paul F. Souney , Larry N. Swanson; *Comprehensive Review of Pharmacy*; 2009; 7th edition; Lippincott Williams & Wilkins; ISBN: 978-1582557113

4. Milo Gibaldi; *Bio Pharmaceutics and Clinical Pharmacokinetics*; 2011; 4th edition; Pharma Book Syndicate, Hyderabad; ISBN: 9788188449064



**BPH-703/
BPL-703**

MEDICINAL CHEMISTRY - II- THEORY

40 Hrs

Guidelines: The following topics shall be treated covering chemical naming, structure activity relationship, physicochemical and stereo aspects, mode of action (where applicable) and uses. The emphasis would be only on B.P. and I.P. compounds. Synthesis of only those drugs given in parentheses under each topic would be covered

UNIT – 1: Anesthetic Agents

A. General Anesthetic Agents: Introduction, medicinal aspects of anaesthetics, mode of action; gases and volatile liquid anaesthetics, intravenous anaesthetics or fixed anaesthetics, toxicity of general anaesthetics (Divinyl ether, Ethyl chloride, Nitrous oxide, Thiopentone Sodium)

B. Local Anesthetic Agents: Introduction: Structure-activity relationships, benzoic acid derivatives, amino benzoic acid derivatives, Amides/Anilides; miscellaneous; toxicity; mode of action (Benzocaine, Procaine Hydrochloride, Lidocaine Hydrochloride, Cinchocaine Hydrochloride).

UNIT – 2: Sedatives-Hypnotics

A. Sedatives-Hypnotics: Introduction; classification of sedative-hypnotics; structure-activity relationships; barbiturates; amides and imides; alcohols and their carbamate derivatives; aldehydes and their derivatives; mode of action; pharmacological properties and side effects (Barbital, Phenobarbitone, Cyclobarbitone, Pentobarbitone, Quinalbarbitone)

B. Anticonvulsants: Introduction, Epilepsy and its types; structure activity relationships; Barbiturates (official products); Hydantoins, Oxazolidinediones, Succinimides; Miscellaneous drugs; (Phenytoin Sodium; Troxidone, Ethosuximide, Methosuximide, and Phensuximide)

UNIT – 3: Psychopharmacological Agents

A. Antipsychotics, Phenothiazines (Chlorpromazine; Trifluoperazine; Butyrophenones, Miscellaneous).

B. Antidepressants: Tricyclic antidepressants: Imipramine, Doxepine, (Amitriptyline); Monoamine oxidase inhibitors: Phenelzine, Tranylcypromine.

C. Antianxiety drugs: Meprobamate and related drugs; Benzodiazepines (Diazepam)

UNIT – 4: Antihistamines, NSAIDs , Anticoagulants and Haemostatic Agents

A. Antihistamines: (Mepyramine, Diphenhydramine, Chlorpheniramine, Promethazine, Triprolidine) and Acrivastine.

B. Non-steroidal Anti-inflammatory Drugs (includes anti-gout Drugs) (Indomethacin, Phenylbutazone, Allopurinol, Probenecid, Ibuprofen)

C. Anticoagulants and Haemostatic Agents (Warfarin, Phenindione)

UNIT – 5: Antimalarials & Antiamoebics

A. Antimalarials; Quinoline and analogues, 8-aminoquinolines, 9-amino acridines, 4-aminoquinolines, diaminopyrimidine, and biguanides (Primaquine, Mepacrine, Chloroquine and Pyrimethamine).

B. Antiamoebic agents; Emetine hydrochloride, quinoline derivatives, metal free substances; Diloxanide furoate, Metronidazole, organometallic compounds, acetarsol (Diodohydroxyquinoline, Metronidazole).

TEXT BOOKS

1. Thomas. L. Lomke, David. A. William, Victoria. F. Roche, S. William. Zito; *Foye's principles of medicinal chemistry*; Wolters Kluwer, Lippincott Williams & Wilkins; 6th edition; 2008; ISBN:9788189960308
2. John. M. Beale Jr, John. M. Block, Wilson and Griswold's *Textbook of organic medicinal and pharmaceutical chemistry*, Wolters Kluwer, Lippincott Williams & Wilkins; 12th edition; 2011; ISBN:9788184733969

REFERENCE BOOKS

1. Singh, H. and Kapoor, VK.; *Medicinal and Pharmaceutical Chemistry*; VallabhPrakashan; 3rd edition; 2012; ISBN:9788185731773.
2. Wolff, ME. Ed., *Burger's Medicinal Chemistry Drug discovery and Development*; John Wiley and Sons; 7th edition; 2010; ISBN: 0470278153.
3. *Indian Pharmacopoeia*; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695
4. Richard B Silverman; *The organic Chemistry of Drug design and Drug action*; 2004; 2nd edition; Elsevier; ISBN: 8181474503.



**BPH-703P/
BPL-703P**

MEDICINAL CHEMISTRY PRACTICAL - I

40 Hrs

Ex.No-01: Preparation of Isoamyl acetate.

Tasks/Skills: Esterification; refluxing, extraction and simple distillation.

Ex.No-02: Preparation of 2-aminobenzaldehyde

Tasks/Skills: Reduction; distillation, suction filtration, recrystallization

Ex.No-03: Preparation of Benzanilide from benzophenone

Tasks/Skills: Beckmann rearrangement reaction; suction filtration and melting point determination

Ex.No-04: Preparation of Benzimidazole

Tasks/Skills: Condensation; Water bath, suction filtration, water condenser and melting point determination

Ex.No-05: Preparation of Benzotriazole.

Tasks/Skills: Diazotization and N-coupling reaction; Magnetic stirrer, suction filtration and crystallization

Ex.No-06: Preparation of 4-methoxy benzophenone

Tasks/Skills: Acylation; Water bath, Trap for acidic gases, water sensitive reactants and suction filtration

Ex.No-07: Preparation of 1-indanone

Tasks/Skills: *Electrophilic aromatic substitution reaction; suction filtration, melting point determination.*

Ex.No-08: Preparation of Methyl orange

Tasks/Skills: *Diazotization and coupling reaction; Cooling mixture, suction filtration.*

Ex.No-09: Preparation of Benzoic acid and Benzyl alcohol.

Tasks/Skills: *Cannizzaro reaction; Refluxing, separatory funnel, suction filtration and melting point determination.*

Ex.No-10: Preparation of Anthranilic acid

Tasks/Skills: *Hoffmann degradation reaction; Cool bath, steam bath, suction filtration and melting point determination*

Ex.No-11: Preparation of methyl red from Anthranilic acid

Tasks/Skills: *Diazotization and coupling; Cooling mixture, suction filtration*

Ex.No-12: Construct molecular model of selected allene system, assign absolute configuration as per CIP rule and comment on its biological activity

Tasks/Skills: *Axial chirality; Ball and stick molecular model set – Drill 1*

Ex.No-13: Construct molecular model of selected allene system, assign absolute configuration as per CIP rule and comment on its biological activity

Tasks/Skills: *Axial chirality; Feiser molecular model research kit – Drill 2*

Ex.No-14: Construct molecular model of selected olefinic compounds and apply Cis-trans and E-Z nomenclature system

Tasks/Skills: *Cis-trans and E-Z nomenclature; Ball and stick molecular model set*

Ex.No-15: Construct molecular model of selected cis-trans isomers from pharmaceuticals and comment on its biological activity

Tasks/Skills: *Cis-trans isomerism; Ball and stick molecular model set*

Ex.No-16: Preparation of sulphanilide from acetanilide

Tasks/Skills: *Nucleophilic substitution, hydrolysis; Water bath, refluxing, vacuum filtration and crystallization.*

Ex.No-17: Preparation of Para Amino Benzoic Acid (PABA).

Tasks/Skills: *Acetylation, Permanganate oxidation, hydrolysis; Ice bath, steam bath, Vacuum filtration, refluxing and crystallization*

Ex.No-18: Determination of the % of Carboxyl group in the given organic compound

Tasks/Skills: *Estimation of functional group; titration arrangement*

Ex.No-19: Determination of the % of amino group in the given organic compound

Tasks/Skills: *Estimation of functional group; titration arrangement*

Ex.No-20: Determination of the % of aldehyde group in the given organic compound

Tasks/Skills: *Estimation of functional group; titration arrangement*

Note: *Though 20 are listed, minimum of 12 Practical Exercises need to be completed*

during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Furniss BS, Hannaford Aj, Smith PWG, Tatchell AR, Vogel'S textbook of Practical organic Chemistry, Pearson Education Limited, 5th edition, 1996, ISBN- 81-297-0263-6.
2. Mann FG, Saunders BC. Practical Organic Chemistry, Pearson Education Limited, 4th edition, 2009, ISBN- 8131727106.
3. Donald I Pavia, Garry M Lampman and George S Kris; Introduction to Organic Laboratory Techniques; 1987; 3rd edition; Harcourt School; ISBN:9780030148132



**BPH-704/
BPL-704**

**PHARMACEUTICAL JURISPRUDENCE-
THEORY**

40 Hrs

UNIT – 1: Introduction, Ethics & Pharmacy Act

A. Concept of law, Pharmaceutical and drug legislation in India, Principle of professional ethics, Code of Pharmaceutical Ethics in relation to job, trade, medical profession, own profession, and professional organizations.

B. Pharmacy Act: Objective, Definitions, Constitution and Functions of Pharmacy Council of India and State Pharmacy Councils. Administration of Act, Registration of Pharmacists, Offences and Penalties.

UNIT – 2: Drugs and Cosmetics Act & Rules – Part 1

A. Drugs and Cosmetics Act and the Rules: Objective, Scope, Definitions, study of various Schedules.

B. Study of important provisions and rules related to Import, Manufacture, Labelling, Packing, Sale of Drugs and Cosmetics.

UNIT – 3: Drugs and Cosmetics Act & Rules – Part 2

A. Detailed study of Schedule H, Schedule M, Schedule N, Schedule P, Schedule X, and Schedule Y, Offences and Penalties. Recent amendments to Drugs and Cosmetics Act.

B. Drugs and Cosmetics Act and the Rules: Provisions related to Homeopathic Medicines, Ayurveda, Siddha and Unani (ASU) Drugs.

UNIT – 4: Drugs and Cosmetics Act & Rules – Part 3

A. Drugs and Cosmetics Act and the Rules: Administration – Constitution, Composition and Functions Drug Technical Advisory Board, Drugs Consultative Committee.

B. Qualification, Appointment, Responsibilities and Duties of Drugs Controller General India, State Drug Controller, Drugs Inspector and Government Analyst.

C. Functions of Central Drugs Laboratory and State Drug Laboratory.

UNIT – 5: Other Relevant Acts

A. Narcotic drugs and psychotropic substances Act, 1985: Objective, Definitions, constitution and functions of narcotic & psychotropic consultative committee, prohibition, control & regulation, import, export.

B. Medicinal and toilet preparations (Excise duties) act 1955: Objective, legal definitions, licensing, manufacturing of alcoholic preparations, bonded and non-bonded laboratory.

C. Drugs and Magic Remedies (Objectionable Advertisement) Act – Prohibited and Exempted advertisements; Administration; Offences and Penalties.

D. Drug Price Control Order: Objectives, Definitions, Determination of the ceiling price of Scheduled Formulations

TEXT BOOKS

1. Mithal BM; *A text book of forensic pharmacy*; 2010; 10th edition; VallabhPrakasham, Delhi; ISBN:9788185731131
2. Jain NK; *A text book of forensic pharmacy*; 2013; 7th edition; VallabhPrakasham, Delhi; ISBN: 9788185731155
3. Kokate, CK., Gokhle, SB.; *Textbook of Forensic Pharmacy*; 2008; 2nd edition; PharmaMed Press; Hyderabad; ISBN: 9788188449482
4. Guru Prasad Mohanta; *Textbook of Forensic Pharmacy – A Companion for Pharmacy Students and Professionals*; 2013; 1st edition; CBS Publishers, New Delhi; ISBN:9788123923000

REFERENCE BOOKS

1. Vijay Malik; *Law relating to Drugs and Cosmetics*; 2011; 21st edition; Eastern Book Company, Lucknow; ISBN:9788170121343
2. Narayan, CV.; *Textbook of Forensic Pharmacy*; 2010; 1st edition; Anmol Publisher, New Delhi; ISBN:9788126144778
3. Vijay Malik; *Law relating to Drugs and Cosmetics*; 2011; 22nd edition; Eastern Book Company, Lucknow; ISBN:9789350282113



**BPH-705/
BPL-705**

PHARMACOGNOSY – IV - THEORY

40 Hrs

UNIT – 1: Production of Plant drugs and factors affecting their Quality

- A. General principles and methods of Cultivation of medicinal plants, collection, drying, garbling, packaging, storage and preservation of plant drugs.
- B. Exogenous and Endogenous factors influencing cultivation, yield and plant drug quality including climate, attitude, latitude, soil, fertilizers, pests and their control, plant disease; mutation, polyploidy, hybridization and application of plant growth regulators.

UNIT – 2: Quality Control of Plant Drugs – Part 1

- A. Introduction to Plant drug quality control – Significance, current status objectives of standardization, Classification of evaluation methods.
- B. Adulteration of plant drugs, types of adulteration and adulterants with illustrations; Deterioration of stored plant drugs.
- C. Microbial contamination of plant drugs, Toxic residues such as Heavy metals, Aflatoxins, Pesticides and fumigants; their health hazards and brief outline of detection methods.

UNIT – 3: Quality Control of Plant Drugs – Part 2

- A. Sampling of plant drugs for analysis size sampling methods, and samples preparation. Preliminary analysis – Sensory, Macroscopical and Microscopical analysis including Quantitative microscopy, their purpose and limitations.
- B. Evaluation of Parameters applicable to Plant drugs such as Foreign matter, Moisture content, Loss on drying, Extractive values, Ash values, Crude fibre, Volatile oil content,

Tannin content, Swelling index, Optical rotation, Sp. gravity, Refractive index, Filth, Insoluble matter etc.

UNIT – 4: Quality Control of Plant Drugs – Part 3

A. Modern Sample preparation/extraction methods for Chromatographic analysis of Plant products including Soxhlet, SFE, PLE, MAE, Solid phase micro-extraction, Ultrasonication, Distillation etc.

B. Application of chromatographic methods of analysis to plant drugs using TLC, PC, Column, HPTLC, HPLC, GLC/GC techniques and tools; Spectrometric methods including UV-Visible, IR, Fluorescence, in plant drug analysis.

C. Chemical Analytical (wet) methods (at least 2 illustrative assays), Radioimmunoassay and a survey of biological evaluation methods.

UNIT – 5: GMP and GAP for Herbal products

A. Good Agriculture Practices (GAP) for medicinal plants: Identification and Authentication of plants, Seeds and propagation materials, Cultivation, Soil, Harvest, Personnel; Good Collection Practices: Premises, Technical planning, Selection of plants, Collection, Personnel; Post-harvest processing, primary processing, Drying, Specific processing, Processing facilities, Equipment, Bulk packaging and labelling, Storage and transportation.

B. WHO Guidelines on GMP for Herbal Medicinals: General principles, Sanitation and Hygiene, Personnel and their Hygiene, Premises, Equipment, Materials, Documentation, Good practices in production and quality control

TEXT BOOKS

1. Williams Charles Evans; Trease and Evans Pharmacognosy; 2009; 16th edition; Elsevier, London; ISBN:978-0-7020-2934-9

2. Kokate, CK., Purohit, AP. and Gokhale, SB.; Pharmacognosy; 2010; 46th edition; Nirali Prakashan, Pune; ISBN:978-81-96396-15-2

REFERENCE BOOKS

1. WHO; Quality Control Methods for Herbal Materials; 2011; World Health Organization, Geneva; ISBN:978 92 4 150073 9

2. Pulok K Mukherjee; Quality Control of Herbal Drugs; 2002; 1st edition; Business Horizons, New Delhi; ISBN:819007884-4

3. WHO; WHO guidelines on good manufacturing practices (GMP) for herbal medicines; 2007; World Health Organization, Geneva; ISBN:978-92-4-1547-16-1

4. National Medicinal Plants Board; Good Agricultural Practices for Medicinal Plants; 2009; National Medicinal Plants Board, Govt. of India, New Delhi; ISBN:978-81-909121-2-9

5. Agrawal, SS., Paridhavi, M.; Herbal Drug Technology; 2009; 1st edition; University Press, Hyderabad; ISBN:978-81-7371-579-2



**BPH-705P/
BPL-705P**

PHARMACOGNOSY – IV PRACTICAL

40 Hrs

Ex.No-01: Determine Foreign Organic Matter in a give sample of Drugs

Tasks/Skills: *Identify and Separate the organic matter physically; weighing; Calculation; Method prescribed in Reference 1 below.*

Ex.No-02: Determine the number of starch grains in a given sample of Ginger powder using Lycopodium spore method.

Tasks/Skills: *Learn a quantitative microscopic technique to count well defined particles under microscopic fields.*

Ex.No-03: Determine Total Ash and Acid insoluble Ash values.

Tasks/Skills: *Perform weighing, incineration, to determine the inorganic components in a plant sample; and soil contamination.*

Ex.No-04: Determine the Water-soluble Extractive value for given sample of powdered plant drug using Hot extraction method.

Tasks/Skills: *Weigh the sample, Hot extraction, Evaporation, Weighing.*

Ex.No-05: Determine the Moisture (water) content in the given sample of plant drug using Azeotropic method.

Tasks/Skills: *Weigh sample, Distillation,*

Ex.No-06: Determine the Loss on drying to estimate the content of moisture and volatile content in a given sample of plant drug.

Tasks/Skills: *Weigh the sample, heat to a constant weight, calculate the loss.*

Ex.No-07: Estimate the Volatile oil content of given sample of plant drug.

Tasks/Skills: *Weigh sample, distillation using clavanger apparatus, measure the oil*

Ex.No-08: Determine the Swelling index (factor) of the given sample of mucilage containing drug

Tasks/Skills: *Weigh Isapgol seeds or husk, Soak in water, shake intermittently, measure volume of swollen seeds and report.*

Ex.No-09: Determine the Foaming index of given sample of saponin containing drug.

Tasks/Skills: *Foaming capacity of soap nuts (*Sapindus mukorossi*) or *Acacia concinna* (*shikakai*) by serial dilution of the extract.*

Ex.No-10: Determine the Acid value of given sample of oil

Tasks/Skills: *Acid base titration method as prescribed in Indian Pharmacopoeia*

Ex.No-11: Determine the Saponification value of the given sample of oil

Tasks/Skills: *Saponification by reflux heating, Acid base titration as per IP*

Ex.No-12: Determine the Peroxide value of the given sample of oil

Tasks/Skills: *Perform Iodometric method prescribed in Indian Pharmacopoeia*

Ex.No-13: Determine the Iodine value of the given sample of oil.

Tasks/Skills: *Perform Iodometric titration as prescribed in Indian Pharmacopoeia*

Ex.No-14: Perform TLC of Alkaloid containing drugs

Tasks/Skills: *Make Silica gel G TLC plates, make solvent System, develop Chromatogram, use*

spray reagent for detection & report Rf values.

Ex.No-15: Perform TLC of Glycoside containing drugs

Tasks/Skills: As in Exercise No. 14.

Ex.No-16: Perform TLC of Steroid containing drugs

Tasks/Skills: As in Exercise No. 14.

Ex.No-17: Perform TLC of some Isoprenoid (V.oil) containing drugs

Tasks/Skills: As in Exercise No. 14.

Ex.No-18: Perform Paper Chromatography of some Amino acids.

Tasks/Skills: Developing paper chromatogram and detection method.

Ex.No-19: Estimation of Quinine/Ephedrine /Atropine in the given sample

Tasks/Skills: Use Non-aqueous assay methods prescribed in Pharmacopoeia

Ex.No-20: Estimation of Tannins in the given sample

Tasks/Skills: Grind Myrobalan and Weigh sample, follow WHO method.

Ex.No-21: Estimation of Total carbohydrates in the given sample

Tasks/Skills: Use of Anthrone or Phenol-Sulphuric acid and determination by colorimetric method

Note: Though 21 exercises are listed, minimum of 12 exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. WHO, *Quality Control Methods for Herbal Materials*; 2011; World Health Organization; Geneva; ISBN: 9789241500739
2. *Indian Pharmacopoeia*; 6th edition; 2010; Indian Pharmacopoeia Commission; Govt. of India. ISBN: 9788190343664
3. *British Pharmacopoeia*; 2012; British Pharmacopoeia Commission; London; ISBN: 9780113228690
4. Hildebert Wagner, Sabine Bladt; *Plant Drug Analysis - A Thin Layer Chromatography Atlas*; 2nd edition; 2009; Springer Dordrecht Heidelberg, London; ISBN: 9783642005732
5. Sadasivam, S., Manickam, A., *Biochemical Methods*, 3rd edition, 2007, New Age International Publishers, New Delhi, ISBN: 9788122421408





B. Pharm. VIII Semester



BPH-801 /

MODERN DRUG DELIVERY SYSTEMS - THEORY

40 Hrs

BPL-801

UNIT – 1: Modified-Release Peroral Drug Delivery Systems

The rationale for sustained release pharmaceuticals, Terminology, Sustained vs. Controlled release, Drug candidates for sustained (extended) release products, Kinetic pattern of drug release required for controlled release dosage forms, Design of sustained release drug delivery systems – Robinson Equation. Recent developments in drug delivery systems.

UNIT – 2: Sustained-Release Technology for Oral Dosage Forms

Coated beads, Microspheres, Microencapsulated drug – Microencapsulation, Matrix (monolithic) systems – formulation, Reservoir (membrane controlled) systems – components and formulation, Osmotic pump, Gastric retentive system.

UNIT – 3: Epidermal and Transdermal Drug Delivery

Ointments – Ointment bases, Preparation of ointments, compendial requirements; Features and use of ophthalmic ointments, Creams and Gels.

Transdermal drug delivery systems (TDDS) – Drug transport through the skin, percutaneous absorption, Design features of TDDS, Types of TDDS – Monolithic and Rate limiting membrane systems, Advantages of TD patches.

UNIT – 4: Rectal and Vaginal Drug Delivery

Suppositories – local and systemic action, bases, factors of drug absorption for rectal suppositories, preparation by molding and compression; Vaginal suppositories, Packaging and storage, Vaginal inserts.

UNIT – 5: Polymers in Drug Delivery

Role of polymers in drug delivery, Ideal properties of polymers, Classification of polymers, Soluble polymers, Biodegradable or bio-erodible polymers, Mucoadhesive polymers, characterization of polymers, recent developments.

TEXT BOOKS

1. Robinson JR, Lee VHL; *Controlled Drug Delivery Systems-Fundamentals and applications*; 2005; 2nd edition; Marcel Dekker, New York; ISBN:9780824775889.
2. Vyas SP, Khar RK, *Controlled Drug Delivery Concepts and Advances*; 2002; 2nd edition; VallabhPrakashan, New Delhi; ISBN: 9788185731742

REFERENCE BOOKS

1. Chein YW.; *Novel Drug Delivery Systems*; 2009; 2nd edition; Marcel Dekker, New York; ISBN3: 9780824785208
2. Allen Jr. LV; *Remington: The science and practice of pharmacy*; 2010; 22nd edition. Lippincott Williams & Wilkins, Philadelphia; ISBN:9780857110626
3. Jain NK; *Advances in Controlled and Novel Drug Delivery*; 2011; CBS Publishers and Distributors, New Delhi; ISBN: 9788123907277
4. Florence AT, Siepmann J; *Modern Pharmaceutics (2 volumes)*; 2009; 5th edition; CRC Press,

USA; ISBN:9781420065701

5. Ranade VV, Hollinger MA.; *Drug delivery systems*; 2004; 2nd edition, CRC Press, USA; ISBN:9780849314339



**BPH-801P/
BPL-801P**

**MODERN DRUG DELIVERY SYSTEM
PRACTICAL**

40 Hrs

Ex.No-01: Determination of total dose of a sustained release dosage form for 12 hour of model drugs (propranolol HCl, DiltiazemHCl)

Tasks/Skills: *Loading and sustained doses using pharmacokinetic data*

Ex.No-02: Development and formulation of sustained release tablets of a model drug using HPMC polymer

Tasks/Skills: *Sustained release matrix system*

Ex.No-03: Development and formulation of sustained release oral tablets of a model drug using hydrophobic matrix

Tasks/Skills: *Sustained release hydrophobic matrix system*

Ex.No-04: Development and preparation of microcapsules of a drug

Tasks/Skills: *Co-acervation Phase separation micro-capsulation technique*

Ex.No-05: Development and preparation of solid dispersion of Aspirin

Tasks/Skills: *Solvent evaporation/other techniques*

Ex.No-06: Formulation and evaluation of a floating tablet (containing ciprofloxacin or metformin)

Tasks/Skills: *Floating (buoyant) matrix tablet using gas generating agent, sodium bicarbonate*

Ex.No-07: Study the release of drug (salicylic acid) from different ointment bases

Tasks/Skills: *Preparation of salicylic acid ointment and its release behaviour*

Ex.No-08: Development and preparation of a Transdermal Patch

Tasks/Skills: *Membrane controlled TD patch (Fentanyl/Diclofenac)*

Ex.No-09: Study of diffusion of drug from TD Patch

Tasks/Skills: *Ascertain the diffusion and correlate the drug delivery through skin*

Ex.No-10: Development and preparation of pain balm using suitable base

Tasks/Skills: *Ointment with water washable base*

Ex.No-11: Development and preparation of antifungal (clotrimazole) cream

Tasks/Skills: *Vanishing cream based ointment*

Ex.No-12: Dissolution study of a commercial SR dosage form for 8 hours and its dissolution profile

Tasks/Skills: *Dissolution rate of sustained release product*

Ex.No-13: Development and preparation of bisacodyl 10 mg rectal suppository.

Tasks/Skills: Moulding method using hydrogenated vegetable oil

Ex.No-14: Development and preparation vaginal clotrimazole suppository

Tasks/Skills: Use of PEG base

Note: Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Robinson JR, Lee VHL. *Controlled Drug Delivery Systems-Fundamentals and applications*, 2nd Edition, Marcel Dekker, New York, 2005 ISBN-13: 9780824775889.
2. Vyas SP, Khar RK, *Controlled Drug Delivery Concepts and Advances*; 2002; 2nd edition, VallabhPrakashan, New Delhi; ISBN:9788185731742
3. Mithal BM, *A Text Book of Pharmaceutical Formulation*, 6th Edition, VallabhPrakashan, New Delhi, 1997. ISBN-13: 9788185731049
4. Allen Jr. LV. *Remington: The science and practice of pharmacy*, 22nd Edition. Lippincott Williams & Wilkins, Philadelphia, 2010. ISBN-13: 9780857110626
5. Florence AT, Siepmann J. *Modern Pharmaceutics*, 5th Edition (2 volumes), CRC Press, USA. 2009. ISBN-13: 9781420065701



**BPH-802/
BPL-802**

PHARMACEUTICAL ANALYSIS –III THEORY

40 Hrs

UNIT – 1: PMR Spectroscopy

- A.** Principle & Instrumentation, working of Proton magnetic resonance spectroscopy. Sample preparation, Solvents & reference standards.
- B.** Chemical shift, factors influencing chemical shift, Shielding & deshielding of a proton & its effect on chemical shift, Spin-Spin splitting. Primary information elicited from PMR spectra: Setting up of a NMR scale, equivalent & non-equivalent protons. Chemical shift, factors influencing chemical shift, Calculation of number of protons from the integrated peak height, coupling constants [J values]. Spectral interpretation of simple organic molecules, applications.

UNIT – 2: MASS Spectroscopy

- A.** Principle, instrumentation and working of mass spectroscopy: sample introduction system, ionizers, and mass analyzers. Low & high resolution instruments. Components & importance of each in brief.
- B.** Primary information elicited from MASS spectra, Calculations of hydrogen deficiency index or Unsaturation index [UI]. Base and parent peaks, concept of isotope abundance, molecular ion, M + 1, M + 2 peaks, Nitrogen Rule.
- C.** Fragmentation patterns & Rearrangements in mass spectrometry: Major modes of fragmentations of hydrocarbons, hydroxyl compounds, halogen compounds, aldehydes, ketones, carboxylic acids, and amines. Spectral interpretation of simple organic molecules, Applications.

UNIT – 3: IR Spectroscopy & UV structural interpretation

- A.** Principle & Instrumentation of IR spectroscopy, brief understanding of Fourier transform

[FT] IR spectroscopy. Sample handling techniques.

B. Primary information elicited from IR spectra, Functional group & finger print regions in the spectrum. Functional groups identification & their use in characterization of compounds.

Spectral interpretation of simple organic molecules, applications.

C. UV spectroscopy in structural analysis: The nature of electronic excitations, effect of conjugation on alkenes, Woodward – Fieser rule for dienes, carbonyl compounds, aromatic compounds, substituent's with unshared electrons, electron releasing and withdrawing effects.

UNIT – 4: Validation of analytical methods & equipments

A. Basic statistics used in Analytical chemistry: mean, standard deviation, variance, Confidence Interval, significance tests: t-tests [paired, unpaired], one way ANOVA.

B. Validation of Analytical procedures as per ICH guidelines: Definition, Purpose of validation, Defining the following Terms: Specificity, linearity, Range, Accuracy, Precision [Repeatability, Intermediate precision, Reproducibility], Detection limit, Quantization limit, Robustness, Ruggedness, System suitability testing.

UNIT – 5: Quality assurance, Quality control & Thermal Analysis, Chromatography

A. Definitions & concepts for Quality assurance, quality control, GLP, GMP, SOP. Control charts: Construction, interpretation rules.

B. Thermal Analysis: Thermal Gravimetric Analysis [TGA], Differential Thermal Analysis [DTA], Differential Scanning Calorimetry [DSC]: principle, instrumentation & Applications.

C. Super Critical Fluid Chromatography: Principle, instrumentation & operating variables, mobile phases, columns, detectors, super critical versus other column chromatography, Applications.

TEXT BOOKS

1. Robert M. Silverstein, Francis X. Webster, David Kiemle; *Spectrometric Identification of Organic Compounds*; 2005; 7th edition; Wiley; ISBN:978-0471393627

2. Beckett, AH., Stenlake, JB.; *Practical Pharmaceutical Chemistry: Part I & II*; 2001; 4th edition; CBS; ISBN:9780485113235

REFERENCE BOOKS

1. Joachim Ermer, John H. McB. Miller; *Method Validation in Pharmaceutical Analysis*; 2005; 1st edition; Wiley-VCH; ISBN:9783527312559

2. Robert Neilson Boyd, Saibal Kanti Bhattacharjee, Robert Thornton Morrison; *Organic Chemistry with study guide*; 2011; 7th edition; Pearson; ISBN:9788131704813

3. David T Harvey; *Modern Analytical Chemistry*; 1999; 1st edition; McGraw-Hill Science; ISBN:9780072375473

4. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; *Fundamentals Of Analytical Chemistry*; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286

5. James W. Robinson, Eileen M. Skelly Frame, George M. Frame II; *Undergraduate Instrumental Analysis*; 2004; 6th edition; CRC Press; ISBN: 978-0824753597



**BPH-802P/
BPL-802P**

**PHARMACEUTICAL ANALYSIS – III -
PRACTICAL**

40 Hrs

NOTE: Reagents used in Analysis Experiments should have **MOLARITY** Units by default as adopted in Pharmacopeias unless otherwise specified.

Ex.No-01: Assay of Pharmaceutical Dosage forms using UV-VIS Spectrometry including determining Linearity range, Limit of Detection [LOD], Limit of Quantification [LOQ] – Drill 1

Tasks/Skills: The assays of different dosage forms such as tablets, capsules, injections, suspensions, gels [official / unofficial], etc. Calculation of drug content using A 1% 1cm , calibration curves, & reference standards,

Ex.No-02: Assay of Pharmaceutical Dosage forms using UV-VIS Spectrometry including determining Linearity range, Limit of Detection [LOD], Limit of Quantification [LOQ] – Drill 2

Tasks/Skills: The assays of different dosage forms such as tablets, capsules, injections, suspensions, gels [official / unofficial], etc. Calculation of drug content using A 1% 1cm , calibration curves, & reference standards,

Ex.No-03: Quantitative estimations of Drugs using fluorimetry. Determination of $E_{1\%}^{1\text{cm}}$ & $E_{1\text{cm}}^{1\%}$.

Ex.No-04: Calibration & Validation of any ONE analytical instruments like colorimeter & UV-VIS Spectrophotometer, Spectrofluorimeter, IR.

Ex.No-05: Perform Calculations involved in Theory of chromatography – Drill 1

Tasks/Skills: Study chromatograms, and calculation of various parameters relevant to HPLC such as distribution constants, retention times, retention factor, selectivity factor, plate height H, plate count N, mobile flow rate, theory of band broadening – van deemter equation; column resolution, optimisation techniques for improving resolution through variation in: plate height, retention factor, selectivity factor.

Ex.No-06: Perform Calculations involved in Theory of chromatography – Drill 2

Tasks/Skills: Study chromatograms, and calculation of various parameters relevant to HPLC such as distribution constants, retention times, retention factor, selectivity factor, plate height H, plate count N, mobile flow rate, theory of band broadening – van deemter equation; column resolution, optimisation techniques for improving resolution through variation in: plate height, retention factor, selectivity factor.

Ex.No-07: Interpretations of IR spectra: Experiments with known & unknown compounds for identification of different functional groups. Use of finger print region in identification of a compound. Identification of simple compounds [containing up to 10 carbons, oxygen, and nitrogen] based on published spectra. – Drill 1

Ex.No-08: Interpretations of IR spectra: Experiments with known & unknown compounds for identification of different functional groups. Use of finger print region in identification of a compound. Identification of simple compounds [containing up to 10 carbons, oxygen, and nitrogen] based on published spectra. – Drill 2

Ex.No-09: Interpretations of PMR spectra: Identification of simple compounds [containing up to 10 carbons, oxygen, nitrogen] based on published spectra. – Drill 1

Ex.No-10: Interpretations of PMR spectra: Identification of simple compounds [containing up to 10 carbons, oxygen, nitrogen] based on published spectra. – Drill 2

Ex.No-11: Interpretations of MASS Spectra: Identification of simple compounds [containing up to 10 carbons, oxygen, nitrogen] based on published spectra. – Drill 1

Ex.No-12: Interpretations of MASS Spectra: Identification of simple compounds [containing up to 10 carbons, oxygen, nitrogen] based on published spectra. – Drill 2

Ex.No-13: Problem solving in Analytical Chemistry based on use of different statistical techniques such as Linear Regression, t tests, one way ANOVA. – Drill 1

Ex.No-14: Problem solving in Analytical Chemistry based on use of different statistical techniques such as Linear Regression, t tests, one way ANOVA. – Drill 2

Ex.No-15: Validation of analytical methods using standard protocols.

Note: Though 15 are listed, minimum of 12 Practical Exercises need to be completed during the semester. New Experiments relevant to the course may also be included.

BOOKS FOR REFERENCE

1. Robert Neilson Boyd, Saibal Kanti Bhattacharjee, Robert Thornton Morrison; *Organic Chemistry with study guide*; 2011; 7th edition ; Pearson; ISBN:978-8131704813
2. Robert M. Silverstein, Francis X. Webster, David Kiemle; *Spectrometric Identification of Organic Compounds*; 2005; 7th edition; Wiley; ISBN:978-0471393627
3. Joachim Ermer, John H. McB. Miller; *Method Validation in Pharmaceutical Analysis*; 2005; 1st edition; Wiley-VCH; ISBN:978-3527312559
4. Douglas A. Skoog , F. James Holler, Stanley R. Crouch; *Principles of Instrumental Analysis*; 2006; Sixth Ed.; Brooks Cole; ISBN:978-0495012016
5. Douglas A. Skoog, Donald M. West, James F. Holler, Stanley R Crouch; *Fundamentals Of Analytical Chemistry*; 2013; 9th edition; Brooks/Cole Cengage Learning; ISBN:9780495558286
6. Mendham, J., Denney, RC., Barnes, JD., Thomas, MJK.; *Vogel's Quantitative Chemical Analysis*; 2000; 6th edition; Prentice Hall; ISBN:978-0582226289
7. Donald I Pavia, Garry M Lampman and George S Kris; *Introduction to Organic Laboratory Techniques*; 1987; 3rd edition; Harcourt School; ISBN:9780030148132



**BPH-803/
BPL-803**

MEDICINAL CHEMISTRY - III THEORY

40 Hrs

Guidelines: The following topics shall be treated covering chemical naming, structure activity relationship, physicochemical and stereo aspects, mode of action (where applicable) and uses. Compounds. Synthesis of only those drugs given in parentheses under each topic would be covered

UNIT – 1: Cardiovascular Agents

A. Cardiovascular Agents: Introduction; cardiac glycosides, structure-activity relationship; mechanism of action; toxic effects.

B. Antihypertensive agents: Introduction, etiology, ganglion blocking agents; antiadrenergic agents, drugs acting directly on smooth muscles, drugs acting on CNS (Propranolol, Captopril).

C. Antianginals and vasodilators: Introduction, mechanism of smooth muscle vasodilation, esters of nitrous and nitric acid, side-effects (Nitroglycerine, Minoxidil, Hydralazine).

D. Antiarrhythmic and antifibrillic drugs: Classification of antiarrhythmic drugs, mechanism

of action, side effects (Procainamide, Disopyramide)

UNIT – 2: Antibiotics

Antibiotics: Introduction, Classification;

A. Penicillins: Biosynthetic Penicillin (Benzyl penicillin), Procaine penicillin, phenoxymethyl penicillin; Semisynthetic penicillin: Phenethicillin, Cloxacillin, Ampicillin, Amoxicillin;

B. Cephalosporins: (Cephalexin), Cefadroxil, Cefalothin, Cefuroxime;

C. Polypeptides: Bacitracin, Polymixin B, Capreomycin;

D. Aminoglycosides: Streptomycin, Neomycin, Kanamycin, Gentamicin;

E. Tetracyclines: Chlortetracycline, Oxytetracycline, (Doxycycline);

F. Macrolide & Other Antibiotics: Erythromycin, Novobiocin, Vancomycin, Rifampicin; (Chloramphenicol).

UNIT – 3: Sulphonamides

A. Antibacterial agents; Development nomenclature and classification, antimicrobial spectrum, drug resistance, synergism with dihydrofolate reductase inhibitors, toxicity and side effects, reduction of crystal urea, physicochemical properties and biological activity, metabolism, sulphonamides and trimethoprim combination (Sulphanilamide, Sulphacetamide, Sulphadiazine, Sulphadimethoxine, Sulphamethazole and Sulphamethoxazole).

B. Hypoglycemic Drugs: (Tolbutamide, Chlorpropamide, Glipizide)

UNIT – 4: Antineoplastic agent

Introduction, characteristics of cancer cell, cell growth cycle, causes of cancer.

A. Antimetabolites: 6-thioguanine, Methotrexate, 6-mercaptopurine, Cytarabine, 5-fluorouracil and Dacarbazine

B. Alkylating agents: (Mechlorethamine, melphalan, busulphan), Cisplatin, (Cyclophosphamide), Carmustine, Lomustine and (Thiotepa)

C. Miscellaneous: (Hydroxyurea), epirubicin

UNIT – 5: QSAR and Drug design

A. Lead discovery, Lead modification strategies, SAR, Isosteres, Bio- isosteres, Application of bioisosterism in drug design.

B. Introduction to QSAR, electronic parameters, partition coefficient, Hansch analysis.

TEXT BOOKS

1. Thomas. L. Lomke, David. A. William, Victoria. F. Roche, S. William. Zito; *Foye's principles of medicinal chemistry*; Wolters Kluwer, Lippincott Williams & Wilkins; 6th edition; 2008; ISBN:9788189960308

2. John. M. Beale Jr, John. M. Block, Wilson and Griswold's *Textbook of organic medicinal and pharmaceutical chemistry*; Wolters Kluwer, Lippincott Williams & Wilkins; 12th edition; 2011; ISBN:9788184733969

REFERENCE BOOKS

1. Singh, H. and Kapoor, VK.; *Medicinal and Pharmaceutical Chemistry*; VallabhPrakashan; 3rd edition; 2012; ISBN:9788185731773.

2. Wolff, ME. Ed., *Burger's Medicinal Chemistry Drug discovery and Development*; John Wiley and Sons; 7th edition; 2010; ISBN: 0470278153.

3. *Indian Pharmacopoeia*; 2010; Government of India, The Indian Pharmacopoeia Commission; ISBN: 9788190343695

4. Richard B Silverman; *The organic Chemistry of Drug design and Drug action*; 2004; 2nd edition; Elsevier; ISBN: 8181474503.



**BPH-804/
BPL-804**

PHARMACOLOGY - III- THEORY

40 Hrs

Note: Mechanism of action, pharmacological actions, adverse drug reactions, precautions, contraindications, preparations, drug interactions, therapeutic uses/indications are required to be studied wherever necessary.

UNIT – 1: Gastro Intestinal Drugs

A. Digestants, antifatulents. Drug treatment of peptic ulcer- classification (H₂ blockers, proton pump inhibitors, prostaglandin analogs, antacids, ulcer protectives). Treatment of Helicobacter pylori infection.

B. Emetics, antiemetics, prokinetic drugs – Classification, mechanism of action, adverse drug reaction, uses & drug interactions. Treatment of gastroesophageal reflux disease.

C. Drug treatment of gallstones.

D. Agents used for constipation – classification, laxatives, purgatives and hazards of purgatives.

E. Drugs used in diarrhoea – indications for the use of antimotility agents, antimicrobial agents and antisecretory agents and oral rehydration powder.

F. Drugs used in Inflammatory Bowel Diseases: IBS, Crohn's Disease, Ulcerative Colitis.

UNIT – 2: Hormones and Hormone Antagonists

A. Hormones – Definition, different types and their mechanism of action.

B. Anterior pituitary hormones – Regulation of secretion, preparations and uses. Importance of drug induced alterations in prolactin levels.

C. Thyroid hormones – Levo thyroxine, antithyroid drugs- classification, preparations and uses.

D. Antidiabetic drugs – Insulins – Actions conventional preparations, highly purified preparations, reactions, uses, newer insulin delivery devices. Oral hypoglycemic drugs- classification, management of hypoglycemia, diabetic ketoacidosis.

E. Glucagon – Actions, uses.

F. Corticosteroids – regulation of secretion, preparations, Glucocorticoid antagonists.

G. Gonadal hormones – Androgens, anabolic steroids – preparations, side effects, uses, antiandrogens – side effects, uses. Estrogens – preparations, hormonal replacement therapy, antiestrogens, selective estrogen receptor modulators. Progestins – Preparations, antiprogestins – (Mifepristone) hormonal contraceptives – types of methods, preparations, male contraceptive.

H. Drugs acting on uterus – uterine stimulants- classification, (Oxytocin, Ergometrine, Prostaglandins). Uterine relaxants – Preparations.

I. Drugs affecting calcium balance: Calcium parathyroid hormone, calcitonin, Vitamin D, preparations, uses. Bisphosphonates – actions, uses, Pharmacotherapy of osteoporosis.

UNIT – 3: Chemotherapy - I

- A.** General principles of chemotherapy, antibiotics – definition, sources, chemical nature, mechanism of action, (spectrum of activity, type of action, problems. Toxicity, hypersensitivity reactions, drugs resistance – types, mechanisms, prevention of super infection. Factors determining the choice of antibiotic, minimum inhibitory concentration (MIC), post antibiotic effect (PAE), minimum bactericidal concentration (MBC). Combinations of Antimicrobials – Advantages, Indications. Prophylactic use of Antimicrobials – indications with examples, causes for the failure of chemotherapy.
- B.** Sulfonamides - Preparations, cotrimoxazole
- C.** Quinolones – Classification- first generation, Second generation. Drugs used in typhoid fever.
- D.** Beta lactam antibiotics: Classification, Penicillins (including semisynthetic, Acid resistant, penicillinase resistant, Extended spectrum), Beta lactamase inhibitors, Cephalosporins, monobactams, carbapenems.
- E.** Tetracyclines and chloramphenicol.
- F.** Aminoglycosides- Classification.
- G.** Macrolide and miscellaneous antibiotics –Classification, newer macrolides, clindamycin, Lincomycin, vancomycin, Teicoplanin, Linezolid, Fusidic acid, Polymyxin B, Bacitracin, Tyrothricin – Spectrum and uses.
- H.** Antitubercular drugs – Classification, first line drugs, Second line drugs, newer drugs, antitubercular drug regimens, management of Adverse Drug Reaction with antitubercular drugs, chemoprophylaxis, tuberculosis in AIDS, pregnancy, breast feeding, drugs used in Atypical Mycobacteriae.
- I.** Antileprotic drugs - Classification, Pharmacotherapy, drug regimen (Multi Drug Therapy - MDP) Revised National Tuberculosis Control Programmes (DOTS and DOTS – Plus) , Alternative regimens, newer drugs.
- J.** Drugs used in urinary tract infection, urinary antiseptics,
- K.** Drugs used in sexually transmitted diseases

UNIT – 4: Chemotherapy - II

- A.** Antifungal drugs: Classification, local, systemic mycoses management.
- B.** Antiviral drugs: Classification, Anti-herpes virus drugs, anti influenza virus drugs, nonselective antiviral drugs. Anti-retrovirus drugs, WHO and National Aids Control Organisation (NACO) guidelines for the treatment of HIV infection,
- C.** Anti malarial drugs: Classification, different forms of anti malarial therapy, management of cerebral malaria, radical cure, malaria prophylaxis, resistant malaria.
- D.** Antiamoebic drugs: Classification, drugs for giardiasis.
- E.** Drugs for Trichomoniasis,
- F.** Drugs for leishmaniasis (kala-azar).
- G.** Anthelmintics: Classification, choice of drugs for various worm infestation
- H.** Antifilarial drugs.

UNIT – 5: Toxicology

- A.** Heavy metals and antagonists – Lead, Arsenic, cadmium, Mercury poisoning and Management. Antagonists (eg- dimercaprol)
- B.** General Principles of treatment of acute poisonings- Clinical assessment, Emergency stabilization, active removal of toxin, methods

to increase elimination of toxic agents, plasma exchange and exchange transfusion.

C. Non-metallic environmental toxicants and occupational toxicology: Air pollution by Carbon monoxide, Hydrogen sulphide, Sulphur dioxide, Nitrogen dioxide.

D. Management of over dosage with commonly used therapeutic agents.

TEXT BOOKS

1. Satoskar, RS., Bhandarkar, SD., Ainapure, SS.; *Pharmacology and Pharmacotherapeutics*; 2006; 19th edition; Popular Prakashan Pvt Ltd; ISBN: 9788179912515

2. Tripathi, KD.; *Essentials of Medical Pharmacology*; 2008; 6th edition; Jaypee Brothers Medical Publishers (P) Ltd; ISBN:8184480857

REFERENCE BOOKS

1. Laurence L. Brunton, Bruce A. Chabner, Bjorn Christian Knollmann; *Goodman and Gilman's The Pharmacological Basis of Therapeutics*; 2010; 12th edition; McGraw-Hill Professiona; ISBN:978-0071624428

2. Bertram G. Katzung; *Basic Clinical Pharmacology*; 2011; 12th edition; McGraw-Hill Medical; ISBN: 978-0071764018

3. Richard A. Harvey, Pamela C. Champe; *Lippincott's Illustrated Reviews: Pharmacology*; 2005; 4th edition; Lippincott Williams & Wilkins; ISBN: 9780781741187

4. Humphrey P. Rang, Maureen M. Dale, James M. Ritter, Rod J. Flower, Graeme Henderson; *Rang & Dale's Pharmacology*; 2011; 7th edition; Churchill Livingstone; ISBN-13: 978-0702034718

5. David Grahame-Smith, Jeffrey Aronson; *Oxford Textbook of Clinical Pharmacology and Drug Therapy*; 2002; 3rd edition; Oxford University Press, USA; ISBN: 978-0192632340



**BPH-805a/
BPL-805a**

PHARMACEUTICAL PACKAGING- THEORY

40 Hrs

UNIT – 1: Basics of Packaging & Packaging Materials

A. Introduction: Purpose of packaging and labelling, selection of the ideal package, hazards encountered by the package, various types of inner and outer packages and their specifications, factors effecting selection of a suitable package. Environmental considerations of packaging; Child resistant package and Tamper Evident Packaging.

B. Packaging materials: Detailed study of materials used for containers & closures with regard to composition packaging characteristics, advantages, economics and limitations of various packaging materials with special emphasis on glass, plastics, metals and rubber. Quality control tests and evaluation of packaging materials.

UNIT – 2: Strip & Blister Packaging

A. Strip Packing: Significance of Strip Packing, advantages, economics and limitation of Strip Packing, Strip Packing machinery, films employed in Strip Packing (including composites and laminates) and evaluation of films and strips packs.

B. Blister Packaging: Blister packing materials, significance of Blister packing, advantages, economics and limitation of blister packing, blister packing machinery, various types of blister

packages, evaluation of blister package.

UNIT – 3: Pouch & Liquid Packaging

A. Pouch packaging: Materials used, advantages, economics and limitation of pouch packing, pouch packing machinery, spectrum of applications, and evaluation of pouch packing.

B. Liquid Formulation Packaging: Various containers/closures employed for liquid formulations. Machinery employed for liquid filling – constant level, volumetric, gravimetric etc. Evaluation of liquid formulation packages.

UNIT – 4: Semi-solid & Aerosol Packaging

A. Semi-Solid Packaging: Various types of containers/packages used for semi-solid products, filling and sealing machinery (including collapsible tube filling and sealing machine) merits and limitations of various packages, evaluation of semi-solid product package.

B. Packaging of aerosols: Components of aerosol packages, material used for containers, components of the valve used in aerosol package, types of actuators, stability testing of aerosol container, quality control of aerosol containers.

UNIT – 5: Sterile Product Packaging & Labelling

A. Sterile Product Packaging: General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals.

Types of closures used for the sterile products. Evaluation of the sterile product packages

B. Labelling: Types of label (including Bar code, RF, structured program, in-mould and decorative labelling), Legal requirements of Labelling, packaging inserts and outserts.

Adhesives and machinery employed for labelling.

TEXT BOOKS

1. Leon Lachman, Liberman, HA., and Kanig, JL; *The Theory and Practice of Industrial Pharmacy*, Lea & Febiger, Philadelphia;

2. Sanju Nanda, Rakesh Pahwa and Arun Nanda; *Pharmaceutical Packaging Technology*; New Age Publications, New Delhi

REFERENCE BOOKS

1. Dean, DA.; *Pharmaceutical Packaging Technology*; 2000; Taylor & Francis, New York ; ISBN: 9780748404407



**BPH-805b/
BPL-805b**

PHARMACEUTICAL MARKETING- THEORY

40 Hrs

UNIT – 1: Basics of Marketing & Ethics

A. Marketing Management: Meaning, functions, negative demand, no demand, latent demand, falling demand, irregular demand, full demand, overall demand, and wholesome demand.

B. Ethics in Pharmaceutical marketing.

UNIT – 2: Issues in Pharmaceutical Marketing

A Brief history, Industry Structure, Current issues, Price Control; Patents and IPR, Pharmaceutical Market, Many dimensions of the market, Market segmentation theory, Pharmaceutical market segmentation, The Served Market Concept, Opportunity Analysis,

Strategic Options.

UNIT – 3: Product Management and Price

A. Product: The Product Concept, What is a brand, Augmented Product Concept, Product Life Cycle, Market Life Cycle, Product positioning, Product strategy, New Product Adoption.

B. Price as an element of Pharmaceutical Marketing, History of Price control, Bases for Pricing, Pricing strategies, Pricing management

UNIT – 4: Pharmaceutical Promotion & Personal selling

A. Promotion: Marketing communication, Barriers of Communications, Gateways to Communication, Promotional objectives and Tasks, Principles of Medical advertising, Launching and Managing new Products

B. Personal Selling: Super Sales Person, Medical Representatives Roles, Doctors expectation from Medical Representative, Study of Prescribing Behaviour, Prescription Research.

UNIT – 5: Sales force management & Marketing pipeline

A. Sales Force Management: Importance, sales force decision, sales force size, recruitment and selection, training, controlling compensation, Fixing sales territories evaluation.

B. The Marketing pipeline: Manufacturer, Wholesaler, The Retailer, Pharmaceutical Distribution Channels.

TEXT BOOKS

1. *Subba Rao Chaganti; Pharmaceutical Marketing In India Concepts Strategy Cases; 2013; Pharma Book Syndicate, Hyderabad; ISBN: 9788188449255*

2. *Kumardatt A. Ganjre; Pharmaceutical Marketing: Strategies And Practices; 2011; 1st edition; International Book House; ISBN: 9789381335024*

REFERENCE BOOKS

1. *Mickey Smith; Principles of Pharmaceutical Marketing; 2004; 3rd edition; CBS Publishers, Delhi; ISBN: 9788123908182*

2. *Philip Kotler, Gary Armstrong, Ehsan Ul Haque, Prafulla Y. Agnihotri; Principles of Marketing; 2010; Pearson, Chennai ; ISBN: 978-8131731017*



**BPH-805c/
BPL-805c**

**PHARMACEUTICAL REGULATORY
AFFAIRS- THEORY**

40 Hrs

UNIT – 1: Regulatory Requirements in India

Pharmaceutical Regulatory Process in India: Hierarchy and working flow of Drug Regulatory Authorities in India, Roles of DCGA and CDSCO in drug control, Drug Control Authority and its responsibilities in the state. Current Good Manufacturing practice Guidelines - Schedule M & U requirements. Overview of Indian Patent Law.

UNIT – 2: Validation techniques

Quality Control in Pharmaceutical Industries - Introduction to validation – Process validations for tablet manufacturing, cleaning validation, Validation air handling systems – analytical method validation.

UNIT – 3: ICH guidelines

The International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH): Organization and function – harmonization process – overview of the guidelines – guidelines on impurities in pharmaceutical substance and pharmaceutical products – guidelines on stability studies.

UNIT – 4: Quality assurance

Overview of ISO 9000, NABL accreditation, good laboratory practice

UNIT – 5: International regulatory affairs

US-FDA regulatory affairs: Hatch – Waxman amendment, - exclusivity - Abbreviated New Drug Application (ANDA) for generic market - types of ANDA - Data presentation - verification and grant by FDA - orange book listings. Drug master file (DMF) need, types and approval process – common technical documentation. WHO certification (Certificate of Pharmaceutical Products by CDSCO)

REFERENCE BOOKS

1. *US FDA CDER handbook, Department of Health and Human Services, Food and Drug Administration, Center for Drug Evaluation and Research.* <http://www.fda.gov/downloads/AboutFDA/CentersOffices/CDER/UCM198415.pdf>
2. *ICH guidelines* www.ich.org
3. *Douglas J. Pisano, David S. Mantus; FDA Regulatory Affairs; 2008; 2nd edition; Informa Healthcare, New York; ISBN:9781420073546*
4. *NABL – 100 (Issue 1, 1996), National Accreditation Board for Testing & Calibration laboratories., Department of Science & Technology, Ministry of Science & Technology, Government of India.*
5. *Jain NK; A text book of forensic pharmacy; 2013; 7th edition; Vallabh Prakasham, Delhi; ISBN: 9788185731155*
6. *Loftus, BT. and Nash, RA.; Pharmaceutical Process Validation, Drugs and Pharmaceutical Sci. Series, Vol. 23, Marcel Dekker Inc., N.Y.*



**BPH-805d/
BPL-805d**

CLINICAL RESEARCH- THEORY

40 Hrs

UNIT – 1: Clinical Research Basics and Indian Regulations

- A. Introduction to Clinical Research, Types: Bioavailability and Bioequivalence, Clinical Trials, India – a favourable destination for Clinical Trials.
- B. Drug Discovery and Development Process.
- C. Indian Regulation on Clinical Trials (Schedule Y of Drugs and Cosmetics Act 1940 and the Rules 1945)

UNIT – 2: Clinical Trials – Design, Ethics, Protocols

- A. Introduction to Clinical Trials, Various Phases.
- B. Designing of Clinical Trials.
- C. Ethical Issues in Clinical Research: Indian Council for Medical Research Guideline – Fundamental Principles, Ethics Committee – Composition and Procedure for Approval,

Informed Consent Process and Designing of Informed Consent Form, Vulnerable Groups.
D. Protocol Writing.

UNIT – 3: Clinical Trials – QA, SOP, GCLP & Data Management

- A. Concept of Quality Assurance in Clinical Trials.
- B. Standard Operating Procedure (SOP): Concept, Essential Attributes, Writing SOPs.
- C. Good Clinical Laboratory Practice (GCLP): Concept; Responsibilities of Trial Facility Management, Analytical Project Manager, Trial Staff; Facilities Required; Equipments; and SOPs.
- D. Data Management: Concept.

UNIT – 4: Good Clinical Practice, Bio-Evaluation & Safety Monitoring

- A. Good Clinical Practice (GCP): Concept and various components; Indian and ICH Requirements.
- B. Bioavailability and Bioequivalence Testing: Concept and Guidelines.
- C. Safety Monitoring during Clinical Trials.

UNIT – 5: Stake Holders Roles & Responsibilities, Compensation & INA

- A. Role and responsibilities of stake holders: Sponsor, Investigator, Monitor, Clinical Research Organization (CRO), Regulatory Authority.
- B. Compensation payment.
- C. Investigational New Drug Application – Concept and Components of application.

TEXT BOOKS

1. *Gupta, SK.; Basic Principles of Clinical Research and Methodology; 2007; 1st edition; Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India; ISBN: 81-8448-086-5.*
2. *Guru Prasad Mohanta; Textbook on Clinical Research – A Guide for Aspiring Professionals and Professionals; 2011; 1st edition; PharmaMed Press, Hyderabad; ISBN:9789381075050.*

REFERENCE BOOKS

1. *Handbook for Good Clinical Research Practice (GCP), Guidance for Implementation; 2005, World Health Organization; ISBN: 92 4 159392 X.*
2. *Health Research Methodology: A Guide for Training in Research Methods; 2nd Edition, 2001; WHO Regional Office for Western Pacific, Manila; ISBN: 92 9061 157 X*
3. *Drugs and Cosmetics Act 1940 and the Rules 1945 (up to date amendment), Government of India.*
4. *ICH E6: Guideline for Good Clinical Practice, 1996; http://www.ich.org/fileadmin/Public_Web_Site/ICH_Products/Guidelines/Efficacy/E6_R1/Step4/E6_R1__Guideline.pdf.*
5. *Ethical Guidelines for Biomedical Research on Human Participants, Indian Council for Medical Research, 2006; http://icmr.nic.in/ethical_guidelines.pdf.*

