SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY



R U L E S & S Y L L A B U S

SECOND YEAR BACHELOR OF PHARMACY (B. Pharm.) COURSE
2018 pattern

(EFFECTIVE FROM ACADEMIC YEAR 2019-2020)

CHAPTER- I: REGULATIONS

1. **Short Title and Commencement** these regulations shall be called as "The Revised Regulations for the B. Pharm. Degree Program (CBCS) of the Pharmacy Council of India, New Delhi". They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by Pharmacy Council of India.

2. **Minimum qualification for admission**

2.1 **First year B. Pharm**: Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B / P.C.M.B.) as optional subjects individually. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

2.2. **B. Pharm lateral entry (to third semester)**: A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. **Duration of the program** The course of study for B.Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

4. **Medium of instruction and examinations** Medium of instruction and examination shall be in English.

5. **Working days in each semester** each semester shall consist of not less than 90 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. **Attendance and progress** A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

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

7.1. **Credit assignment**

7.1.1. **Theory and Laboratory courses** Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for

practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

7.2. **Minimum credit requirements** The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus. The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

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

9. **Course of study** The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Table – I to VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table – I to VIII.

Table-I: Course of study for semester I

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3/45	1	4
BP102T	Pharmaceutical Analysis I – Theory	3/45	1	4
BP103T	Pharmaceutics I – Theory	3/45	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3/45	1	4
BP105T	Communication skills – Theory *	2/30	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2/30	-	D
BP107P	Human Anatomy and Physiology – Practical	4/60	-	2
BP108P	Pharmaceutical Analysis I – Practical	4/60	-	2
BP109P	Pharmaceutics I – Practical	4/60	-	2

BP110P	Pharmaceutical Inorganic Chemistry – Practical	4/60	-	2
BP111P	Communication skills – Practical*	2/30	-	1
BP112RBP	Remedial Biology – Practical*	2/30	-	D
Total		**32/34$^{\$}$/36$^{\#}$/480/510$^{\$}$/540$^{\#}$**	**4**	**27**

Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course. However for Remedial biology and Mathematics no credits to be allotted only 50 % passing i.e D grade will be prerequisite.

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

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3/45	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3/45	1	4
BP203T	Biochemistry – Theory	3/45	1	4
BP204T	Pathophysiology – Theory	3/45	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3/45	-	3
BP206T	Environmental sciences – Theory *	3/45	-	3
BP207P	Human Anatomy and Physiology II –Practical	4/60	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4/60	-	2
BP209P	Biochemistry – Practical	4/60	-	2
BP210P	Computer Applications in Pharmacy – Practical*	4/60	-	1
Total		**32/480**	**4**	**29**

*Non University Examination (NUE)

Table-III: Course of study for semester III

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3/45	1	4
BP302T	Physical Pharmaceutics I – Theory	3/45	1	4
BP303T	Pharmaceutical Microbiology – Theory	3/45	1	4
BP304T	Pharmaceutical Engineering – Theory	3/45	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4/60	-	2
BP306P	Physical Pharmaceutics I – Practical	4/60	-	2
BP307P	Pharmaceutical Microbiology – Practical	4/60	-	2
BP 308P	Pharmaceutical Engineering –Practical	4/60	-	2
Total		**28/420**	**4**	**24**

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3/45	1	4
BP402T	Medicinal Chemistry I – Theory	3/45	1	4
BP403T	Physical Pharmaceutics II – Theory	3/45	1	4
BP404T	Pharmacology I – Theory	3/45	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3/45	1	4

BP406P	Medicinal Chemistry I – Practical	4/60	-	2
BP407P	Physical Pharmaceutics II – Practical	4/60		2
BP408P	Pharmacology I – Practical	4/60	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4/60	-	2
Total		**31/465**	**5**	**28**

Table-V: Course of study for semester V

Course code	**Name of the course**	**No. of Hours per week/Total no of hours**	**Tutorial**	**Credit points**
BP501T	Medicinal Chemistry II – Theory	3/45	1	4
BP502T	Formulative Pharmacy– Theory	3/45	1	4
BP503T	Pharmacology II – Theory	3/45	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3/45	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3/45	1	4
BP506P	Formulative Pharmacy – Practical	4/60	-	2
BP507P	Pharmacology II – Practical	4/60	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4/60	-	2
Total		**27/405**	**5**	**26**

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3/45	1	4
BP602T	Pharmacology III – Theory	3/45	1	4
BP603T	Herbal Drug Technology – Theory	3/45	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3/45	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3/45	1	4
BP606T	Quality Assurance –Theory	3/45	1	4
BP607P	Medicinal chemistry III – Practical	4/60	-	2
BP608P	Pharmacology III – Practical	4/60	-	2
BP609P	Herbal Drug Technology – Practical	4/60	-	2
Total		**30/450**	**6**	**30**

Table-VII: Course of study for semester VII

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3/45	1	4
BP702T	Industrial Pharmacy – Theory	3/45	1	4
BP703T	Pharmacy Practice – Theory	3/45	1	4
BP704T	Novel Drug Delivery System – Theory	3/45	1	4
BP705P	Instrumental Methods of Analysis – Practical	4/60	-	2
BP706PS	Practice School*	12/180	-	6
Total		**28/420**	**5**	**24**

***** Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course code	Name of the course	No. of Hours per week/Total no of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3/45	1	4
BP802T	Social and Preventive Pharmacy	3/45	1	4
BP803ET	Pharmaceutical Marketing	3 + 3 = 6/90	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardizations of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812PW	Project Work	12/180	-	6
Total		**24/360**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	**27**
II	29
III	26
IV	28
V	26
VI	26
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**209**

***** The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

[$]Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics course**.**

[#]Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology course**.**

1. Program Committee

1. The B. Pharm. program shall have a Program Committee constituted by the Head of the institution in consultation with all the Heads of the departments.

2. The composition of the Program Committee shall be as follows:

   A senior teacher shall be the Chairperson; One Teacher from each department handling B.Pharm courses; and four student representatives of the program (one from each academic year), nominated by the Head of the institution.

3. Duties of the Program Committee:

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

2. Examinations/Assessments

The scheme for internal assessment and end semester examinations is given in Table – X.

2.1. End semester examinations

The End Semester Examinations for each theory and practical coursethrough semesters I to VIII shall beconducted by the university except for the subjects with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

Tables-X: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy and Physiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112RBP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**70/75$/80#**	**115/125$/130#**	**24$/26# Hrs**	**185/200$/210#**	**490/525$/ 540#**	**31.5/33$/ 35# Hrs**	**675/725$/ 750#**

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

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

* Non University Examination (NUE)

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**80**	**125**	**20 Hrs**	**205**	**520**	**30 Hrs**	**725**

***** The subject experts at college level shall conduct examinations

Semester III

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	PhysicalPharmaceuticsI –Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**

Semester V

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP501T	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Formulative Pharmacy– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Formulative Pharmacy – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**65**	**105**	**17 Hr**	**170**	**480**	**27 Hrs**	**650**

Semester VI

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**75**	**120**	**18 Hrs**	**195**	**555**	**30 Hrs**	**750**

Semester VII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
Total		**70**	**70**	**8Hrs**	**140**	**460**	**21 Hrs**	**600**

* The subject experts at college level shall conduct examinations

Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardizations of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812PW	Project Work	-	-	-	-	150	4 Hrs	150
Total		**40**	**60**	**4 Hrs**	**100**	**450**	**16 Hrs**	**550**

11.2 Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table-XI:Scheme for awarding internal assessment: Continuous mode

Theory		
Criteria	**Maximum Marks**	
Attendance (Refer Table – XII)	4	2
Academic activities (Average of any 2 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	4	03
Student – Teacher interaction	2	
Total	**10**	**5**
Practical		
Attendance (Refer Table – XII)	2	
Based on Practical Records, Regular viva voce, etc.	3	
Total	**5**	

Table- XII: Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

11.2.1. Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical Sessional examinations is given below. The average marks of two Sessional exams shall be computed for internal assessment as per the requirements given in tables – X.

Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. Similarly Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks. The duration for the conduct of the exam is as below

Exam Type	Marks allotted	Duration
Theory	30	1.5 Hr
Practical	40	04 Hr

Question paper pattern for theory Sessional

For subjects having University exams

I. Objective Type Questions (Answer 05 out of 7)	=5 x 2 = 10
II. Long Answers (Answer 1 out of 2)	=1 x 10 = 10
III. Short Answers (Answer 2 out of 3)	=2 x 5 = 10
Total	**30 marks**

For subjects having Non University Examination

I. Long Answers (Answer 1 out of 2)	=1 x 10 = 10
II.Short Answers (Answer 4 out of 6)	=4 x 5 = 20
Total	**30 marks**

Question paper pattern for practical sessional examinations

I. Synopsis	= 10
II. Experiments	= 25
III. Viva voce	= 05
Total	**40 marks**

12 . Promotion and award of grades

A student shall be declared PASS and eligible for getting gradein a course of B.Pharm.program if he/she secures at least 50% marks in that particular course including internal assessment.For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

13. Carry forward of marks

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

14. Improvement of internal assessment

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

15. Re-examination of end semester examinations

Reexamination of end semester examination shall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time to time.

Table-XIII: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I, III, V and VII	November / December	May / June
II, IV, VI and VIII	May / June	November / December

Question paper pattern for end semester theory examinations

For 75 marks paper

I. Objective Type Questions (Answer 5 out of 7)	=5x 3= 15
II. Long Answers (Answer 2 out of 4)	= 2 x 10 = 20
III. Short Answers (Answer 8 out of 10)	= 8 x 5 = 40
Total	**= 75marks**

For 50 marks paper

I. Long Answers (Answer 2 out of 3)	= 2 x 10 = 20
II. Short Answers (Answer 6 out of 8)	= 6 x 5 = 30
Total	**= 50 marks**

For 35 marks paper

I. Long Answers (Answer 1out of 2)	= 1 x 10 = 10
II. Short Answers (Answer 5 out of 7)	= 5 x 5 = 25
Total	**= 25 marks**

Question paper pattern for end semester practical examinations

I. Synopsis	= 05
II. Experiments	= 25
III. Viva voce	= 05
Total	**= 35marks**

16. Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. Academic progression rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of I and II semesters are successfully completed.

A student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of I, II, III and IV semesters are successfully completed.

A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 26.

A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.

A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed.

A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 26.

Any student who has given more than 4 chances for successful completion of I / III semester courses and more than 3 chances for successful completion of II / IV semester courses shall be permitted to attend V / VII semester classes ONLY during the subsequent academic year as the case may be. In simpler terms there shall NOT be any ODD BATCH for any semester.

Note: Grade AB should be considered as failed and treated as one head for deciding academic progression. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

Rules for Carry Forward:

The curriculum (including regulations, structure and syllabi) is in force from academic year 2018-19 and onwards for First Year B. Pharm, for academic year 2019- 20 onwards for Second Year B. Pharm., for academic year 2020-21 and onwards for Third Year B. Pharm., and for academic year 2021-22 and onwards for Final Year B. Pharm.

The learners who were admitted to First Year B. Pharm. of 2015 pattern during the academic year 2017-18 or before & failed in the First Year B.Pharm. of 2015 pattern examination will have to take admission to Semester-III of Second Year B. Pharm. of 2018 pattern in academic year 2019-20 or onwards, provided that

a. Their result of F. Y. B. Pharm of 2015 pattern is either pass or fails with A. T. K. T.
The said students will have to take up additional remedial courses as follows.

b) The learners who were admitted to S.Y B. Pharm. of 2015 pattern during the academic year 2018-19 or before and fail in the S.Y B.Pharm. of 2015 pattern examination will have to take admission to Semester-V of Third Year B. Pharm. of 2018 pattern in academic year 2020-21 or onwards, provided that
Their result of S. Y. B. Pharm of 2015 pattern is either pass or fails with A. T. K. T. The said students will have to take up additional remedial course as follows.

Sr. No	**Remedial courses for admission to S.Y.B.Pharm in Academic Year 2019-20 (Cleared F.Y. B. Pharm as per 2015 Pattern)**		
	(Non University Examination)	**Semester**	**Passing Criteria**
1	Biochemistry – Theory/Practicals	Semester III	Minimum 50% marks with D grade
2	Pathophysiology- Theory		Minimum 50% marks with D grade
3	Computer Applications in Pharmacy – Theory/Practicals	Semester IV	Minimum 50% marks with D grade
4	Environmental sciences – Theory		Minimum 50% marks with D grade

Sr. No	Remedial courses for admission to T.Y. B.Pharm in Academic Year 2020-21 (Cleared S. Y.B. Pharm as per 2015 Pattern)		
	(Non University Examination with 50% passing.)	**Semester**	**Passing Criteria**
01	Medicinal Chemistry I – Theory/ Practical	Semester V	Minimum 50% marks with D grade

Grading of performances

17.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table – XII.

Table – XII: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses(Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C1 + C2 + C3 + C4 + C5}$$

The SGPA is calculated to two decimal points.It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4 * ZERO + C5G5}{C1 + C2 + C3 + C4 + C5}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed statusin case of F grade(s),till the course(s) is/are passed. When the course(s)is/are passedby obtaining a pass grade on subsequent examination(s) theCGPA shall only reflect the new grade and not the fail grades earned earlier.The CGPA is calculated as:

$$CGPA = \frac{C1S1 + C2S2 + C3S3 + C4S4 + C5S5 + C6S6 + C7S7 + C8S8}{C1 + C2 + C3 + C4 + C5 + C6 + C7 + C8}$$

where C_1, C_2, C_3,.... is the total number of credits for semester I,II,III,…. and S_1,S_2, S_3,....is the SGPA of semester I,II,III,…. .

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows

First Class with Distinction	= CGPA of. 7.50 and above
First Class	= CGPA of. 6.00 to 7.49
Second Class	= CGPA of. 5.00 to 5.99

21. Project work

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subject opted by the student in

semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students). The projects shall be evaluated as per the criteria given below

Evaluation of Dissertation Book:

Objective(s) of the work done	15 Marks
Methodology adopted	20 Marks
Results and Discussions	20 Marks
Conclusions and Outcomes	20 Marks
Total	**75 Marks**

Evaluation of Presentation:

Presentation of work	25 Marks
Communication skills	20 Marks
Question and answer skills	30 Marks
Total	**75 Marks**

Explanation: The 75 marks assigned to the dissertation book shall be same for all the students in a group. However, the 75 marks assigned for presentation shall be awarded based on the performance of individual students in the given criteria.

22. Industrial training (Desirable)

Every candidate shall be required to work for at least 150 hours spread over four weeks in a Pharmaceutical Industry/Hospital. It includes Production unit, Quality Control department, Quality Assurance department, Analytical laboratory, Chemical manufacturing unit, Pharmaceutical R&D, Hospital (Clinical Pharmacy), Clinical Research Organization, Community Pharmacy, etc. After the Semester – VI and before the commencement of Semester – VII, and shall submit satisfactory report of such work and certificate duly signed by the authority of training organization to the head of the institute.

AND/OR

Every candidate shall be required to undergo any one of the Skill development modules mentioned below**(Duration – Min. 04 weeks)**

a) Hands on Training (Central instrumentation lab/Machine room etc)

b) UGC/AICTE recognized online courses (SWAYAM/NPTEL etc)

After the successful completion of the module the candidate shall submit satisfactory report and certificate duly signed by the authority of training organization/Head of the institute

23. Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.

At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level and grade point shall be awarded.

24. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the B.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the B. Pharm program in minimum prescribed number of years, (four years) for the award of Ranks.

25. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

26. Duration for completion of the program of study

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

27. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

No condonation is allowed for the candidate who has more than 2 years of break up period and he/she has to rejoin the program by paying the required fees.

CHAPTER - II: SYLLABUS

Semester III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory) 45 Hours

Scope

This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds is also studied here. The syllabus emphasizes on mechanisms & orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives

Upon completion of the course the student shall be able to

Write the structure, name and the type of isomerism of the organic compound

Write the reaction, name the reaction and orientation of reactions

Account for reactivity/stability of compounds

Prepare small organic compounds

COURSE CONTENT

Note : General methods of preparation (any 05) and reactions of compounds superscripted with asterisk (*) to be explained.

UNIT-I

Benzene and its derivatives

Introduction to benzene, orbital picture, resonance in benzene, Huckel's rule

Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel-Craft's alkylation- reactivity, limitations, Friedel-Craft's acylation. **10 Hours**

Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction

UNIT-II

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests for phenols, structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* - Basicity of amines, effect of substituents on basicity, Nitrosation reaction, coupling and Sandmayer's reaction, Hinsberg Test, synthetic uses of aryl diazonium salts. **08Hours**

UNIT-III

Stereo Isomerism

Optical isomerism

Elements of symmetry, chiral and achiral molecules

Optical activity, enantiomerism, diastereoisomerism, *meso* compounds

D & L system of nomenclature of optical isomers, sequence rules, *R* & *S* system of nomenclature of optical isomers **10 Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (*Cis & Trans, E & Z, Syn & Anti* systems)

Methods of determination of configuration of geometrical isomers.

UNIT-IV

Polynuclear hydrocarbons

ıthesis, reactions and structure and medicinal uses of naphthalene, phenanthrene, anthracene, diphenylmethane, triphenylmethane and their derivatives. **10 Hours**

UNIT-V

Cycloalkanes*

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only. **05 Hours**

UNIT-VI

Fats and Oils - Hydrolysis, Hydrogenation, Saponification and Rancidity of oils. **02 Hours**

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Practical) **4 Hours/Week**	
I. Experiments involving laboratory techniques Recrystallisation Steam distillation	**1 turn**
II. Experiments involving Separation of Binary mixtures	**2 turns**
III. Determination of saponification value of oil samples (Any two)	**1 turn**
IV. Synthesis of following compounds Benzanilide /phenyl benzoate /acetanilide from aniline/ phenol/ aniline by benzoylation/acylation reaction 2, 4, 6-Tribromoaniline/para-bromo acetanilide from aniline p-bromo Acetanilide by halogenation (Bromination) reaction. 5-Nitrosalicylic /meta-dinitrobenzene from salicylic acid/ nitrobenzene by nitration reaction Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. 1-Phenylazo-2-naphthol from aniline by diazotization and coupling reactions/ *p*-Iodobenzoic acid from P-aminobenzoic acid by replacement reaction. Benzil from benzoin by oxidation reaction Dibenzal acetone from benzaldehyde by Claisen-Schmidt reaction	**11 turns**

Recommended Books

1. Morrison, R. T. & Boyd, R. D., Textbook of Organic Chemistry, VI (ed.) ELBS, London, 1996
2. Pine, S. H, Organic Chemistry, V, Tata McGraw Hill, New Delhi, 2003
3. Finar, I. L., Organic Chemistry Vol. I, V (ed.), ELBS, Pearson Education, New Delhi, 2003
4. Joule and Mills, Heterocyclic Chemistry, IV (ed.), Blackwel Publishing House, Oxford, UK,
5. 2004
6. Li, J. J., Name Reactions, III (ed.), Springer, Berlin, 2006
7. Stereochemistry of Organic Compound Principles and Applications by Nasipuri, Revised Edition, New Age International Publishers.
8. Stereochemistry Conformation and Mechanism by P.S. Kalsi, 7/Ed 2008, New Age International Publishers, New Delhi.

9. Furniss, B. S., Hannaford, A. J. Smith, P. W. G., and Tatchel, A. R., "Vogel's Textbook of Practical Organic Chemistry", V (ed.), Pearson, London, **1994**

10. Finar, I. L., Organic Chemistry Vol. I, V (ed.), ELBS, Pearson Education, New Delhi, **2003**

11. Mann, F. G. and Saunders, B. C., Practical Organic Chemistry, IV(ed.), Pearson, UK, **2009**

12. Advanced General Organic Chemistry-A Modern Approach by Sachin Kumar Ghosh, 3/Ed. 2009, New Central Book Agency (P) Ltd.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory) 45Hours

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

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

1. Investigate and apply various theories, laws and equations related to different states of matter
2. Distinguish the principles of complexation/ protein binding & to use them for calculations of drug release and stability constant**.**
3. **Demonstrate use of physicochemical properties of drugs in the formulation development and evaluation of dosage forms.**

Course Content:

UNIT-I **12 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, Solubility of Solids in liquids (Binary solutions, ideal solutions with respect to their colligative properties) Raoult's law, real solutions. Partially miscible liquids(Phase equilibria, Phase rule, One , two and three component systems, ternary phase diagram, Critical solution temperature and applications). Distribution law, its limitations and applications

UNIT-II **10Hours**

States of Matter and properties of matter:State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, Liquefaction of gases, aerosols– inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous(Methods of crystal analysis: X-Ray Diffraction, Bragg's equation.) & polymorphism (Definition, Different shapes of polymorphs, Example and its Pharmaceutical applications, Brief introduction of Detection techniques).

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

UNIT-IV **08Hours**

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

UNIT-V **07 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method.
12. Determination of Refractive index of given sample.
13. Determination of thermodynamic parameters using solubility studies.

Recommended Books:

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.

7. Physical Pharmaceutics by Ramasamy C and ManavalanR**.**

8. LaboratoryManual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma settee

9. Physical Pharmaceutics by C.V.S. Subramanyam

10. Text book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory) 45Hours

Scope:

•Study of microorganisms and its effect on pharmaceutical products

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

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To understand the importance and implementation of sterlization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products**.**
4. Carried out microbiological standardization of Pharmaceuticals**.**
5. Understand the cell culture technology and its applications in pharmaceutical industries**.**

Course content:

Unit I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance.

Introduction to Prokaryotes and Eukaryotes

Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).

Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

Definition and examples of Probiotics and Prebiotics

Unit II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC). Definition of D value & Z value and its significance.

Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous,radiation and mechanical method of sterilization**.**

Evaluation of the efficiency of sterilization methods.

Equipments employed in large scale sterilization.

Sterility indicators.

Unit III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic**.**

Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP**.**

Unit IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.

Unit V **07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations**.**

Growth of animal cells in culture, general procedure for cell culture,

Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hours/week

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow or aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media**.**
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations**.**
4. **Staining methods-** Simple, Grams staining and acid fast staining (Demonstration with practical**).**
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. **Microbiological assay of antibiotics by cup plate method and other methods**
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals (Any two samples).
9. Bacteriological analysis of water
10. Biochemical test of any one microorganism**.**

Recommended Books

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London**.**
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi**.**
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn**.**
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology**.**
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution**.**
8. Peppler: Microbial Technology.

9. I.P., B.P., U.S.P.- latest editions**.**

10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai

11. Edward: Fundamentals of Microbiology**.**

12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

14. "Nutrition Probiotics and prebiotics" by Pamela Mason; The Pharmaceutical Journal Vol 266 No 7132 p118-121**.**

15. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory) 45 Hours

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry**.**

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

1. To know various unit operations used in Pharmaceutical industries.

2. To understand the material handling techniques**.**

3. To perform various processes involved in pharmaceutical manufacturing process.

4. To carry out various test to prevent environmental pollution**.**

5. To appreciate and comprehend significance of plant lay out design for optimum use of resources**.**

6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

Course content:

UNIT-I 10 Hours

•**Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer**.**

•**Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill**.**

•**Size Separation:** Objectives, applications & mechanism of size separation**,** official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II 10 Hours

•**Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers**.**

•**Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator**.**

•**Distillation:** Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT- III **08 Hours**

•**Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

•**Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier**,**

UNIT-IV **08 Hours**

•**Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

•**Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V **07 Hours**

•**Materials of pharmaceutical plant construction, Corrosion and its prevention**: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

BP308 P - PHARMACEUTICAL ENGINEERING (PRACTICAL)

4 Hours/week

I. Determination of radiation constant of any one of – brass/ iron/unpainted and painted glass**.**

II. Steam distillation- To calculate the efficiency of steam distillation**.**

III. To determine the overall heat transfer coefficient by heat exchanger**.**

IV. Construction of drying curves (for calcium carbonate and starch)

V. Determination of moisture content and loss on drying.

VI. Determination of humidity of air - i) From wet and dry bulb temperatures -use of Dew point method

VII. Description of Construction, working and application of any two Pharmaceutical Machinery such as Rotary tablet Machine, capsule filling machine, tablet coating machine, autoclave, oven and dehumidifier.

VIII. Size analysis by sieving -To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.

IX. Size reduction: To verify the laws of size reduction using ball mill and and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.

X. Demonstration of any two equipments such as colloid mill, planetary mixer, fluidized bed dryer, Spray dryer Laminar Air Flow, Ball Mill and such other major equipments.

XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity).

XII. To study the effect of time on the Rate of Crystallization**.**

XIII. To calculate the uniformity Index for given sample by using Double Cone Blender**.**

Semester – IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

Scope

The subject imparts knowledge on stereo chemical aspects of organic compounds and organic reactions, important name reactions, chemistry of important heterocyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives

Upon completion of the course the student shall be able to

Understand the methods of preparation and properties of organic compounds.

Explain the stereochemical aspects of organic compounds and stereo chemical reactions.

3. Know the medicinal uses and other applications of organic compounds

COURSE CONTENT

UNIT-I

Stereo isomerism

07 Hours

Reactions of Chiral molecules

Racemic modification and resolution of racemic mixture.

Introduction to Asymmetric synthesis with suitable examples

UNIT-II

Geometrical isomerism

06 Hours

Conformational isomerism in *n*-Butane and cyclohexane.

Stereoisomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III

Heterocyclic compounds

08 Hours

Nomenclature and classification of heterocyclic compounds in to classes: Oxygen containing five & six membered rings, Nitrogen containing five & six membered rings, sulphur containing five & six member rings; Oxygen & nitrogen containing five & six membered rings, oxygen & sulphur containing five & six membered rings, and sulphur and nitrogen containing five & six membered rings; benzo-fused heterocyclic compounds as benzimidazole, benzthiazole, benzopyran

Chemistry (reactivity, stability, acidity and basicity), Synthesis (any one), reactions and medicinal uses of following compounds Pyrrole, Furan, and Thiophene and their derivatives (any one from each class)

UNIT-IV

Chemistry(reactivity, stability, acidity and basicity), Synthesis (any one), reactions and medicinal uses of following compounds and their derivatives (any one from each class)

12 Hours

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole

Synthesis (any one) and medicinal uses of following compounds Pyrimidine, Purine, Azepines and their derivatives (any one from each class)

UNIT-V

Name Reactions of synthetic importance

Pinacol-Pinacolone, Hofmann, Baeyer-Villiger oxidation, Benzilic acid rearrangement reaction, Beckmann's rearrangement and Schmidt rearrangement, Claisen-Schmidt condensation, Clemmensen reduction, Wolff rearrangement, Oppenauer-oxidation and Dakin reaction, and Birch reduction. **12 Hours**

Recommended Books

1. Morrison, R. T. & Boyd, R. D., Textbook of Organic Chemistry, VI (ed.) ELBS, London, 1996
2. Advanced General Organic Chemistry-A Modern Approach by Sachin Kumar Ghosh, 3/Ed. 2009, New Central Book Agency (P) Ltd.
3. Pine, S. H, Organic Chemistry, V, Tata McGraw Hill, New Delhi, 2003
4. Finar, I. L., Organic Chemistry Vol. I, V (ed.), ELBS, Pearson Education, New Delhi, 2003
5. Joule and Mills, Heterocyclic Chemistry, IV (ed.), Blackwell Publishing House, Oxford, UK, 2004
6. Li, J. J., Name Reactions, III (ed.), Springer, Berlin, 2006
7. Stereochemistry of Organic Compound Principles and Applications by Nasipuri, Revised Edition, New Age International Publishers.
8. Stereochemistry Conformation and Mechanism by P.S. Kalsi, 7/Ed 2008, New Age International Publishers, New Delhi.
9. Stereochemistry of Organic Compound Principles and Applications by Nasipuri, Revised Edition, New Age International Publishers.

BP402T. MEDICINAL CHEMISTRY – I (Theory) 45 hours

Scope

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives

Upon completion of the course the student shall be able to

Understand the chemistry of drugs with respect to their pharmacological activity.

Understand the drug metabolic pathways, adverse effect and therapeutic value of Drugs.

Know the Structural Activity Relationship (SAR) of different class of drugs.

Write the chemical synthesis of some drugs.

COURSE CONTENT

Note: Study of the development of the following classes of drugs, classification, mechanism of action, Structure activity relationship, uses of drugs mentioned in the course.
The synthesis of drugs mentioned in bracket [] only needs to be covered.

UNIT-I **06 hours**

Introduction to Medicinal Chemistry

a) History and development of medicinal chemistry

b) Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

c) Drug metabolism

Drug metabolism principles - Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT-II

Drugs acting on Autonomic Nervous System **10 hours**

a) Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

b) Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Dopamine, Phenylephrine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol, Oxymetazoline and Xylometazoline

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine
- Agents with mixed mechanism: Ephedrine, Amphetamine.

c) Adrenergic Antagonists:

- **Alpha adrenergic blockers:** Tolazoline, Phentolamine, Phenoxybenzamine, Prazosin.
- **Beta adrenergic blockers:** SAR of beta blockers, Propranolol, Atenolol, Labetolol, Carvedilol.

[Phenylephrine, Salbutamol, Tolazoline, Propranolol]

UNIT-III **10 hours**

a) Cholinergic neurotransmitters: Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

b) Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine**,** Carbachol, Bethanechol, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine, Edrophonium chloride, Donepezil, Tacrine hydrochloride, Parathion, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents :Solanaceous alkaloids and analogues: Atropine sulphate, Scopolamine hydrobromide, Ipratropium bromide

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Dicyclomine, Glycopyrrolate, Propantheline bromide

[Neostigmine, Dicyclomine hydrochloride]

UNIT-IV **10 hours**

Drugs acting on Central Nervous System

a) Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous:**Amides & imides Alcohol & their carbamate derivatives Aldehyde & their derivatives

b) Antipsychotics Phenothiazeines: SAR of Phenothiazines - Chlorpromazine hydrochloride, Triflupromazine, Thioridazine hydrochloride, Trifluoperazine hydrochloride

Ring Analogues of Phenothiazeines: Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Benzamides: Sulpiride.

c) Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Mephobarbital

Hydantoins: Phenytoin, Mephenytoin

Oxazolidine diones: Trimethadione

Succinimides: Phensuximide, Methsuximide

Urea and monoacylureas: Phenacemide, Carbamazepine

Benzodiazepines: Clonazepam

Miscellaneous: Levetiracetam, Valproic acid , Gabapentin ,Felbamate

d) General anesthetics:

Inhalation anesthetics: Halothane, Enflurane

Ultra short acting barbitutrates: Methohexital sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.

[Diazepam, Barbital, Chlorpromazine hydrochloride, Phenytoin, Carbamazepine, Halothane, Ketamine hydrochloride]

UNIT-V **07 hours**

Centrally Acting analgesics

a) Narcotic and non-narcotic analgesics Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Diphenoxylate hydrochloride,Loperamide hydrochloride, Fentanyl citrate, Methadone hydrochloride, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

b) Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid, Indomethacin, Sulindac, Diclofenac,Ketorolac, Ibuprofen, Piroxicam, Acetaminophen, Phenylbutazone.

[Fentanyl citrate, Methadone hydrochloride, Mefenamic acid, Ibuprofen]

BP406P. MEDICINAL CHEMISTRY – I (Practical) 4Hrs/week

Synthesis of following medicinally important compounds / drug intermediates with Recrystallization of compound and monitoring reactions with TLC

Preparation of drugs/ intermediates (any six) 10 turns

1,3-pyrazole
1,3-oxazole
Benzimidazole
Benztriazole
2,3- diphenyl quinoxaline
Benzocaine
Phenytoin
Phenothiazine
Barbiturate

Purification of above synthesized compounds by Column chromatography **(any one) 01 turns**

Determination of Partition coefficient and Ionisation constants **(any two compounds). 04 turns**

Recommended Books (Latest Editions)

1. John Marlowe Beale, Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry. 11th E/d,
2. Thomas L. Lemke, David A. Williams, Victoria F. Roche, Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV, 6th E/d, M. E. Wolff. John Wiley & Sons, New York. 1997.
4. Smith and Williams, Introduction to principles of drug design, CRC Press; 4 edition.
5. John E. Hoover, Remington's Pharmaceutical Sciences, Mack Publishing Company; 13th edition (1965).
6. Sean C. Sweetman, Martindale's extra pharmacopoeia, Pharmaceutical Society of Great Britain.
7. Organic Chemistry by I.L. Finar, Vol. II, Longmans Green & Co., 3rd E/d.
8. Daniel Lednicer, Lester A. Mitscher, The Organic Chemistry of Drug Synthesis, John Wiley & Sons, Inc, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory) 45 Hours

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

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

1.Relate various physicochemical properties of drug and excipient molecules in designing the dosage forms

2.Distinguish the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations

3.Demonstrate the behavior and mechanism of drugs and excipients in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I **07 Hours**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

UNIT-II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling sphere, rotational viscometers,Visco elasticity

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV **08 Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order(complex reaction:reversible, parallel and side reactions), units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis,Simple numerical problems.Stabilization of medicinal agents against common reactions like hydrolysis & oxidation.Accelerated stability testing in expiration dating of pharmaceutical dosage forms.Photolytic degradation and its prevention

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical) 4 Hours/week

1. Determination of particle size, particle size distribution using sieving method

2. Determination of particle size, particle size distribution using Microscopic method

3. Determination of bulk density, true density and porosity

4. Determine the angle of repose and influence of lubricant on angle of repose

5. Determination of viscosity of liquid using Ostwald's viscometer

6. Determination sedimentation volume with effect of different suspending agent

7. Determination sedimentation volume with effect of different concentration of single suspending agent

8. Determination of viscosity of semisolid by using Brookfield viscometer

9. Determination of reaction rate constant first order.

10. Determination of reaction rate constant second order

11. Accelerated stability studies

12. Determination of Cloud point and Krafft point of given surfactant.

13. Determination of effect of salts on stability of hydrophobic sols

Recommended Books:

1. Physical Pharmacy by Alfred Martin, Sixth edition

2. Experimental pharmaceutics by Eugene, Parott.

3. Tutorial pharmacy by Cooper and Gunn.

4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.

5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.

6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.

7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP 404 T. PHARMACOLOGY-I (Theory) 45Hours

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs, mechanism of action, physiological and biochemical effects (Pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and route of administration of different classes of drugs.

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

1. Understand the pharmacological actions of different categories of drugs.
2. Explain the mechanism of action at organ system/sub cellular/macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effects of drugs on animal by simulated experiments.
5. Appreciate correlation of pharmacology with other bio medical sciences.

Unit-I **General Pharmacology:** **Hrs**

Introduction to Pharmacology

Definition, Historical landmarks and scope of pharmacology, Nature and source of drugs, Essential drugs concept and Routes of drug administration.

Pharmacokinetics

Membrane transport, Absorption, Distribution, Metabolism and Excretion of drugs. Enzyme induction, Enzyme inhibition, Introduction tokinetics of elimination.

Unit-II **General Pharmacology** **Hrs**

Pharmacodynamics:

Principles and mechanisms of drug action.

Receptortheories and classification of receptors, regulation of receptors. Drugreceptors interactions, Signal transduction mechanisms, G-protein–coupledreceptors, Ion channel receptors, Transmembrane enzyme linked receptors,JAK-STAT binding receptors and receptors that regulate transcriptionfactors,Spare receptors.

Dose response relationship, Therapeutic index,Agonists, Antagonists (competitive and non-competitive),Combined effects of drugs.

Factors modifying drug action.

Adverse drug reactions:

Addiction, Tolerance, Dependence, Tachyphylaxis, Idiosyncrasy, Allergy (explain with suitable examples).

Drug interactions:

Pharmacokinetic and pharmacodynamic drug interactions.

	Drug discovery and clinical evaluation of new drugs: Introduction to drug discovery, Preclinical evaluation and Clinical trials Introduction to Pharmacovigilance	
Unit III	**Pharmacology of drugs acting on Peripheral Nervous System** Introduction to Autonomic Nervous System, Parasympathomimetics, Parasympatholytics, Sympathomimetics and Sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anaesthetic agents. Drugs used in myasthenia gravis and glaucoma	**08 Hrs**
Unit-IV	**Pharmacology of drugs acting on central nervous system** Neurohumoral transmission in the C.N.S.- Special emphasis tobe given on importance of various neurotransmitters like with GABA, Glutamate, Glycine, Serotonin, Dopamine. General anaesthetics and pre-anaesthetics Sedatives, Hypnotics and Centrally acting muscle relaxants Anti-epileptics Alcohol and Disulfiram	**09 Hrs**
Unit-V	**Pharmacology of drugs acting on Central Nervous System** Psychopharmacological agents:Antipsychotics, Antidepressants, Anti-anxiety agents, anti-manics and Hallucinogens Drugs used in Parkinson's disease and Alzheimer's disease CNS stimulants and Nootropics Opioid analgesics and antagonists (including addiction, abuse, tolerance and dependence)	**08 Hrs**

REFERENCES:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale'sPharmacology,.Churchil Livingstone Elsevier.
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams &Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company,Kolkata.

10. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi.
11. A textbook of Pathophysiology, Bodhankar, SL and Vyawahare, NS, NiraliPrakashan, Pune.
12. Das, M. M. and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
13. Satoskar , R.S. and Bhandarkar S.D. Pharmacology and Pharmacotherapeutics (PopularPrakashan, Bombay).
14. Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co, Boston.
15. JamesCrossland. Lewis,s Pharmacology Basis of Therapeutics, Pergamon Press, New York.
16. Harrison's Principle and Practice of Medicine, 18th Edition, Churchill, Livingston, .London.
17. Roger and Walker. Clinical Pharmacy and Therapeutics, Churchill, Livingston, London.
18. Dipiro Joseph L. A pathphysiological Approach, Elsevier.
19. Davidson's Principle of Internal Medicine, McGraw-Hill companies.
20. Guyton AC. Textbook of medical Physiology. W. B. Sanders CO., Philadelphia, USA.
21. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
22. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London.

BP 408 P.PHARMACOLOGY-I (Practical) 4 Hours/week

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs byMES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

REFERENCES:

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton &Company,Kolkata.
2. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.
3. Burn JH. Practical Pharmacology Blackwell Scientific, Oxford London.
4. Jaju BP. Pharmacology: A Practice Exercise Book, Jaypee Brothers, New Delhi.
5. Sheth UK, Dadkar NK and Kamat UG. selected topics in experimental pharmacology,(Kothari Book Depot, Mumbai)
6. Perry W.L.M. Pharmacological Experiments on Isolated Preparation, E&S Livingstone,London.
7. Goyal R. K., Practicals in Pharmacology, B. S. Shah Prakashan, Ahemadabad.

BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory) - 45 Hours

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

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

1. to know the techniques in the cultivation and production of crude drugs
2. to know the crude drugs, their uses and chemical nature
3. know the evaluation techniques for the herbal drugs
4. to carry out the microscopic and morphological evaluation of crude drugs

COURSE CONTENT — **45 Hours**

UNIT-I

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture

(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs — **10 Hours**

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants. — **10 Hours**

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. — **07 Hours**

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT-IV

Plant description, morphology and anatomy:

Leaves, Roots, Barks, Wood, Flowers, Fruits, Seeds, subterranean organs

10 Hours

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT-V

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

08 Hours

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): General methods of extraction of lipids.

Castor oil, Chaulmoogra oil, Shark liver oil and Cod liver oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources a) Cardiovascular agents and b) Anti cancer agents

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical): 4Hrs/week

1. Analysis of crude drugs by chemical tests:
   (i)Tragaccanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books:

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs byM.A. Iyengar