PROGRESSIVE EDUCATION SOCIETY'S MODERN COLLEGE OF PHARMACY, NIGDI, PUNE

(AUTONOMOUS)

AFFILIATED TO

SAVITRIBAI PHULE PUNE UNIVERSITY

FACULTY OF SCIENCE AND TECHNOLOGY

RULES & SYLLABUS

FIRST YEAR BACHELOR OF PHARMACY (B. Pharm.) COURSE – 2019 Pattern

(WITH EFFECT FROM ACADEMIC YEAR 2025-2026)

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)

	Democracy, Election and Governance*	2/30		2

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**	**4**	**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#**	**23/24$/26# Hrs**	**185/200$/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 grade in 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 examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

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 ofend semester examinationshall 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	**= 35 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	2S2emester IV	Minimum 50% marks with D

	Pharmacy – Theory/Practicals		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**
1.	Medicinal Chemistry I – Theory/ Practical	Semester V	Minimum 50% marks with D grade

17. 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 ABand 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 $C_1, C_2, C_3, \ldots$ is the total number of credits for semester I,II,III,…. and $S_1, S_2, S_3, \ldots$ 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-I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory) 45 Hours

Scope:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of the human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working patterns of different organs of each system.

COURSE CONTENT:

Unit	Topics	Hours
Unit I	**a) Introduction to Human Body**– Definition and scope of anatomy and physiology– Levels of structural organization and body systems– Basic life processes– Homeostasis, Basic anatomical terminology **b) Cellular Level of Organization**– Structure and functions of cell– Transport across cell membrane, Cell division and cell junctions. General principles of cell communication– Intracellular signaling pathways: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine **c) Tissue Level of Organization**– Classification of tissues– Structure, location and functions of epithelial, muscular, nervous, and connective tissues	**10 hrs**
Unit II	**a) Skeletal System**– Divisions of skeletal system– Types of bone– Salient features and functions of bones of axial and appendicular skeletal system– Organization of skeletal muscle– Physiology of muscle contraction– Neuromuscular junction **b) Joints**– Structural and functional classification– Types of joint movements and articulation	**08 hrs**
Unit III	**a) Body Fluids and Blood**– Body fluids– Composition and functions of blood– Hemopoiesis– Formation of hemoglobin– Anemia– Mechanisms of coagulation– Blood grouping, Rh factor– Transfusion, its significance– Disorders of blood– Reticuloendothelial system. **b) Lymphatic System**– Lymphatic organs and tissues– Lymphatic vessels– Lymph circulation and functions	**10 hrs**
Unit IV	**a) Peripheral Nervous System -** Classification of PNS– Structure and functions of sympathetic and parasympathetic nervous system– Origin and functions of spinal and cranial nerves **b) Special Senses**– Structure and functions of Skin, eye, ear, nose, and tongue– Disorders of special senses	**10 hrs**

Unit V	**a) Cardiovascular System**– Anatomy of heart– Blood circulation– Structure and functions of blood vessels (artery, vein, capillaries)– Conduction system of heart– Heartbeat and its regulation by ANS– Cardiac output and cardiac cycle– Regulation of blood pressure– Pulse– Electrocardiogram (ECG)– Heart disorders	**7 hrs**

Recommended Books:

1. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
2. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London.
3. Guyton, A.C., Textbook of Medical Physiology. W. B. Saunders Co., Philadelphia, USA.
4. Tortora, G.J. and Grabowski, S.R., 2005. Principals of Anatomy and Physiology. Harper Collins College Publishers, New York.
5. Vander, A.J., Sherman, J.H. and Luciano, D.S., Human Physiology. McGraw-Hill Publishing Co., USA.
6. Waugh, A. and Grant, A., Ross and Wilson's Anatomy and Physiology in Health and Illness. Churchill-Livingstone, London.
7. West, J.B., Best and Taylor's Physiological Basis of Medical Practice. Williams and Wilkins,Baltimore, USA.
8. Warwick, R. and Williams, P., Gray's Anatomy. Longman, London.
9. Chaudhari S K. Concise Medical Physiology. New Central Book Agency (P) Ltd., Calcutta.
10. Godkar P.B and Godkar D.P., Textbook of Medical Laboratory Technology. Bhalani Publishing House, Mumbai.
11. Joshi V.D. Practical Physiology. Vora Medical Publications, Mumbai.
12. DiFiore-Mariano S.H., Atlas of Human Histology. Lea and Febiger, Philadelphia.
13. Garg K., Bahel I. and Kaul M., A Textbook of Histology. CBS Publishers and Distributors, New Delhi.
14. Goyal, R.K., Patel, N.M. and Shah, S.A., Practical Anatomy, Physiology and Biochemistry. B. S. Shah Prakashan, Ahmedabad.
15. Ranade, V.G., Joshi, P.N. and Pradhan, S., Textbook of Practical Physiology. Pune Vidyarthi Griha Prakashan, Pune.
16. Singh, I., BD., Chaurasia's Human Anatomy. CBS Publisher and Distributors, New Delhi. 17. Singh, I., Textbook of Human Histology. Jaypee brothers Medical Publishers, New Delhi. 18. Mukherjee, K.L., Medical Laboratory Technology. Tata McGraw Hill Publishing Company Ltd. New Delhi.
19. Beck, W.S., Human Desigh: Molecular, Cellular and Systemic Physiology. Harcourt Brace Jovanovich Inc. New York.
20. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee Brothers medical publishers, New Delhi.
21. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
22. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
23. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
24. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.

BP107P. HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

4 Hours/week

Practical physiology is complementary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight into the subject**.**

1. Study of compound microscopes.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. To Study the integumentary and special senses using specimen, Models etc.
12. To demonstrate positive and negative feedback mechanism.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording blood pressure.

Recommended Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.

7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkat

BP102T. PHARMACEUTICAL ANALYSIS-I(Theory) 45 hours

Scope

This course deals with the fundamentals of analytical chemistry and the principles of electrochemical analysis of drugs.

Objectives

Upon completion of the course a student shall be able to understand

- The principles of volumetric and electrochemical analysis.
- Carry out various volumetric and electrochemical titrations.
- Develop analytical skills.

COURSE CONTENT

Unit	Topic	Hours
Unit I		
a	**Pharmaceutical analysis -** Definition and scope	05
	Different techniques of analysis	
	Methods of expressing concentration, Introduction to Mole Concept (units like % w/v, %v/v, % w/w, including aligation method)	
	Primary and Secondary standards (along with examples)	
b	**Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures	
Unit II		
a	**Acid base titration:** Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves. Preparation and standardization of sodium hydroxide, hydrochloric acid, sulphuric acid, estimation of ammonium chloride	10
II b	**Non aqueous titration:** Solvents, acidimetry and alkalimetry titrations, and estimation of sodium benzoate	
UNIT-III		
a	**Precipitation titrations:** Mohr's method, Volhard's method, Modified Volhard's method, Fajans method, and estimation of Sodium Chloride I.P.	12
b	**Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, and estimation of Calcium gluconate I.P.	
c	**Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, and estimation of Barium sulphate I. P.	
UNIT-IV		
	Redox titrations	

a	i. Concepts of oxidation and reduction. ii. Preparation and standardization of potassium permanganate I. P., Ceric Ammonium Sulphate I. P./B. P. and Sodium Thiosulphate I. P./B. P. iii. Types of redox titrations (Principles and applications): permaganometry, cerimetry, iodimetry, iodometry, bromatometry, dichrometry, titrations with potassium iodate I. P.	08
UNIT-V		
	Electrochemical methods of analysis **i.Conductometry** - Introduction, Conductivity cell, Conductometric titrations, applications.	10
	ii. Potentiometry - Electrochemical cell, construction and working of reference (Standard Hydrogen Electrode, Silver Chloride Electrode and Calomel Electrode) and Indicator Electrodes (Metal electrodes and Glass Electrode), methods to determine end-point of potentiometric titration and applications.	
	iii. **Polarography** - Principle and Ilkovik Equation	
b	**Refractometry** - Introduction, refractive index, specific and molar refraction, measurement of RI, Abbe's refractometer and applications.	

Recommended Books

1. Indian Pharmacopoeia, Ministry of Health and Family Welfare, Controller of Publications Edition, New Delhi.
2. British Pharmacopoeia, British Pharmacopoeia Commission, London, 2015.
3. Beckett, A.H. and Stenlake J. B., Practical Pharmaceutical Chemistry, Vol I, Stahlome Press, University of London.
4. Vogel, A. I., A Textbook of Quantitative Chemical Analysis, Thames Polytechnic, London, Longman Group, UK Ltd.
5. Connors K. A., A Textbook of Pharmaceutical Analysis, Third Edition, John Wiley and Sons.
6. Christian G. D., Analytical Chemistry, 6/Ed, John Wiley & Sons.
7. Mahadik K. R., Wadodkar S.G., More H. N, Pharmaceutical Analysis, Vol. I and II, Nirali Prakashan.
8. Kar Ashutosh, Pharmaceutical Drug Analysis, Minerva Press, New Delhi.
9. Day R. A. & Underwood A. L. Quantitative Analysis. 5/Ed., Prentice Hall of India Pvt.Ltd. New Delhi.
10. Skoog, A. D. West, D. M. et al. Fundamentals of Analytical Chemistry. 8/ Ed. Thomson Brookslcole.
11. Willard Merit. Dean Settle, Instrumental Methods of Analysis, 7/Ed, CBS Publisher & Distributor.
12. Sharma, B. K. Instrumental Methods of Chemical Analysis, Goel Publishing House.

BP108P. PHARMACEUTICAL ANALYSIS-I (Practical)
4 Hours/week

I. Introduction to Analytical Glassware		
Introduction to measuring glasswares, calibration of glasswares, introduction to labwares		1 turn
I. (A) Preparation and standardization of		
1	Aq. Sodium Hydroxide I. P.	3 turns
2	Aq. Sulphuric Acid I. P./ Aq. Hydrochloric Acid I. P.	
3	Aq. Sodium Thiosulfate I. P.	
4	Aq. Potassium Permanganate I. P.	
5	Aq. Ceric Ammonium Sulphate I. P.	
I (B) Preparation of stock solutions and serial dilutions		1 turn
II. Assay of the following compounds along with standardization of Titrant		
1	Ammonium chloride by acid-base titration	6 turns
2	Sodium benzoate I. P. by non-aqueous titration	
3	Sodium chloride I. P. by precipitation titration	
4	Calcium gluconate I. P. by complexometry	
5	Ferrous sulphate I. P. by cerimetry	
6	Copper sulphate I. P. by iodometry	
III (A) To calibrate Potentiometer and Conductometer		**1 turn**
III. (B) Determination of Normality by electro-analytical methods		
1	Conductometric titrations of strong acid against strong base	3 turns
2	Conductometric titration of strong acid and weak acid against strong base	
3	Potentiometric titration of strong acid against strong base (Using Sigmoidal and First order derivative plot)	
IV. Measurement of refractive index of some samples (Glycerol, Water, Rectified Spirit, Castor Oil I. P.)		1 turn

Recommended Books

1. Indian Pharmacopoeia, Ministry of Health and Family Welfare, Controller of Publications Edition, New Delhi.
2. British Pharmacopoeia, British Pharmacopoeia Commission, London, 2015.
3. Beckett, A.H. and Stenlake J. B., Practical Pharmaceutical Chemistry, Vol I, Stahlome Press, University of London.
4. Vogel, A. I., A Textbook of Quantitative Chemical Analysis, Thames Polytechnic, London, Longman Group, UK Ltd.
5. Mahadik K. R., Wadodkar S.G., More H. N, Pharmaceutical Analysis, Vol. I and II, Nirali Prakashan

BP103T. PHARMACEUTICS- I (Theory) 45 Hours

Scope: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives:

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

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

COURSE CONTENT

UNIT – I ▪ **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career. Introduction of pharmacopoeias. Introduction to DPCO act **Dosage forms:** Introduction to various dosage forms including ayurvedic formulations ▪ **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription. ▪ **Posology:** Definition, Factors affecting posology. Paediatric dose calculations based on age, body weight and body surface area.	**10 Hrs**
UNIT – II • **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight. • **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques. Classification of Solvent System	**10 Hrs**
UNIT – III • **Monophasic liquids:** Definitions, classification and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. • **Biphasic liquids:**	**10 Hrs**

• **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome and Evaluation tests • **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	
UNIT – IV **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	**8 Hours**
UNIT V **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms **Introduction to Surgical aids -** Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.	**7 Hours**

Recommended Books:

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

BP109P. PHARMACEUTICS- I (Practical)

4 Hours / week

1. Syrups

a) Syrup IP'66

b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs a) Piperazine citrate elixir

b) Paracetamol pediatric elixir

3. Linctus a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate

b) Cresol with soap solution

c) Lugol's Solution

5. Suspensions (Any two experiments)

a) Calamine lotion

b) Magnesium Hydroxide mixture

c) Aluminum Hydroxide gel

6. Emulsions a) Turpentine Liniment

b) Liquid paraffin emulsion

7. Powders and Granules (Any three experiments)

a) ORS powder (WHO) b) Effervescent granules

c) Dusting powder d) Divided powders

8. Suppositories (Any two experiments)

a) Glycero Gelatin suppository

b) Cocoa Butter suppository

c) Zinc Oxide suppository

9. Semisolids (Any two experiments)

a) Sulphur ointment

b) Non-staining iodine ointment with methyl salicylate

c) Carbopol gel

10. Gargles and Mouthwashes a) Iodine gargle

b) Chlorhexidine mouthwash

Recommended Books:

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. A text-book Professional Pharmacy by N.K.Jain and S.N.Sharma
6. Practical Pharmaceutics by A.K.Seth.
7. A Practical Book of Pharmaceutics -I by Beena Kumari.
8. A Practical Book of Pharmaceutics by Gokhale S.B.
9. A Practical Book of Pharmaceutics-I by Dole S.N.
10. A Practical manual of Pharmaceutics-I by Honmane S.

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory) 45 Hours

Scope

This subject deals with the monographs and pharmaceutical importance of inorganic drugs and pharmaceuticals.

Objectives

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

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
- Understand the medicinal and pharmaceutical importance of inorganic compounds.

COURSE CONTENT

UNIT	TOPIC	HOURS
UNIT I		
	Impurities in pharmaceutical substances: History of Pharmacopoeia, Source and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate	**07 Hours**
General methods of preparation, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes		
UNIT II		
	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical system, preparation, stability, buffered isotonic solutions, measurement of tonicity, calculations and method of adjusting isotonicity	**10 Hours**
	Major extra and intracellular electrolytes: Function of major physiological ions, Electrolyte used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance	
	Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	
UNIT III Inorganic Compounds in Marketed Formulations (Example for each Category)		
	Gastrointestinal agents	

	Acidifiers: Ammonium chloride*and Dil. HCl	**10 Hours**
	Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture	
	Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite	
	Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	
UNIT IV		
	Miscellaneous compounds **Expectorants:** Potassium iodide, Ammonium chloride*.	**11 Hours**
	Emetics: Copper sulphate*, Sodium potassium tartarate	
	Haematinics: Ferrous sulphate*, Ferrous gluconate	
	Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite	
	Astringents: Zinc Sulphate, Potash Alum	
	Tableting Aids: **Diluents:** Calcium sulfate* **Lubricants:** Calcium stearate, Magnesium stearate	
UNIT V		
	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.	**07 Hours**

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4 th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3 rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry 7. Indian Pharmacopoeia
7. Block. Roche. Soine. Wilson, Inorganic Medicinal and Pharmaceutical Chemistry, Indian Edition, ISBN 0-8121-0443-9, Pg no: 435-437

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical) 4 Hours/Week

Scope

This practical course deals with the hands-on aspects of inorganic pharmaceutical chemistry. It covers:

- conducting limit tests for common inorganic impurities (chlorides, sulphates, iron, heavy metals, arsenic, etc)
- identification tests of inorganic pharmaceutical substances and their purity
- assay and determination of inorganic pharmaceutical preparations and mixtures
- preparation of selected inorganic pharmaceutical compounds (e.g., boric acid, alum, ferrous sulphate)
- qualitative & quantitative analysis of inorganic drugs and their excipients in a laboratory environment

Objectives

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

1. Perform and interpret limit tests for inorganic impurities in pharmaceutical substances.
2. Carry out identification tests and purity checks for pharmaceutically important inorganic compounds.
3. Prepare standard solutions and carry out volumetric/gravimetric/complexometric titrations of selected inorganic pharmaceutical preparations.
4. Synthesize or prepare selected inorganic drugs in the laboratory & evaluate their quality.
5. Demonstrate good laboratory practices, maintain accurate records, communicate results and understand the significance of quality control in inorganic pharmaceuticals.

I. Introduction to Inorganic Chemicals & their Side effects	**1 turns**
II. Use of Merck Index to Learn Safety & Properties of Chemicals	**1 turns**
III. Limit Test of the following: 1. Chloride 2. Sulphate 3. Iron 4. Arsenic 5. Lead 6. Heavy metals	**6 turns**

IV. Identification Test 1. Magnesium Hydroxide 2. Ferrous sulphate 3. Sodium bicarbonate 4. Calcium guloconate 5. Copper sulphate	**3 turns**
V. Test for Purity 1. Swelling power of Bentonite 2. Neutralizing capacity of Aluminium hydroxide gel 3. Determination of Potassium iodate and iodine in potassium iodide	**3 turns**
VI. Preparation of Inorganic Pharmaceuticals 1. Boric acid 2. Potash alum 3. Ferrous sulphate	**3 turns**

Recommended Books:

1. Practical Handbook of Pharmaceutical Inorganic Chemistry by Pranita S. Shankaratti, Sejal T. Bhase, Shruti S. Chame & Snehal D. Barve — JEC Publications.
2. A Practical Book of Pharmaceutical Inorganic Chemistry (As Per PCI Latest Pattern) by Ketan B. Patil, Narendra B. Patil & Paresh A. Patil — IP Innovative Publication.
3. Practical Pharmaceutical Inorganic Chemistry (Simplified) by K. S. Jain, J. N. Kadam & M. G. Shinde — Nirali Prakashan.
4. Practical Pharmaceutical Chemistry Vol I & II by A.H. Beckett & J.B. Stenlake (Stahlon Press of University of London).
5. A. I. Vogel – Textbook of Quantitative Inorganic Analysis, 5th Edition, Longman Group Ltd.
6. G. R. Chatwal & S. K. Anand – Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
7. R. M. Verma – Analytical Chemistry, CBS Publishers & Distributors.
8. WHO & OSHA laboratory safety guidelines
9. The Merck Index — an Encyclopedia of Chemicals, Drugs, and Biologicals, 15th Edition, Royal Society of Chemistry.

BP105T.COMMUNICATION SKILLS (Theory) 30Hours

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business**.**

Objectives

Upon completion of the course the student shall be able to

1. Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation.
2. Communicate effectively (Verbal and Non Verbal)
3. Effectively manage the team as a team player
4. Develop interview skills
5. Develop Leadership qualities and essentials

COURSE CONTENT

UNIT – I	**Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context	**7 Hrs**
	Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers	
	Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	
UNIT – II	**Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical	**7 Hrs**
	Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	
UNIT – III	**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations	**7 Hrs**
	Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication	
	Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	
UNIT – IV	**Interview Skills:** Purpose of an interview, Do's and Dont's of an interview	**5 Hrs**
	Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery	
UNIT – V	**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion.	**4 Hrs**

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours/week

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

Basic communication covering the following topics

- Meeting People
- Asking Questions
- Making Friends
- What did you do?
- Do's and Dont's

Pronunciations covering the following topics

- Pronunciation (Consonant Sounds)
- Pronunciation and Nouns
- Pronunciation (Vowel Sounds)

Advanced Learning

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

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals –PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw

Hill Education, 2011
11. Effective communication, John Adair, 4th Edition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill, 1999.

BP 106RBT.REMEDIAL BIOLOGY (Theory) 30 Hours

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

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

- know the classification and salient features of five kingdoms of life
- understand the basic components of anatomy & physiology of plant
- know understand the basic components of anatomy & physiology animal with special reference to human

COURSE CONTENT

UNIT I	**Living world:** • Definition and characters of living organisms • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,	**7Hours**
	Morphology of Flowering plants • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidons	
UNIT II	**Body fluids and circulation** Composition of blood, blood groups, coagulation of blood Composition and functions of lymph Human circulatory system Structure of human heart and blood vessels Cardiac cycle, cardiac output and ECG	**7Hours**
	Digestion and Absorption Human alimentary canal and digestive glands Role of digestive enzymes Digestion, absorption and assimilation of digested food	
	Breathing and respiration Human respiratory system Mechanism of breathing and its regulation Exchange of gases, transport of gases and regulation of respiration Respiratory volumes	
UNIT III	**Excretory products and their elimination** • Modes of excretion • Human excretory system- structure and function • Urine formation	**7Hours**

	• Rennin angiotensin system **Neural control and coordination** • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata	
	Chemical coordination and regulation • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands	
	Human reproduction • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • Menstrual cycle	
UNIT IV	**Plants and mineral nutrition:** Essential mineral, macro and micronutrients Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation	**5Hours**
	Photosynthesis Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis	
UNIT V	**Plant respiration:** Respiration, glycolysis, fermentation (anaerobic).	**4Hours**
	Plant growth and development Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators	
	Cell - The unit of life Structure and functions of cell and cell organelles.Cell division	
	Tissues Definition, types of tissues, location and functions.	

Text Books

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

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C.Dutta.

4. Outlines of Zoology byM. Ekambaranatha ayyer and T. N. Ananthakrishnan.
5. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112RBP. REMEDIAL BIOLOGY (Practical)
2 Hours/week

1. Introduction to experiments in biology
    a) Study of Microscope
    b) Section cutting techniques
    c) Mounting and staining
    d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum. Biology forum of Karnataka. Prof .M.J.H.Shafi

BP 106 RMT.REMEDIAL MATHEMATICS (Theory) 30 hours

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

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

1. Know the theory and their application in Pharmacy

2. Solve the different types of problems by applying theory

3. Appreciate the important application of mathematics in Pharmacy

COURSE CONTENT

UNIT – I	**Partial fraction** Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics.	**6Hours**
	Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.	
	Function*:* Real Valued function, Classification of real valued functions	
	Limits and continuity : Introduction , Limit of a function, Definition of limit of a function (ε - δ *n n* definition) , $\lim \frac{x^n - a^n}{} = na^{n-1}$, $\lim \frac{\sin\theta}{} = 1,$	
UNIT – II	**Matrices and Determinant:** Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations Respiratory volumes.	**6Hours**

UNIT – III	**Calculus** **Differentiation** : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of *xn w.r.t*x,where *n* is any rational number, Derivative of *ex*,, Derivative of loge *x*, Derivative of *ax* , Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application	**6 Hours**
UNIT –IV	**Analytical Geometry** **Introduction:** Signs of the Coordinates, Distance formula, **Straight Line**: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line	**6 Hours**
	Integration: Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application	
UNIT-V	**Differential Equations** : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**	**6 Hours**
	Laplace Transform : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**	

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

Semester- II

BP201T: HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)
45 Hours

Scope:

This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

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

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system.
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

COURSE CONTENT

Unit	Topics Covered	Hours
Unit I	**a) Nervous System**– Organization of nervous system– Neuron, neuroglia– Classification & properties of nerve fibers– Electrophysiology, action potential, nerve impulse– Receptors, synapse, neurotransmitters **b) Central Nervous System**– Meninges, brain ventricles, cerebrospinal fluid (CSF)– Structure & functions of cerebrum, brain stem, cerebellum– Spinal cord: gross structure, afferent & efferent tracts– Reflex activity	**10 hrs**
Unit II	**a) Digestive System**– GI tract anatomy– Functions of stomach (acid secretion, parasympathetic control, pepsin action)– Anatomy & functions of small and large intestine– Salivary glands, pancreas, liver– GI movements, digestion & absorption of nutrients– Disorders of GIT **b) Energetics**– ATP formation and role– Creatinine phosphate– Basal Metabolic Rate (BMR)	**08 hrs**
Unit III	**a) Respiratory System**– Anatomy of respiratory system and lungs– Mechanism & regulation of respiration– Lung volumes and capacities– Transport of respiratory gases– Artificial respiration and resuscitation methods, disorders of respiratory system **b) Urinary System**– Anatomy of kidney, nephron, and urinary tract– Functions of kidney and urinary tract– Physiology of urine formation–	**10 hrs**

	Micturition reflex– Role of kidneys in acid-base balance– Renin-Angiotensin System (RAS)– Kidney disorders	
Unit IV	**a) Endocrine System**– Classification of hormones– Mechanism of hormone action– Structure & functions of: • Pituitary gland • Thyroid gland • Parathyroid gland • Adrenal gland • Pancreas • Pineal gland • Thymus– Endocrine disorders	**08 hrs**
Unit V	**a) Reproductive System**– Anatomy & functions of male and female reproductive systems– Sex hormones– Physiology of menstruation, fertilization– Spermatogenesis & oogenesis– Pregnancy & parturition, disorders of reproductive system **b) Introduction to Genetics** Chromosomes, genes and DNA– Protein synthesis– Genetic pattern of inheritance	**09 hrs**

Recommended Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview,MI USA
4. Text book of Medical Physiology- Arthur C, Guyton and John.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
9. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
10. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje , Academic Publishers Kolkata

BP207P. HUMAN ANATOMY AND PHYSIOLOGY-II (Practical)

4 Hours/week

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. To determine the Platelet count.
2. To perform the differential leukocyte count (DLC).
3. Determination of osmotic fragility of RBCs.
4. To study the nervous system using specimen, models, etc.,
5. To study the endocrine system using specimen, models, etc
6. To demonstrate the general neurological examination
7. To demonstrate the function of olfactory nerve
8. To examine the different types of taste.
9. To demonstrate the visual acuity
10. To demonstrate the reflex activity
11. Recording of body temperature.
12. Determination of tidal volume and vital capacity.
13. Estimation of Haemoglobin Content
14. Determination of Blood Group.
15. Study of Digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
16. Recording of basal mass index.
17. Study of family planning devices and pregnancy diagnosis test.
18. Demonstration of total blood count by cell analyser.
19. Permanent slides of vital organs and gonads.
20. Visit to Hospital/ Pathology Laboratory.

Recommended Books

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory) 45 Hrs

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

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,
- Identify/confirm the identification of organic compound.

COURSE CONTENT

Note:

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

2. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.

UNIT-I	**(7Hrs)**
Basic Principles of Organic Chemistry: Atomic structure, Hybridization of atomic orbitals of carbon, nitrogen and oxygen to form molecular orbitals. Molecular orbital theory, Molecular orbitals, Types of bonds, bond fission, intermolecular forces, inductive effect, steric effect, electromeric, mesomeric effect and resonance, hyperconjugation, concept of tautomerism. Bonding and Antibonding orbitals, Bond dissociation energy, Polarity of molecules	**03 Hrs**
Classification, nomenclature and isomerism: Classification of Organic Compounds. Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerism in organic compounds).	**04 Hrs**
UNIT II	**(10Hrs)**
Alkanes*: SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.	**02 Hrs**

Alkenes*: Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.	**05 Hrs**
Conjugated dienes*: Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	**03 Hrs**
UNIT III	**(10Hrs)**
Alkyl Halides- SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethyl chloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.	**06 Hrs**
Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, Structure and uses of chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	**04 Hrs**
UNIT IV	**(10Hrs)**
Carbonyl compounds* (Aldehydes and ketones)- Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation,	**04 Hrs**
Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation	**04 Hrs**
Qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde	**02 Hrs**
UNIT V	**(8 Hrs)**
Carboxylic acids*- Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid	**05 Hrs**
Aliphatic amines*- Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	**03 Hrs**

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, 2007
3. Finar, I. L.,Organic Chemistry Vol.-I, Ved,, ELBS, Pearson Education, New Delhi,

2003
4. Finar, I. L., Organic Chemistry Vol. II, V (ed.), ELBS, Pearson Education, NewDelhi,2003
5. Eliel, E. L., "Stereochemistry of Carbon Compounds", Wiley-Interscience, 1994

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY – I (Practical) 4 Hours/Week

1	Important Reagents and Their Preparations	**1 Turn**
2	Introduction and Demonstration of Chem Draw Software	. **1 Turn**
3	Construction of molecular models/ Working Models	**1 Turn**
4	Systematic qualitative analysis of unknown organic compounds like • Preliminary test: color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. • Detection of elements like nitrogen, sulphur and halogen by Lassaigne's test. • Solubility test • Functional group test like phenols, amides, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons, nitro compounds and anilides. • Melting point/Boiling point of organic compounds. • Identification of the unknown compound from the literature using melting point/ boiling point.	**10 Turns**
5	Preparation of suitable solid derivatives from organic compounds	**2 Turns**

Recommended Books (Latest Editions)

1. Practical Organic Chemistry by Mann and Saunders.
2. Vogel's text book of Practical Organic Chemistry
3. Advanced Practical organic chemistry by N.K.Vishnoi.
4. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
5. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

BP203 T. BIOCHEMISTRY (Theory) 45 hours

Scope

Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is to provide biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It also emphasizes on genetic organization of mammalian genome, hetero and autocatalytic functions of DNA.

Objectives

Upon completion of course the students shall able to

- Understand the catalytic role of enzymes and importance of enzyme in biochemical process.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

COURSE CONTENT

UNIT –I		**10Hours**
	a) Biomolecules Introduction, classification, chemical nature and biological role of carbohydrates, lipids, nucleic acids, amino acids and proteins.	3 Hr
	b) Carbohydrate metabolism i. Glycolysis – Pathway, energetics and significance. ii. Citric acid cycle- Pathway, energetics and significance. iii. HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency. iv. Glycogen metabolism Pathways and glycogen storage diseases (GSD). v. Gluconeogenesis- Pathway and its significance. vi. Hormonal regulation of blood glucose level and Diabetes mellitus. Clinical Data Based Case Study.	 1 Hr 1 Hr 2 Hr 1 Hr 1 Hr 1 Hr
UNIT –II		**8 Hours**
	a) Biological oxidation **i.** Electron transport chain (ETC) and its mechanism. **ii.** Oxidative phosphorylation & its mechanism and substrate level. Phosphorylation Inhibitor **iii.** ETC and oxidative phosphorylation / uncouplers.	 2 Hr 1 Hr 1 Hr
	b) Bioenergetics	

	i. Concept of free energy, endergonic and exergonic reaction, relationship between free energy, enthalpy and entropy. **ii.** Energy rich compounds; classification; biological significances of ATP and cyclic AMP.	2Hr 2Hr
UNIT-III		**10Hours**
	a) Lipid metabolism **i.** β-Oxidation of saturated fatty acid (Palmitic acid). **ii.** Formation and utilization of ketone bodies; ketoacidosis. **iii.** *De novo* synthesis of fatty acids (Palmitic acid). Biological significance of cholesterol and conversion of cholesterol intobile acids, steroid hormone and vitamin D. Disorders of lipid metabolism: hypercholesterolemia, atherosclerosis, fatty liver and obesity.	 1 Hr 1 Hr 1 Hr 1 Hr 1 Hr
	b) Amino acid metabolism **i.** General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders **ii.** Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, alkaptonuria, tyrosinemia) **iii.** Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline **iv.** Catabolism of heme; hyperbilirubinemia	 2 Hr 1 Hr 1 Hr 1 Hr
UNIT-IV		**10Hours**
	Nucleic acid metabolism and genetic information transfer **i.** Biosynthesis of purine and pyrimidine nucleotides. **ii.** Catabolism of purine nucleotides and hyperuricemia and gout disease. **iii.** Organization of mammalian genome. **iv.** Structure of DNA and RNA and their functions. **v.** DNA replication (semi conservative model) **vi.** Transcription or RNA synthesis. **vii.** Genetic code, Translation or Protein synthesis and inhibitors	 2 Hr 2 Hr 1 Hr 1 Hr 1 Hr 1 Hr 2 Hr
UNIT-V		**07 hours**
	Enzymes **i.** Introduction, properties, nomenclature and IUB classification of enzymes. **ii.** Enzyme kinetics (Michaelis plot, Line Weaver Burke plot). **iii.** Enzyme inhibitors with examples. **iv.** Regulation of enzymes: enzyme induction and repression, allosteric enzyme-regulation. **v.** Therapeutic and diagnostic applications of enzymes and isoenzymes. **vi.** Coenzymes–Structure and biochemical functions; Co-factors.	 1 Hr 2 Hr 1 Hr 1 Hr 1 Hr 1 Hr

Recommended Books

1. David Nelson and Cox M. M., Lehninger's Principles of Biochemistry, 4/Ed., Palgrave Macmillon.
2. Robert K. Murry, Daryl K., Granner and Victor W. Rodwell, Harper's Biochemistry, 27/Ed, McGraw Hill.
3. Lubert Stryer, W.H., Freeman & Company, Biochemistry, New York
4. U. Satyanarayana & U. Chakrapani, Biochemistry, 3/Ed., Books & Allied (P) Ltd.
5. Rao, A. V. S. S. Rama Rao, Textbook of Biochemistry, first edition, UBS Publishers' Distributors Pvt. Ltd.

BP209P. BIOCHEMISTRY (Practical)
4 Hours/week

Sr. No.	Title of Experiments	Turns
1.	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)	2 Turns
2.	Identification tests for Amino acids (any one aliphatic or aromatic)	2 Turns
3.	Identification tests for Proteins (albumin and Casein)	1 Turn
4.	Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)	1 Turn
5.	Qualitative analysis of urine for abnormal constituents	2 Turns
6.	Introduction to Sample Collection Techniques. (video demonstration)	1 Turn
7.	Determination of blood creatinine	1 Turn
8.	Determination of blood sugar	1 Turn
9.	Determination of serum total cholesterol	1 Turn
10.	Preparation of buffer solution and measurement of pH	1 Turn
11.	Study of enzymatic hydrolysis of starch	1 Turn
12.	Determination of Salivary amylase activity	1 Turn
13.	Study the effect of Temperature on Salivary amylase activity.	1 Turn
14.	Study the effect of substrate concentration on salivary amylase activity.	1 Turn
15.	Estimation of SGOT and SGPT in Serum.	1 Turn

References:

1. David T. Plummer, Introduction of Practical Biochemistry. 3/Ed, Tata McGraw-Hill Education Pvt. Ltd.
2. Rajagopal and Ramakrishna, Practical Biochemistry for Medical students, Orient BlackSwan (1983)
3. Harold Varley, Varley's Practical Clinical Biochemistry, 6/Ed., CBS Publishers, New Delhi.
4. David T. Plummer, Introduction to Practical Biochemistry, III (ed.), McGraw-Hill Publishing Co., New York, 1987.
5. Alan H. Gowenlock, Varley's Practical Clinical Biochemistry, VI (ed.), Butterworth Heinemann Ltd., UK & CBS Publication, New Delhi, 2002.

BP204T – PATHOPHYSIOLOGY (Theory) 45 Hours

Scope:

Pathophysiology is the study of causes of diseases and the reactions of the body to such disease-producing factors. This subject is designed to impart a thorough knowledge of the pathological aspects of various disease conditions with relevance to pharmacological applications. It provides a foundational understanding of the pathophysiological mechanisms that occur during diseases. The study of this subject helps students gain essential knowledge required for the safe, rational, and effective practice of medicine. It also helps in understanding the pathology subject as a whole. It is important to note that pharmacotherapy of drugs is not considered for examination purposes in this subject, as it deals specifically with the pathological aspects.

Objectives:

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

1. Describe the etiology (cause) and pathogenesis (development mechanism) of the selected disease states.
2. Identify and explain the signs and symptoms associated with various diseases.

COURSE CONTENT

Unit	Topics Covered	Hours
Unit I	**Basic principles of Cell Injury and Adaptation** •Definitions & causes of cellular injury • Pathogenesis: Membrane, mitochondrial, ribosomal, nuclear damage • Morphology: Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Dysplasia • Cell swelling, intracellular accumulation, calcification, enzyme leakage, cell death • Acid-base imbalance (acidosis/alkalosis), Electrolyte imbalance **Inflammation and Repair** • Signs and types of inflammation • Mechanisms: vascular permeability, WBC migration • Mediators of inflammation • Principles of wound healing in skin	**10 hrs**
Unit II	**Cardiovascular system** • Hypertension• Congestive heart failure • Ischemic heart disease (Angina, MI, Atherosclerosis, Arteriosclerosis) **Respiratory system** • Asthma• Chronic Obstructive Airway Disease (COAD) **Renal system** • Acute renal failure • Chronic renal failure	**10 hrs**

Unit III	**Haematological diseases** • Iron deficiency anaemia, Megaloblastic anaemia, Sickle cell anaemia, Thalassemia, Haemophilia **Endocrine system** • Diabetes mellitus • Thyroid disorders (Hypo/Hyperthyroidism, Goitre) • Sex hormone disorders (Amenorrhoea, PCOS, Hypogonadism) **Nervous system** • Epilepsy • Parkinson's disease• Stroke • Psychiatric disorders: Depression, Schizophrenia, Alzheimer's **Gastrointestinal system** • Peptic ulcer • Inflammatory bowel disease • Jaundice • Hepatitis (A–F) • Alcoholic liver disease	**12 hrs**
Unit IV	**Diseases of Bones & Joints** • Rheumatoid arthritis • Osteoporosis • Gout **Cancer** • Classification • Etiology • Pathogenesis	**6 hrs**
Unit V	**Infectious diseases** • Tuberculosis, Leprosy • Malaria, Dengue • Meningitis, Typhoid • Urinary Tract Infections (UTI) **Sexually Transmitted Diseases (STDs)** • AIDS • Syphilis • Gonorrhoea	**7 hrs**

References:

1. Pathologic Basis of Disease by Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran; South Asia edition; India; Elsevier;2014.
2. Text book of Pathology by Harsh Mohan; 6thedition; India; Jaypee Publications;2010.
3. Basis of Therapeutics by Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The

Pharmacological; 12th edition; New York; McGraw-Hill;2011.
4. Best and Taylor's Physiological basis of medical practice by Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); 12th ed; united states.
5. William and Wilkins, Baltimore;1991 [1990printing].
6. Davidson's Principles and Practice of Medicine by Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston; 21st edition; London; ELBS/Churchill Livingstone;2010.
7. Textbook of Medical Physiology by Guyton A, John. E Hall; 12th edition; WB Saunders Company;2010.
8. Pharmacotherapy: A Pathophysiological Approach by Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; 9th edition; London; McGraw-Hill Medical; 2014.
9. Basic Pathology by V. Kumar, R. S. Cotran and S. L. Robbins; 6th edition; Philadelphia; WB Saunders Company;1997.
10. Clinical Pharmacy and Therapeutics by Roger Walker, Clive Edwards; 3rd edition; London; Churchill Livingstone publication;2003. 68

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896(Online)
2. The American Journal of Pathology. ISSN:0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology.ISSN-0377-4929

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory) 30 Hours

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

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

1. know the various types of application of computers in pharmacy
2. know the various types of databases
3. know the various applications of databases in pharmacy

COURSE CONTENT

UNIT – I	**Number system**: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division	**06 hours**
	Concept of I nformation Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	
UNIT – II	**Web technologies**: Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products, Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	**06 hours**
UNIT – III	**Application of computers in Pharmacy** – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	**06 hours**
UNIT – IV	**Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery.	**06 hours**
UNIT – V	**Computers as data analysis in Preclinical development**: Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)	**06 hours**

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)
2 Hours/week

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

Recommended books :

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

BP 206 T. ENVIRONMENTAL SCIENCES (Theory) 30 hours

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

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

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

COURSE CONTENT

Unit-I	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources	**10hrs**
Unit-II	Ecosystems ▪ Concept of an ecosystem. ▪ Structure and function of an ecosystem. ▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**10hrs**
Unit-III	Environmental Pollution: Air pollution; Water pollution; Soil pollution	**10hrs**

Recommended Books:

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental

Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

2 credit Compulsory course for all the First Year students in All Faculties Democracy, Election and Governance 30Hours

Objectives:

1. To introduce the students meaning of democracy and the role of the governance
2. To help them understand the various approaches to the study of democracy and governance

Module 1 Democracy- Foundation and Dimensions

a. Constitution of India
b. Evolution of Democracy- Different Models
c. Dimensions of Democracy- Social, Economic, and Political

Module 2 Decentralization

a. Indian tradition of decentralization
b. History of panchayat Raj institution in the lost independence period
c. 73rd and 74th amendments
d. Challenges of caste, gender, class, democracy and ethnicity

Module 3 Governance

a. Meaning and concepts
b. Government and governance
c. Inclusion and exclusion

References:

1. Banerjee-Dube, I. (2014). *A history of modern India*. Cambridge University Press.
2. Basu, D. D. (1982). *Introduction to the Constitution of India*. Prentice Hall of India.
3. Bhargava, R. (2008). *Political theory: An introduction*. Pearson Education India.
4. Bhargava, R., Vanaik, A. (2010) *Understanding Contemporary India: Critical Perspective.* New Delhi: Orient Blackswan.
5. Chandhoke. N., Proyadardhi.P, (ed) (2009), '*Contemporary India: Economy, Society, Politics*', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.
6. Chandra, B. (1999). *Essays on contemporary India*. Har-Anand Publications.
7. Chaterjee, P. (1997). State and Politics in India.
8. Dasgupta. S., (ed) (2011), *'Political Sociology'*, Dorling Kindersley (India) Pvt. Ltd.,

Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.

9. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
10. Guha, R. (2007). India After Gandhi: The History of the World's Largest. *Democracy, HarperCollins Publishers, New York*.
11. Guha, R. (2013). *Gandhi before India*. Penguin UK.
12. Jayal. N.G. (2001). *Democracy in India.*New Delhi: Oxford University Press.
13. Kohli, A. (1990). *Democracy and discontent: India's growing crisis of governability*. Cambridge University Press.
14. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). *The success of India's democracy* (Vol. 6). Cambridge University Press.
15. Kothari, R. (1989). *State against democracy: In search of humane governance*. Apex Pr.
16. Kothari, R. (1970). *Politics in India*. New Delhi: Orient Blackswan.
17. Kothari, R. (1995). *Caste in Indian politics*. Orient Blackswan.
18. Sarkar, S. (2001). *Indian democracy: the historical inheritance. the Success of India's Democracy*, 23-46.

मराठी संदर्भग्रंथ

१. राही, श्रुती गणेश व आवटे, श्रीरंजन. (२०१९). *आपलं आयकार्ड.* सुहास पळशीकर, द युनिक अॅकॅडमी पब्लिकेशन प्रा. लि.

२. व्होरा, राजेंद्र व पळशीकर, सुहास. (२०१४). *भारतीय लोकशाही : अर्थ आणि व्यवहार.* पुणे : डायमंड प्रकाशन.

३. सुमंत, यशवंत. (२०१८). *प्रा. यशवंत सुमंत यांची तीन भाषणे.* पुणे : युनिक अॅकॅडमी पब्लिकेशन्स प्रा. लि.

४. भोळे, भा. ल. (२०१५). *भारतीय गणराज्याचे शासन आणि राजकारण.* नागपूर : पिंपळापुरे बुक प्रकाशन.

५. कसबे, रावसाहेब. (२०१०). *डॉ. आंबेडकर आणि भारतीय राज्यघटना.* पुणे : सुगावा प्रकाशन.

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

CO No.	Upon successful completion of this course, the students will be able to:
1	Understand and apply organic chemistry concepts to drug discovery and pharmaceutical synthesis.
2	Analyze the effect of substituents, functional groups, and stereochemistry on drug reactivity and stability
3	Design and optimize synthetic routes for active pharmaceutical ingredients (APIs).
4	Evaluate laboratory and industrial methods for preparation of key organic compounds and intermediates
5	Apply green chemistry principles and quality standards in pharmaceutical processes

Course Content

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

Unit	Topic	Hrs.
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. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction. Application of nitrobenzene and halobenzenes in API production. Hazard and safety aspects in benzene handling. Atom economy and solvent free reaction in aromatic substitution reactions.	**10**

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. Industrial preparation methods for phenol and aniline derivatives. Genotoxic impurities in amine synthesis, e.g. Nitrosamine.	**08**
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. Geometrical isomerism Nomenclature of geometrical isomers (Cis & Trans, E & Z, Syn & Anti systems). Methods of determination of configuration of geometrical isomers. History/development of some chiral drugs (e.g., thalidomide, ibuprofen) to highlight importance. Asymmetric and chiral synthesis with examples. Industrial methods for chiral resolution and asymmetric synthesis. Modern nomenclature tools and software used for stereochemistry in R&D.	**10**
UNIT-IV	**Polynuclear hydrocarbons** Synthesis, reactions and structure and medicinal uses of naphthalene, phenanthrene, anthracene, diphenylmethane, triphenylmethane and their derivatives (including industrial applications).	**10**
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. Pharmaceutical and medicinal applications of PAHs, such as anthracene derivatives in anticancer drugs. Green synthesis approaches and environmental impact assessment of PAHs. Scale-up lab reactions of anthracene derivatives.	**05**
UNIT-VI	**Fats and Oils** - Hydrolysis, Hydrogenation, Saponification and Rancidity of oils. Industrial hydrogenation, saponification, and quality testing methods. Role of lipids in drug delivery systems, like lipid nanoparticles	**02**

Recommended References (Preferably latest editions):

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.), Blackwell Publishing House, Oxford, UK, 2004
5. Li, J. J., Name Reactions, III (ed.), Springer, Berlin, 2006
6. Stereochemistry of Organic Compound Principles and Applications by Nasipuri, Revised Edition, New Age International Publishers.
7. Stereochemistry Conformation and Mechanism by P.S. Kalsi, 7/Ed 2008, New Age International Publishers, New Delhi.
8. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., and Tatchell, A. R., "Vogel's Textbook of Practical Organic Chemistry", V (ed.), Pearson, London, 1994
9. Mann, F. G. and Saunders, B. C., Practical Organic Chemistry, IV(ed.), Pearson, UK, 2009
10. 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)	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:

CO No.	Upon successful completion of this course, the students will 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 the use of physicochemical properties of drugs in the formulation development and evaluation of dosage forms.

Course Content:

Unit No.	Topics	Hours
UNIT-I	**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	**12**
UNIT-II	**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).	**10**

Unit No.	Topics	Hours
	Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.	
UNIT-III	**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, critical micelle concentration, factors affecting CMC, wetting, and pharmaceutical applications of surfactants in dosage forms, HLB Scale, solubilisation, detergency, adsorption at solid interface.	**08**
UNIT-IV	**Complexation and protein binding:** Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, Inclusion complexation with cyclodextrins and their role in solubility and stability enhancement. Stability constants (concept and significance) and a brief introduction to thermodynamic aspects.	**08**
UNIT-V	**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. Role of buffers in formulation and drug stability.	**07**

Recommended References (Preferably latest editions):

11. Sinko PJ. Martin's Physical Pharmacy and Pharmaceutical Sciences. 8th ed. Philadelphia: Wolters Kluwer; 2023.
12. Subrahmanyam CVS, Thimmasetty J. Physical Pharmaceutics. Vallabh Prakashan; latest revised edition.
13. Subrahmanyam CVS, Thimmasetty J. Laboratory Manual of Physical Pharmaceutics. Vallabh Prakashan.
14. Mobley WC, Amiji MM, Cook TJ. Applied Physical Pharmacy. 3rd ed. McGraw-Hill; 2019..
15. Allen LV Jr, Ansel HC. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. 12th ed. Wolters Kluwer.
16. Cooper and Gunn. Tutorial Pharmacy. CBS Publishers.

BP303T.	PHARMACEUTICAL MICROBIOLOGY (Theory)	45 Hours

Scope:
Study of all categories of microorganisms especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..

Objectives:

CO No.	Upon successful completion of this course, the students will 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 No.	Topics	Hours
UNIT-I	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.	**10**
UNIT-II	Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC). 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. Sterility indicators	**10**
UNIT-III	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 Designing of aseptic area, laminar flow equipment's; 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	**10**

Unit No.	Topics	Hours
	for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic. Introduction to GMP guidelines for sterile products	
UNIT-IV	Designing of aseptic area, laminar flow equipment's; 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. Antibiotics produced by microbiology (Production and uses streptomycin, cephalosporin)	**07**
UNIT-V	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.	**08**

Recommended References (Preferably latest editions):

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

BP304T	PHARMACEUTICAL ENGINEERING (Theory)	45 Hours

Scope:

Pharmaceutical Engineering is a core subject in B. Pharmacy that deals with the art and science of various unit operations used in pharmaceutical industries**.** It helps students understand the engineering principles applied in pharmacy industries for efficient production and plant operation.

Objectives:

CO No.	Upon successful completion of this course, the students will be able to:
1	To know various unit operations used in pharmaceutical industries.
2	To understand material handling techniques used during pharmaceutical manufacturing.
3	To perform various processes involved in pharmaceutical manufacturing processes such as size reduction, mixing, filtration, drying, evaporation, and heat transfer.
4	To appreciate and comprehend the significance of plant layout design for optimum utilization of resources and smooth production flow.
5	To understand various preventive methods used for corrosion control in pharmaceutical industries.

Course Content:

Unit No.	Topics	Hours
UNIT-I	**Flow of fluids:** Definition of Fluid static and dynamics, basic equations, laws of conservation in fluid flow. Pressure measurement equipment Manometers, Types of flow, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Principles, construction, working, uses, merits and demerits of 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	**10**
UNIT-II	**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.	**10**

Unit No.	Topics	Hours
	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	**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,	**08**
UNIT-IV	**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.	**08**
UNIT-V	**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, basic of material handling systems. Conveyors, hoists, and automated guided vehicles (AGVs), Storage systems: bins, silos in warehouses	**07**

Recommended References (Preferably latest editions):

1. Subrahmanyam CVS, Thimma Setty J, Sarasija Suresh, Kusum Devi V. Pharmaceutical Engineering Unit Operations-II. Second Edition, Vallabh Prakashan, Delhi. 2011.
2. Introduction to Pharmaceutical Engineering, Anant Pardkar, Nirali Prakashan.
3. Pharmaceutical Engineering, K Sambamurthy, New age international Publisher.

BP305P	PHARMACEUTICAL ORGANIC CHEMISTRY - II (Practical)	4 Hrs/week

Expt. No.	List of practical	Turns
1	**Experiments involving laboratory techniques** • Recrystallization • Steam distillation	**1 Turn**
2	**Experiments involving Separation of Binary mixtures**	**2 Turn**
3	**Determination of saponification value of oil samples (Any 2)**	**1 Turn**
4	**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/ pIodobenzoic 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 References (Preferably latest editions):

1. Mann, F. G. and Saunders, B. C., Practical Organic Chemistry, IV(ed.), Pearson, UK, 2009
2. Vogel‟s Text Book of Practical Organic Chemistry- Brian Furniss, Antony Hannaford, Peter Smith, Austrin (Eds), 5th edition, ELBS Publication, Singapore, 1997.
3. A Guidebook to Mechanism in Organic Chemistry by Peter Sykes Longman Scientific and Technical, Sixth Edition, 1985.
4. Advanced Organic Chemistry by Francis A. Carey, Part A: Structure and Mechanism, Springer, 2007.
5. Writing Reaction Mechanisms in Organic Chemistry by Audrey Miller, Second Edition, Elsevier Science & Technology Books, 1999.
6. Organic Reactions by Werner E. Bachmann, Volume I, John Wiley and Sons. INC, 1942.
7. Advanced Organic Chemistry Reaction Mechanisms by Reinhard Bruckner, Elsevier, 2002
8. O'Neil MJ, editor. The Merck Index: An Encyclopedia of Chemicals, Drugs, and Biologicals. 15th ed. Cambridge: Royal Society of Chemistry; 2013

BP306P	PHYSICAL PHARMACEUTICS – I (Practical)	4 Hrs/week

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.

Course Content:

Expt. No.	List of practical
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 the Partition Coefficient of a Drug in Octanol–Water System
5	Determination of the % composition of NaCl in a solution using the phenol-water system by the CST method
6	Determination of surface tension of given liquids by the drop count and drop weight method
7	Determination of the HLB number of a surfactant by the saponification method
8	Determination of the Freundlich and Langmuir constants using activated charcoal
9	Determination of the critical micellar concentration of surfactants
10	Determination of Stability Constant of Drug–Cyclodextrin Inclusion Complex by Phase Solubility Method
11	Determination of stability constant and donor-acceptor ratio of Cupric-Glycine complex by pH titration method.
12	Determination of the refractive index of a given sample.
13	Determination of thermodynamic parameters using solubility studies.

Recommended References (Preferably latest editions):

1. Sinko, P.J., *Martin's Physical Pharmacy and Pharmaceutical Sciences*. Lippincott Williams & Wilkins.
2. Allen, L.V. and McPherson, T.B., *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems*. Wolters Kluwer.
3. Adejare, A., *Remington: The Science and Practice of Pharmacy*. Pharmaceutical Press.
4. Aulton, M.E. and Taylor, K.M.G., *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*. Elsevier.

5. Lachman, L. and Lieberman, H.A., *The Theory and Practice of Industrial Pharmacy*. CBS Publishers & Distributors.
6. Subrahmanyam, C.V.S., *Textbook of Physical Pharmaceutics*. Vallabh Prakashan.
7. Bahl, A., Bahl, B.S. and Tuli, G.D., *Essentials of Physical Chemistry*. S. Chand Publications.
8. *Laboratory Manual of Physical Pharmaceutics*. Vallabh Prakashan.
9. Cooper, J. and Gunn, M., *Tutorial Pharmacy*. CBS Publishers & Distributors.

BP307P	PHARMACEUTICAL MICROBIOLOGY (Practical)	4 Hours/week

Scope: Study of all the equipment's used in Pharmaceutical Microbiology equipment's, aseptic handling, microorganism's cultures isolation methods and sterility testing's of sterile dosage forms.

Objectives:

CO No.	Upon successful completion of this course, the students will be able to:
1	Know the principle, handling techniques and applications of different equipment's use in Pharmaceutical Microbiology.
2	Understand the various techniques for sterilization of glassware's, media and dosage forms.
3	Carried out different techniques for isolation of microorganism's pure culture.
4	Understand the microbial assay methods.

Course Content:

Expt. No.	List of practical
1	Introduction and study of different equipment and processing.
2	To study the principle & working of laboratory equipment's. (B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes)
3	To study the different techniques of inoculation of cultures and preparations of nutrient stabs, slant and petri plate
4	Preparation and sterilization of nutrients broth, nutrients agar and glassware's
5	To study the technique of aseptic removal and transfer of microorganisms for Sub culturing.
6	Isolation of Pure Cultures by Using Streak Plate Method
7	Isolation of cultures by using pour plate techniques (loop dilution).
8	To determine total viable count of bacterial suspension by spread plate method.
9	To study the bacterial morphology by simple (monochrome) staining.
10	To study the bacterial morphology by negative staining.
11	To study morphology of bacteria by Gram's Staining,
12	To study bacterial motility by using hanging drop technique
13	To perform sterility test for sodium chloride injection/ water for injection.
14	To perform sterility test for water for injection

Expt. No.	List of practical
15	To perform microbiological assay of crystalline, Sodium salt of Benzyl Penicillin/Benzoic acid by Cup Plate method.
16	To perform microbiological assay of streptomycin sulphate/ Ampicillin by cup plate Method
17	Bacteriological analysis of water (To determine quality of water by Most Probable Number test)

Recommended References (Preferably latest editions):

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. I.P., B.P., U.S.P.- latest editions.
6. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi

BP308P	PHARMACEUTICAL ENGINEERING (Practical)	04 Hrs/Week

Scope:
The course deals with the various processes involved in unit operations during Pharmaceutical dosage form Manufacturing .Also basic knowledge of equipment used during the manufacturing processes

Objectives:

CO No.	Upon successful completion of this course, the students will be able to:
1	To know various unit operations used in pharmaceutical industries
2	To equip with practical knowledge of the equipment handling techniques
3	To perform various processes involved in pharmaceutical manufacturing process.

Course Content:

Expt. No.	List of practical
1	Determination of radiation constant of any one of– brass/ iron/unpainted and painted glass
2	Steam distillation- To calculate the efficiency of steam distillation
3	To determine the overall heat transfer coefficient by heat exchanger.
4	Construction of drying curves (for calcium carbonate and starch)
5	Determination of moisture content and loss on drying.
6	Determination of humidity of air - i) From wet and dry bulb temperatures -use of Dew point method
7	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.
8	Size analysis by sieving -To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9	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
10	Demonstration of any two equipment such as colloid mill, planetary mixer, fluidized bed dryer, Spray dryer Laminar Air Flow, Ball Mill and such other major equipment
11	Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity).
12	To study the effect of time on the Rate of Crystallization
13	To calculate the uniformity Index for given sample by using Double Cone Blender

Expt. No.	List of practical
14	Industrial visit/AI based demonstration

Recommended References (Preferably latest editions):

1. Paradkar A. Introduction to Pharmaceutical Engineering. Eleventh Edition, Nirali Prakashan, Pune. 2007.
2. Subrahmanyam CVS, Thimma Setty J, Sarasija Suresh, Kusum Devi V. Pharmaceutical Engineering Unit Operations-II. Second Edition, Vallabh Prakashan, Delhi. 2011

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:

CO No.	Upon successful completion of this course, the students will be able to:
1	Understand the methods of preparation and properties of organic compounds.
2	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 No.	Topics	Hours
UNIT-I	**Stereo isomerism** Reactions of Chiral molecules Racemic modification and resolution of racemic mixture. Introduction to Asymmetric synthesis with suitable examples. R/S and E/Z nomenclature in detail Drug chirality and pharmacological significance with examples	07
UNIT-II	**Geometrical isomerism** **Conditions for geometrical isomerism** **Stability of geometrical isomers** Conformational isomerism in n-Butane and cyclohexane with energy profile diagram. Stereoisomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereo selective reactions. Pharmaceutical relevance of geometrical isomerism	06
UNIT-III	**Heterocyclic compounds** Nomenclature and classification of heterocyclic compounds in to classes: Oxygen containing five & six membered rings, Nitrogen containing five & six membered rings, sulphur containing five- &	08

Unit No.	Topics	Hours
	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, benzothiazole, benzopyran Chemistry, 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, Synthesis (any one), reactions and medicinal uses of following compounds and their derivatives (any one from each class): 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)	**12**
UNIT-V	**Name Reactions of synthetic importance** Rearrangement reactions-Definition, Classification. 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. (Include statement, reaction, reaction mechanism, stereochemistry/ critical views/ features, application-based examples)	**12**

Recommended References (Preferably latest editions):

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 4. Joule and Mills, Heterocyclic Chemistry, IV (ed.), Blackwell Publishing House, Oxford, UK, 2004
5. Li, J. J., Name Reactions, III (ed.), Springer, Berlin, 2006
6. Stereochemistry of Organic Compound Principles and Applications by Nasipuri, Revised Edition, New Age International Publishers.
7. Stereochemistry Conformation and Mechanism by P.S. Kalsi, 7/Ed 2008, New Age International Publishers, New Delhi.
8. 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:

CO No.	Upon successful completion of this course, the students will be able to:
1	Understand the chemistry of drugs with respect to their pharmacological activity
2	Understand the drug metabolic pathways, adverse effect and therapeutic value of Drugs.
3	Know the Structural Activity Relationship (SAR) of different class of drugs
4	Write the chemical synthesis of some drugs

Course Content:

Unit No.	Topics	Hours
UNIT-I	**Introduction to Medicinal Chemistry:** **History and development of medicinal chemistry** Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Proteinbinding, Chelation, Bioisosterism, Optical and Geometrical isomerism. **Drug metabolism** Drug metabolism principles - Phase I and Phase II. Factors affecting drug metabolism.	**06**
UNIT-II	**Drugs acting on Autonomic Nervous System:** **Adrenergic Neurotransmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution **Sympathomimetic agents:** **SAR of Sympathomimetic agents** **Direct acting agents:** Norepinephrine, Epinephrine, Dopamine, Phenylephrine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol, Oxymetazoline and Xylometazoline **Indirect acting agents:** Hydroxyamphetamine, Pseudoephedrine **Agents with mixed mechanism:** Ephedrine, Amphetamine **Adrenergic Antagonists:** **Alpha adrenergic blockers:** Tolazoline, Phentolamine, Phenoxybenzamine, Prazosin **Beta adrenergic blockers:** SAR of beta blockers, Propranolol,	**10**

Unit No.	Topics	Hours
	Atenolol, Labetolol, Carvedilol. **[Phenylephrine, Salbutamol, Tolazoline, Propranolol]**	
UNIT-III	**Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents:** **SAR of Parasympathomimetic agents Direct acting agents:** Acetylcholine**,** Carbachol, Bethanechol, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine, Edrophonium chloride, Donepezil, Tacrinehydro chloride, 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]**	**08**
UNIT-IV	**Drugs acting on Central Nervous System** **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 **Antipsychotics** **Phenothiazeines:** SAR of Phenothiazines– Chlorpromazine hydrochloride, Triflupromazine, Thioridazine hydrochloride, Trifluoperazine hydrochloride **Ring Analogues of Phenothiazeines:** Thiothixene, Loxapine succinate, Clozapine. **Flurobuterophenones:** Haloperidol, Droperidol, Risperidone. **Benzamides:** Sulpiride. **Anticonvulsants:** SAR of Anticonvulsants**,** mechanism of anticonvulsant action **Barbiturates**: Phenobarbitone, Mephobarbital **Hydantoins:** Phenytoin, Mephenytoin	**10**

Unit No.	Topics	Hours
	Oxazolidinediones: Trimethadione **Succinimides:** Phensuximide, Methsuximide **Urea and monoacylureas**: Phenacemide, Carbamazepine **Benzodiazepines**: Clonazepam **Miscellaneous:** Levetiracetam, Valproic acid, Gabapentin ,Felbamate **General anesthetics:** **Inhalation anesthetics:** Halothane, Enflurane **Ultra-short acting barbitutrates:** Methohexital sodium, Thiopental sodium. **Dissociative anesthetics:** Ketamine hydrochloride. **[Diazepam, Chlorpromazine hydrochloride, Carbamazepine, Halothane, Ketamine hydrochloride]**	
UNIT-V	**Centrally Acting analgesics** **Narcotic and non-narcotic analgesics Morphine and related drugs:** SAR of Morphine analogues, Codeine, Meperidine hydrochloride, Loperamide hydrochloride, Fentanyl citrate, Methadone hydrochloride, Propoxyphene hydrochloride, Pentazocine. **Introduction to Narcotic antagonists** **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid, Indomethacin, Sulindac, Diclofenac, Ketorolac, Ibuprofen, Piroxicam, Acetaminophen, Phenylbutazone. **[Fentanyl citrate, Mefenamic acid, Diclofenac, Ibuprofen]**	**09**

Recommended References (Preferably latest editions):

1. Indian Pharmacopoeia, Ministry of Health and Family Welfare, Controller of Publications Edition, New Delhi.
2. British Pharmacopoeia, British Pharmacopoeia Commission, London, 2015.
3. Connors K. A., A Textbook of Pharmaceutical Analysis, Third Edition, John Wiley and Sons.
4. Christian G. D., Analytical Chemistry, 6/Ed, John Wiley & Sons.
5. Mahadik K. R., Wadodkar S.G., More H. N, Pharmaceutical Analysis, Vol. I and II, Nirali Prakashan.
6. Kar Ashutosh, Pharmaceutical Drug Analysis, Minerva Press, New Delhi.
7. Day R. A. & Underwood A. L. Quantitative Analysis. 5/Ed., Prentice Hall of India Pvt. Ltd. New Delhi.
8. Skoog, A. D. West, D. M. et al. Fundamentals of Analytical Chemistry. 8/ Ed. Thomson Brookslcole.
9. Sharma, B. K. Instrumental Methods of Chemical Analysis, Goel Publishing House.
10. Willard Merit. Dean Settle, Instrumental Methods of Analysis, 7/Ed, CBS Publisher & Distributor.

BP403T.	PHYSICAL PHARMACEUTICS-II (Theory)	45 Hours

Scope:
The course deals with the various physica 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:

CO No.	Upon successful completion of this course, the students will be able to:
1	Understand various physicochemical properties of drug molecules in the designing the dosage forms
2	Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
3	Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms

Course Content:

Unit No.	Topics	Hours
UNIT-I	**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. Stabilty of Colloid : DLVO Theory, Effect of electrolytes, coacervation, peptization & protective action, Application of colloidal System,	07
UNIT-II	**Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, Viscoelasticity, determination of viscosity, capillary, falling Sphere, rotational viscometers, Application of rheology in pharmacy	08
UNIT-III	**Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling in suspensions, Stokes Law, 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	10
UNIT-IV	**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,	10

Unit No.	Topics	Hours
	specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. methods for improvement of flow properties.	
UNIT-V	**Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, 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	**10**

Recommended References (Preferably latest editions):

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.

BP404T	PHARMACOLOGY-I (Theory)	45 Hours

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:

CO No.	Upon successful completion of this course, the students will be able to:
1	To define the fundamental concepts of pharmacology and pharmacokinetics.
2	To understand the basics of pharmacodynamics, adverse reactions, drug interactions and drug discovery
3	To identify the role of neurohumoral transmission and drugs acting on peripheral nervous system
4	To analyze the functions of neurotransmitters and drugs acting on central nervous system.
5	To appraise the pharmacology of Psychopharmacological agents
6	To predict the effects of drugs against neurodegenerative disorders and to elaborate the concepts of drug addiction/abuse/tolerance/ dependence.

Course Content:

Unit No.	Topics	Hours
UNIT-I	**General Pharmacology** **Introduction to Pharmacology** Definition, Historical landmarks and scope of pharmacology, Nature and source of drugs, Essential drugs concept and Routes of drug administration. **Drug discovery and clinical evaluation of new drugs** Introduction to drug discovery, Preclinical evaluation and Clinical trials. Introduction to Pharmacovigilance **Pharmacokinetics** Membrane transport, Absorption, Distribution, Metabolism and Excretion of drugs. Enzyme induction, Enzyme inhibition, Introduction to kinetics of elimination.	**6**
UNIT-II	**General Pharmacology** **Pharmacodynamics** Dose response relationship, Therapeutic index, Agonists, Antagonists (competitive and non-competitive), Combined effects of drugs. Factors modifying drug action Principles and mechanisms of drug action.	**12**

Unit No.	Topics	Hours
	Receptor theories and classification of receptors, regulation of receptors. Drug receptors interactions, Signal transduction mechanisms, G-protein–coupled receptors, Ion channel receptors. Introduction to transmembrane enzyme linked receptors, JAK-STAT binding receptors and receptors that regulate transcription factors, Spare receptors **Adverse drug reaction** Addiction, Tolerance, Dependence, Tachyphylaxis, Idiosyncrasy, Allergy (explain with suitable examples). **Drug interactions** Pharmacokinetic and pharmacodynamic drug interactions.	
UNIT-III	**Pharmacology of drugs acting on Peripheral Nervous System** Introduction to Autonomic Nervous System. Neurohumoral transmission in the A.N.S. Parasympathomimetics, Drugs used in myasthenia gravis, Parasympatholytics, Sympathomimetics and Sympatholytics. Drugs used in glaucoma Neuromuscular blocking agents and skeletal muscle relaxants (peripheral) Local anaesthetic agents.	**8**
UNIT-IV	**Pharmacology of drugs acting on central nervous system** Neurohumoral transmission in the C.N.S. Emphasize the importance of key neurotransmitters: GABA, glutamate, glycine, serotonin, and dopamine. General anaesthetics and pre-anaesthetics Sedatives, Hypnotics and Centrally acting muscle relaxants Anti-epileptics. Alcohol and Disulfiram	**10**
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)	**9**

Recommended References (Preferably latest editions):

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale‟s Pharmacology,. 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. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi.
10. Das, M. M. and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
11. Satoskar , R.S. and Bhandarkar S.D. Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).
12. Harrison‟s Principle and Practice of Medicine, 18th Edition, Churchill, Livingston, .London.
13. Roger and Walker. Clinical Pharmacy and Therapeutics, Churchill, Livingston, London.
14. Dipiro Joseph L. A pathphysiological Approach, Elsevier.
15. Davidson‟s Principle of Internal Medicine, McGraw-Hill companies.
16. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
17. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London

BP405T	Pharmacognosy & Phytochemistry - I	45 Hours

Scope:
The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, identification & 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 cultivation & production of crude drugs
2. To know the crude drugs, their uses and chemical nature
3. To know the evaluation techniques for the herbal drugs
4. To carry out microscopic & morphological evaluation of crude drugs

CO No.	Upon successful completion of this course, the students will be able to:
1	Evaluate the quality, purity, and authenticity of natural drugs utilizing morphological, microscopic, physicochemical, and biological assessment techniques.
2	Apply the principles of cultivation, genetics, and plant tissue culture methodologies for the sustainable production and conservation of medicinal plants.
3	Analyze the morphological and anatomical profiles of various plant organs to identify and differentiate their primary and secondary metabolites.
4	Correlate the biological sources, chemical characteristics, and processing methods of traditional Indian medicines, plant products, and marine drugs with their therapeutic and commercial utility.

Course Content:

Unit No.	Topics	Hours
Unit I	**Introduction to Pharmacognosy:** (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine, Tissue culture, Minerals, Metals and Microbes (two examples of each along with commercial applications) (C) Indian Knowledge System: Introduction to Indian Alternative Systems of Medicine (Ayurveda, Siddha, Unani, Sowa Rigpa) (d) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilage, oleoresins and oleo- gum - resins). **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs **Quality control of Drugs of Natural Origin:** • Detection of Adulteration of drugs of natural origin.	**10**

Unit No.	Topics	Hours
	• Evaluation by organoleptic, microscopic, physical (Ash values, extractive values, Swelling Index, Foaming Index & LOD) chemical and biological methods and properties. • Quantitative microscopy of crude drugs including leaf constants	
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. • Plant hormones and their applications. • Polyploidy, mutation and hybridization with reference to medicinal plants • Conservation of medicinal plants (*In-situ, ex-situ*) Introduction to Organic Farming	**10**
Unit - III	**Plant tissue culture:** • Types of cultures, Nutritional requirements, growth and their maintenance. • Applications of plant tissue culture in pharmacognosy. • Conservation of medicinal plants (micropropagation, Slow-growth storage, cryopreservation & encapsulation)	**7**
Unit - IV	**Plant description, morphology and anatomy:** Leaves, Barks, Wood, Flowers, Fruits, Seeds, Stems, subterranean organs (Roots & rhizomes) **Introduction to secondary metabolites:** Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins	**10**
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 w.r.t chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates**: Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes**: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratio-peptidase, urokinase, streptokinase, pepsin). **Lipids (Waxes, fats, fixed oils):** General methods of extraction of lipids.	**8**

Unit No.	Topics	Hours
	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 (Laminarin & Eledoisin) b) Anti cancer agents (Cytarabin & Bryostatin-I)	

Recommended References (Preferably latest editions) :

1. Evans, W.C., *Trease and Evans Pharmacognosy*. 16th ed. London: W.B. Saunders & Co., 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., *Pharmacognosy*. 9th ed. Philadelphia: Lea & Febiger,1988.
3. Wallis, T.E., *Textbook of Pharmacognosy*. London: J. & A. Churchill Ltd.
4. World Health Organization (2002) *WHO traditional medicine strategy 2002–2005*. Geneva: World Health Organization
5. World Health Organization (1998) *Quality control methods for medicinal plant materials*. Geneva: World Health Organization.
6. World Health Organization (2003) *WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants*. Geneva: World Health Organization.
7. Biren Shah. Textbook of Pharmacognosy and Phytochemistry. 1st ed.Published by Elsevier, India, 2010
8. Indian Pharmacopoeia. Published by The Controller of Publications, Under Govt. of India Ministry of health and Family Welfare, Delhi. 1996, Vol: II. pp. A104–A107.
9. Kokate C.K., Purohit A.P., Gokhale S.B. Text book of Pharmacognosy. Published by Nirali Prakashan. 2010.

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

Expt. No.	List of practical	Turns
1	**Synthesis of following medicinally important compounds / drug intermediates with Recrystallization of compound and monitoring reactions with TLC**	
	Preparation of drugs/ intermediates (any six) • 1,3-pyrazole • 1,3-oxazole • Benzimidazole • Benztriazole • 2,3- diphenyl quinoxaline • Benzocaine • Phenytoin • Phenothiazine • Barbiturate	**10**
2	Purification of above synthesized compounds by Column chromatography **(any one)**	**1 turns**
3	Determination of Partition coefficient and Ionization constants **(any two compounds)**	**4 turns**

Recommended References (Preferably latest editions):

1. John E. Hoover, Remington‟s Pharmaceutical Sciences, Mack Publishing Company; 13thedition (1965).
2. Sean C. Sweetman, Martindale‟s extra pharmacopoeia, Pharmaceutical Society of GreatBritain.
3. Organic Chemistry by I.L. Finar, Vol. II, Longmans Green & Co., 3rd E/d.
4. Daniel Lednicer, Lester A. Mitscher, The Organic Chemistry of Drug Synthesis, JohnWiley & Sons, Inc, Vol. 1-5.
5. Indian Pharmacopoeia.
6. Text book of practical organic chemistry- A.I.Vogel.
7. Medicinal Chemistry By Ashutosh Kar

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BP407P	PHYSICAL PHARMACEUTICS- II (Practical)	4 Hours/week

Course Content:

Expt. No.	List of practical
	Any 13 Experiments
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 and semisolid using Ostwald‟s viscometer
6	Determination of viscosity of liquid and semisolid using Brookfield viscometer
7	Determination of Rheological Behavior of Suspensions/Semisolids **(**Plastic/pseudoplastic/thixotropic flow studies
8	Determination sedimentation volume with effect of different suspending agent
9	Determination sedimentation volume with effect of different concentration of single suspending agent
10	Determination of reaction rate constant first order.
11	Determination of reaction rate constant second order
12	Accelerated stability studies
13	Determination of Cloud point and Krafft point of given surfactant.
14	Determination of effect of salts on stability of hydrophobics
15	Demonstration of measurement of particle size/zeta potential by using particle size analyzer

Recommended References (Preferably latest editions):

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.

BP408P	PHARMACOLOGY-I (Practical)	4 Hours/week

Scope: Experimental pharmacology deals with the study of drug effects using laboratory experiments on animals and tissues. It helps in understanding drug action, safety, toxicity, and therapeutic uses. It also plays an important role in drug discovery, development, and evaluation before clinical use, while following ethical guidelines (CPCSEA).

Objectives:

CO No.	Upon successful completion of this course, the students will be able to:
1	To learn about basic instruments, common laboratory animals used in experimental pharmacology and to organize animal house as per the CPCSEA guidelines.
2	To demonstrate the common laboratory techniques like routes of administration , blood withdrawal, anesthetics and euthanasia used for animal studies.
3	To interpret the effects of various drugs on rabbit eye and ciliary motility of frog oesophagus in correlation with humans
4	To analyse the effect of drugs acting as enzyme inducers, skeletal muscle relaxants and affecting locomotor activity in laboratory animal
5	To evaluate the stereotype and anticatatonic activity of drugs in rats/mice
6	To predict various screening models for anticonvulsant ,anxiolytic and local anaesthetics activity

Course Content:

Expt. No.	List of practical
1	Introduction to experimental pharmacology
2	Commonly used instruments in experimental pharmacology
3	Study of common laboratory animals and its possible use
4	Maintenance of laboratory animals as per CPCSEA guidelines.
5	Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics 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.

Expt. No.	List of practical
12	Anticonvulsant effect of drugs by MES 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 anaesthetics by different methods

Recommended Books (Latest Editions)

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
8. Suryawanshi HP.Md Usman Rageeb Pawar SP Practical Pharmacology-I S Vikas and Company
9. ExPharm software (https://heb-nic.in/Pharm/login.php)

BP409P	Pharmacognosy & Phytochemistry - I	4 Hours/week

Scope: The subject involves the fundamentals of Pharmacognosy like basic identification tests, evaluation of crude drugs by performing quality control tests as per WHO

Objectives: Upon completion of the course, the student shall be able
1. To understand the chemical tests required for identification of certain crude drugs
2. To know the parameters required for QC of crude drugs as per WHO guidelines
3. To understand the micrometry and its application in pharmacy
4. To detect adulterants present in crude drugs

CO No.	Upon successful completion of this course, the students will be able to:
1	Identify crude drugs and their specific phytoconstituents utilizing standard qualitative chemical tests.
2	Execute quantitative microscopic evaluations to measure cellular constants and dimensions, establishing the authenticity of plant tissues.
3	Detect the presence of adulterants in pharmaceutical aids and oils by applying physical and chemical evaluation methods.
4	Evaluate the purity, quality, and physical characteristics of natural drugs by determining their compendial physico-chemical constants.

Course Content:

Expt. No.	List of practical
1	Analysis of crude drugs by chem. tests: Acacia, Tragacanth, Agar, starch
2	Analysis of crude drugs by chem. tests: Honey, Gelatine, Castor oil
3	Determination of stomatal number and index
4	Determination of vein islet & vein termination number
5	Determination of palisade ratio
6	Determination of mean diameter of starch grains
7	Determination of length & width of fibres and calcium oxalate crystals
8	Detection of Adulteration in oil used as pharmaceutical aid: (Specific gravity, Refractive index, Holde's Test, Baudouin Test)
9	Determination of Ash values (Total Ash & Water soluble Ash)
10	Determination of Ash values (Total Ash & Acid Insoluble Ash)
11	Determination of Extractive values (Alcohol)
12	Determination of Extractive values (Water)
13	Determination of LOD of crude drugs
14	Determination of swelling index

Expt. No.	List of practical
15	Determination of foaming index

Recommended References (Preferably latest editions):

1. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. 2004. World Health Organization, Geneva
2. Indian Pharmacopoeia. Published by The Controller of Publications, Under Govt. of India Ministry of health and Family Welfare, Delhi. 1996, Vol: II. pp. A104–A107.
3. Kokate CK. Practical pharmacognosy. New Delhi: Vallabh Prakashan; 2005
4. Khandelwal KR. Practical pharmacognosy techniques and experiments. 19th ed. New Delhi: Nirali Prakashan; 2002.