PROGRAM STRUCTURE AND SYLLABUS
For
B. PHARMACY

[Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (B. Pharm) course regulations 2014]

(Applicable for batches admitted from 2023-2024)

ADITYA PHARMACY COLLEGE
(An Autonomous Institution)
Approved by PCI, Permanently Affiliated to JNTUK, Recognized by UGC (sections 2f)
ISO 9001: 2015 Certified Institution,
Accredited by NAAC with "A" Grade
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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. **Minimumqualification for admission**

2.1 First yearB. 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**

Mediumof instruction and examination shall be in English.

5. **Working days in each semester**

Each semestershall consist of not less than 100 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/Januaryto May/June in everycalendar 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 Projectover 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 scheduleof 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, atotal 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	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry– Theory	3	1	4
BP105T	Communication skills – Theory*	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology– Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry– Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology– Practical*	2	-	1
	Total	**32/34$/36#**	**4**	**27/29$/30#**

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

$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	Tutorial	Credit points
BP201T	Human Anatomy and PhysiologyII – Theory	3	1	4
BP202T	Pharmaceutical Organic ChemistryI – Theory	3	1	4
BP203T	Biochemistry– Theory	3	1	4
BP204T	Pathophysiology– Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory*	3	-	3
BP206T	Environmental sciences – Theory*	3	-	3
BP207P	Human Anatomy and PhysiologyII –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry– Practical	4	-	2
BP210P	Computer Applications in Pharmacy– Practical*	2	-	1
	Total	**32**	**4**	**29**

*****Non University Examination (NUE)

Table-III: Course of study for semester III

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	PhysicalPharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology– Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	PhysicalPharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology– Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	**28**	**4**	**24**

Table-IV: Course of study for semester IV

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal ChemistryI – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	PharmacologyI – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	PharmacologyI – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
	Total	**31**	**5**	**28**

Table-V: Course of study for semester V

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial Pharmacy I– Theory	3	1	4
BP503T	PharmacologyII – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial Pharmacy I – Practical	4	-	2
BP507P	PharmacologyII – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**

Table-VI: Course of study forsemester VI

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP601T	Medicinal ChemistryIII – Theory	3	1	4
BP602T	PharmacologyIII – Theory	3	1	4
BP603T	Herbal Drug Technology– Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology– Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinalchemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology– Practical	4	-	2
	Total	**30**	**6**	**30**

Table-VII: Course of study forsemester VII

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial Pharmacy II – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
	Total	**28**	**5**	**24**

***** Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course Code	Name of the course	No. of Hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semesterwise credits distribution

Semester	Credit Points
I	**27/29$/30#**
II	29
III	26
IV	28
V	26
VI	26
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**209/211$/212#**

* 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**.**

10. 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 Sessional exam (Internal Assessment) and before the end semester exam.

11. Examinations/Assessments

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

11.1. End semesterexaminations

The End Semester Examinations for each theory and practical course through semesters I to VIII shall be conducted 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 UniversityExamination (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	Physical Pharmaceutics I –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	Industrial Pharmacy I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	PharmacologyII – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	PharmacognosyII – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	IndustrialPharmacy I– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	PharmacologyII – 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 Standardization 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 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3	1.5
Student – Teacher interaction	3	1.5
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.

Question paper pattern for theory Sessional examinations

For subjects having University examination

I. Multiple Choice Questions (MCQs)	=	10 x 1 = 10
OR		OR
Objective Type Questions (5 x 2)	=	05 x 2 = 10
(Answer all the questions)		
I. Long Answers (Answer 1 out of 2)	=	1 x 10 = 10
II. 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 of2)	=	1 x 10 = 10
II. Short Answers (Answer 4 out of6)	=	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

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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 only once 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 semesterexaminations

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

Table-XIII: Tentative schedule of end semester examinations

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

Question paper pattern for end semester theory examinations

For 75 marks paper

I. Multiple Choice Questions(MCQs) = 20 x 1 = 20
OR OR
Objective Type Questions (10 x 2) = 10 x 2 = 20
(Answer all the questions)

II. Long Answers (Answer 2 out of 3) = 2 x 10 = 20

III. Short Answers (Answer 7 out of 9) = 7 x 5 = 35

Total = 75 marks

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 1 out of 2) = 1 x 10 =10

II. Short Answers (Answer 5 out of 7) = 5 x 5 = 25

Total = 35 marks

Question paperpattern forend semester practical examinations

I. Synopsis = 5

II. Experiments = 25

III. Viva voce = 5

Total = 35 marks

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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.

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 AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

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

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

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:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO} + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

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 status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

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:

Presentationof work		25 Marks
Communication skills		20 Marks
Questionand 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.

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 afterbreak 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

L	T	P	C
3	1	0	4

HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

Subject Code: BP101T
Course Objectives: Upon completion of the course, the student shall be able to
COB1: Explain the gross morphology, structure & functions of various organs of the human body.
COB2: Describe the various homeostatic mechanisms and their imbalances.
COB3: Identify the various tissues and organs of different systems of human body.
COB4: Perform the various experiments related to special senses and nervous system.
COB5: Appreciate coordinated working pattern of different organs of each system

Course Outcomes:

Course Outcome	Statement
CO1 (L2)	**Demonstrate** human body, Cellular level of organization, Tissue level of organization.
CO2 (L2)	**Explain** Integumentary system, Skeletal system & joints.
CO3 (L1)	**Describe** about Blood components.
CO4 (L2)	**Discuss** about the lymphatic system.
CO5 (L1)	**Describe** about Peripheral nervous system & Special senses.
CO6 (L1)	**Describe** about Cardiovascular system.

Course Content **45 Hours**

Unit I **10 hours**

- **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.
- **Cellular level of organization**
  Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact- dependent b) Paracrine c) Synaptic d) Endocrine
- **Tissue level of organization**
  Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10 hours**

- **Integumentary system**
  Structure and functions of skin
- **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.

- **Joints**
  Structural and functional classification, types of joints movements and its articulation

Unit III **10 hours**

- **Body fluids and blood**

  Body fluids, composition and functions of blood, haemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo-endothelial system.

- **Lymphatic system**

  Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Unit IV **08 hours**

- **Peripheral nervous system:**

  Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

  Origin and functions of spinal and cranial nerves.

- **Special senses**

  Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V **07 hours**

- **Cardiovascular system**

  Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

REFERENCES:

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 ofAnatomy and Physiology byTortora 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. Sri Nageswari and Rajeev Sharma, Jaypee brothers' medical publishers, New Delhi.

Reference Books (Latest Editions)

1) Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

2) Text book ofMedicalPhysiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.

3) HumanPhysiology (vol1 and 2) byDr. C.C. Chatterrje, Academic Publishers Kolkata

L	T	P	C
0	0	4	2

HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

Subject Code: BP107P

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

COB1: Explain the gross morphology, structure and functions of various organs ofthe human body.

COB2: Describe the various homeostatic mechanisms and their imbalances.

COB3: Identify the various tissues and organs of different systems of human body.

COB4: Perform the various experiments related to special senses and nervous system.

COB5: Appreciate coordinated working pattern of different organs of each system

Course Outcomes:

Course Outcomes	Statement
CO1 (L2)	**Demonstration** about microscope.
CO2 (L2)	**Demonstration** about tissues and bones.
CO3 (L2)	**Demonstration** about hemocytometry.
CO4 (L3)	**Calculation** ofWBC, RBC Count.
CO5 (L3)	**Determination** of bleeding time, clotting time, Hemoglobin content, ESR.
CO6 (L5)	**Assess** ofheart rate, pulse rate and B.P.

Course Content **4Hours/week**

List of Experiments:

Expt. No	Title	CO
1.	Study of compound microscope.	**CO1**
2.	Microscopic study of epithelial and connective tissue	**CO1**
3.	Microscopic study of muscular and nervous tissue	**CO1**
4.	Identification of axial bones	**CO2**
5.	Identification of appendicular bones	**CO2**
6.	Introduction to hemocytometry.	**CO3**
7.	Enumeration of white blood cell(WBC) count	**CO4**
8.	Enumeration of total red blood corpuscles (RBC) count	**CO4**
9.	Determination of bleeding time	**CO5**
10.	Determination of clotting time	**CO5**
11.	Estimation of hemoglobin content	**CO5**
12	Determination of blood group	**CO5**
13.	Determination of erythrocyte sedimentation rate (ESR).	**CO5**
14	Determination of heart rate and pulse rate.	**CO6**
15	Recording of blood pressure	**CO6**

References:

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 ofAnatomy and Physiology byTortora 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. Sri Nageswari and Rajeev Sharma, Jaypee brothers' medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text bookofMedicalPhysiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. HumanPhysiology(vol1 and 2) byDr. C.C. Chatterrje, Academic Publishers Kolkata

L	T	P	C
3	1	0	4

PHARMACEUTICAL ANALYSIS (Theory)

Subject code: BP102T

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

COB1: Understand the principles of volumetric and electro chemical analysis

COB2: Carryout various volumetric and electrochemical titrations

COB3: Develop analytical skills

Course outcomes

Course outcome	Statement
CO1 **[L1]**	**Describe** different techniques of analysis, Errors, Sources, errors, minimizing errors, accuracy, precision. Sources of impurities & limit tests.
CO2**[L2]**	**Explain** Acid base titration, Non aqueous, Karl fisher titration
CO3**[L3]**	**Determine** about Precipitation & Complexometric titration, gravimetric analysis, diazotisation titration.
CO4**[L6]**	**Assemble** the procedure for gravimetric analysis
CO5**[L5]**	**Recommend** the Redoxtitrations Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate
CO6**[L4]**	**Classify** the Electrochemical methods of analysis, Conductometric titrations, Potentiometry, Polarography.

Course Content **45 Hours**

UNIT-I **10 Hours**

(a) **Pharmaceutical analysis**- Definition and scope

i) Different techniques ofanalysis

ii) Methods ofexpressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b) **Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

UNIT-II **10 Hours**

- **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.
- **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.
- Determination of moisture content byKarl fisher titration.

UNIT-III **10 Hours**

- **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
- **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calciumgluconate.
- **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.
- Basic Principles, methods and application of diazotization titration.

UNIT-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types ofredox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V **07 Hours**

Electrochemical methods of analysis

- **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications.
- **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.
- **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

References:

1. Pharmaceutical drug Analysis, Ashutosh Kar, Revised 2nd Edition, New Age International Publishers

2. Instrumental Methods Of Chemical Analysis,5th Edition, Gurudeep R Chatwal, Sham K Anand, Himalaya Publishing House

3. Introductionto Instrumental Analysis, Robert D.Braun, PharmaMed Press, 2010

4. Instrumental methods ofchemical analysis, B.K.Sharma, GOEL Publishing House

5. Vogel's textbook of quantitative chemical analysis, 6th Edition, Pearson Education, India

6. Pharmaceutical Titrimetric Analysis, A.A Napoleon, Kalaimani Publishers & Distributors,2013.

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PHARMACEUTICAL ANALYSIS (Practical)

Subject code: BP108P

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

COB1: Understand the principles of volumetric and electro chemical analysis

COB2: Carryout various volumetric and electrochemical titrations

COB3: Develop analytical skills

Course outcomes:

Course Outcome	Statement
CO1(L1)	**Identify** the unknown impurities in the sample by performing the Limit Tests of Chlorides, Sulphates, Iron, Arsenic
CO2(L2)	**Demonstrate** the preparation and standardization of Sodium hydroxide, Sulphuric acid, Sodium thiosulfate, Potassium permanganate, Ceric ammonium Sulphate
CO3(L4)	**Analyse** unknown samples by Acid- Base titrations
CO4(L5)	**Analyse** unknownsamples by Cerimetry, Iodometry, complexometric titrations.
CO5(L4)	**Analyze** the concepts of Permangometry, non-aqueoustitration, precipitation, back titrations.
CO6(L3)	**Determination** of Normality by electro-analytical methods

Course Content **4 Hours / Week**

Listof Experiments:

Expt. No	Title	CO
1.	Limit test for Chlorides	**CO1**
2.	Limit test for Sulphates	**CO1**
3.	Limit test for Iron	**CO1**
4.	Limit test for Arsenic	**CO1**
5.	Preparation and standardization of Sodium hydroxide	**CO2**
6.	Preparation and standardization of Sulphuric acid	**CO2**
7.	Preparation and standardization of Sodium thiosulfate	**CO2**
8.	Preparation and standardization of Potassium permanganate	**CO2**
9.	Preparation and standardization of Ceric ammonium sulphate	**CO2**
10.	Assay of Ammonium chloride by acid base titration	**CO3**
11.	Assay of Ferrous sulphate by Cerimetry	**CO4**
12.	Assay of Copper sulphate by Iodometry	**CO4**
13.	Assayof Calcium gluconate by complexometry	**CO4**
14.	Assay of Hydrogen peroxide by Permanganometry	**CO5**
15.	Assay of Sodium benzoate by non-aqueous titration	**CO5**
16.	Assay of Sodium Chloride by precipitation titration	**CO5**
17.	Assay of Zinc oxide by back titration	**CO5**
18.	Conductometric titration ofstrong acid against strong base	**CO6**
19.	Conductometric titration ofstrong acid and weak acid against strong base	**CO6**
20.	Potentiometric titration ofstrong acid against strong base	**CO6**

References:

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

L	T	P	C
3	1	0	4

PHARMACEUTICS –I (Theory)

Subject Code: BP103T

Course objectives: Upon completion ofthis course the student should be able to:

COB1: Know the history of profession of pharmacy

COB2: Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations

COB3: Understand the professional way of handling the prescription

COB4: Preparation of various conventional dosage forms

COURSE OUTCOMES:

Course Outcome	Statement
CO1 [L1]	**Enumerate** the history of profession of pharmacy, different dosage forms , professional way of handling the prescription
CO2 [L3]	**Compute** dose calculation for paediatrics based on different factors
CO3 [L2]	**Explain** the basics of pharmaceutical calculations , excipients used indifferent dosage forms and solubility enhancing techniques
CO4 [L2]	**Illustration** of various conventional dosage forms and their stability studies
CO5 [L6]	**Design** the Preparation ofsemisolid dosage forms for body cavity, evaluations and pharmaceutical incompatibilities.
CO6 [L5]	**Assess** the dermal penetration mechanisms of drugs, excipients used in semisolids, various factors effecting drug absorption their preparation methods and evaluation studies .

Course Content **45 Hours**

UNIT-I **10 Hours**

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, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introductionto dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription.

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area

UNIT-II **10 Hours**

Pharmaceutical calculations: Weights and measures – Imperial & Metric system,

Calculations involving percentage solutions, alligation, 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

.

UNIT-III **10 Hours**

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT-IV **08 Hours**

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.

UNIT-V **07 Hours**

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

References:

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. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York
11. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

L	T	P	C
0	0	4	2

PHARMACEUTICS-I (Practical)

SUBJECT CODE: BP109P

Course Objectives: Uponcompletion ofthis course the student should be able to:

COB1: Understand the basics of different dosage forms, various pharmaceutical calculations

COB2: Understand the professional way of handling the prescription

COB3: Preparation of various conventional dosage forms

COURSE OUTCOMES:

Course outcome	Course Outcomes
CO1 [L2]	**Explains** the preparation of monophasic liquid dosage forms for internaluse
CO2 [L1]	**Describe** the preparation of monophasic liquid dosage forms for externaluse
CO3 [L5]	**Evaluate** the preparation of Biphasic liquid dosage forms for internal & external use
CO4 [L6]	**Set up** the preparation and dispensing methods for solid dosage forms like various powders
CO5 [L6]	**Formulate** the preparation ofeffervescent powders
CO6 [L3]	**Experiment** the various semisolid dosage forms (ointments, creams, gels, suppositories)

Course Content **3 Hours / Week**

List of Experiments:

Expt. No	Title	CO
1	**Syrups** : a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68	CO1
2	**Elixirs :** a) Piperazine citrate elixir b) Paracetamol pediatric elixir	CO1
3	**Linctus :** a) Terpin Hydrate Linctus IP'66 b) Iodine Throat Paint (Mandles Paint)	CO 1 &CO 2
4	**Solutions :**a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugols solution	CO1&CO2
5	**Suspensions** : a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminimum Hydroxide gel	CO2&CO3
6	**Emulsions** : a) Turpentine Liniment b) Liquid paraffin emulsion	CO2&CO3
7	**Powders and Granules** : a) ORS powder (WHO) b) Effervescent granules c)Dusting powder d) Divded Powders	CO4&CO5
8	**Suppositories** : a) Glycero gelatin suppository b) Coca butter suppository c) Zinc Oxide suppository	CO6

9	**Semisolids** : a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopal gel	**CO6**
10	**Gargles and Mouthwashes** : a) Iodine gargle b) Chlorhexidine mouthwash	**CO2**

REFERENCES:

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. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York

L	T	P	C
3	1	0	4

PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

Course code: BP104T
Course Objectives: Upon completion ofcourse, student shall be able to
COB1: Know the sources of impurities
COB2: Know the methods to determine the impurities in Inorganic drugs and pharmaceuticals
COB3: Understand the medicinal and pharmaceutical importance of inorganic compounds

Course outcome	Statement
CO1[L1]	Discuss the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
CO2[L1]	Define Major extra and intracellular electrolytes: Functions of major physiological ions.
CO3[L2]	Summarize the concept of buffers and Functions of major physiological ions.
CO4[L4]	Classify the gastrointestinal agents, cathartics and anti-microbial agents.
CO5[L4]	Characterize - Expectorants, Emetics, Poison and Antidote and Astringents.
CO6[L2]	Explain the Radio activity, Measurement of radioactivity, Storage conditions, precautions & pharmaceutical application of radioactive substances.

Course Content **45 Hours**

UNIT I **10 HOURS**

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources 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

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 **10 HOURS**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

- **Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes 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 **10 HOURS**

- **Gastrointestinal agents**

Acidifiers: Ammoniumchloride* and Dil. HCl

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 **08 HOURS**

Miscellaneous compounds

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodiumnitrite333

Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 HOURS**

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.

REFERENCES:

- A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical ChemistryVol I & II,Stahlone Press of University of London, 4th edition.
- A.I. Vogel, Text BookofQuantitative Inorganic analysis
- P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
- M.L Schroff, Inorganic Pharmaceutical Chemistry
- Bentleyand Driver's Textbook of Pharmaceutical Chemistry
- Anand & Chatwal, Inorganic Pharmaceutical Chemistry
- Indian Pharmacopoeia

L	T	P	C
0	0	4	2

PHARMACEUTICAL INORGANIC CHEMISTRY-(Practical)

Course code: BP110P
Course Objectives: Upon completion ofcourse, student shall be able to
COB1: Know the sources of impurities
COB2: Know the methods to determine the impurities in Inorganic drugs and pharmaceuticals
COB3: Understand the medicinal and pharmaceutical importance of inorganic compounds

Course outcomes:

Course outcome	Statement
CO1[L3]	**Determine** the sources of impurities and methods to determine the impurities in inorganic formulations.
CO2[L5]	**Justify** the medicinal and pharmaceutical importance of inorganic compounds, drugs and pharmaceuticals
CO3[L2]	**Differentiate** physiological ions.
CO4[L4]	**Categorize** inorganic pharmaceuticals as gastrointestinal agents
CO5[L2]	**Explain** the importance of inorganics as a antidotes
CO6[L5]	**Support** the importance of radiopharmaceuticals in medicines.

Course Content **4 Hours / Week**

List of Experiments:

Expt. No	Title	CO
1	Limit test for Chlorides and Sulphates	**CO1**
2	Limit test for Iron	**CO1**
3	Limit test for Heavy metals	**CO1**
4	Limit test for Lead	**CO1**
5	Limit test for Arsenic	**CO1**
6	Modified limit test for Chlorides and Sulphates	**CO2**
7	Identification tests for Magnesium hydroxide	**CO2**
8	Identification tests for Ferrous sulphate	**CO2**
9	Identification tests for Sodium bicarbonate	**CO2**
10	Identification tests for Calcium gluconate	**CO2**
11	Identification tests for Copper sulphate	**CO2**
12	Swelling power of Bentonite	**CO3**
13	Neutralizing capacityofaluminium hydroxide gel	**CO4**
14	Determination ofpotassium iodate and iodine in potassium Iodide	**CO5**
15	Preparation of inorganic pharmaceuticals Boric acid	**CO6**
16	Preparation of Potash alum	**CO6**
17	Preparation of Ferrous sulphate	**CO6**

References:

- A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II,Stahlone Press of University of London, 4th edition.
- A.I. Vogel, Text BookofQuantitative Inorganic analysis
- P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition

- M.L Schroff, Inorganic Pharmaceutical Chemistry
- Bentleyand Driver's Textbook of Pharmaceutical Chemistry
- Anand & Chatwal, Inorganic Pharmaceutical Chemistry
- Indian Pharmacopoeia

L	T	P	C
2	0	0	2

COMMUNICATION SKILLS (Theory)

Subject Code: BP105T

Course Objective: Upon completion ofthe course the student shall be able to

COB1: Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation

COB2: Communicate effectively (Verbal and Non-Verbal) COB3: Effectively manage the team as a team player COB4: Develop interview skills

COB3: Develop Leadership qualities and essentials

Course Outcomes:

Course Outcome	Statement
CO1(L6)	Make use of the concepts to communicate confidently and competently in English Language in all spheres.
CO2(L5)	Evaluate Make effective use of non-verbal communication in all situations and contexts to enhance effective communication in all aspects.
CO3(L6)	Use listening skills to create more effective, productive professional and personalrelationships.
CO4 (L2)	Illustrate the importance of interview skills for personaland professional growth.
CO5(L6)	Make design use ofeffective delivery strategies for giving oral presentations.
CO6(L2)	Understand the keyskills and behavior required to facilitate a group discussion.

Course content: **30HRS**

UNIT – I **07 Hours**

- **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers
- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II **07 Hours**

- **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication
- **Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT – III **07 Hours**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations

- **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication

- **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

- **Interview Skills:** Purpose ofan interview, Do's and Dont's ofan interview

- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V **04 Hours**

- **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

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COMMUNICATION SKILLS (Practical)

SUBJECT CODE: BP111P

Course Objectives: Upon completion ofthe course the student shall be able to

COB1: Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation

COB2: Communicate effectively (Verbal and Non-Verbal) **COB3:** Effectively manage the team as a team player

COB4: Develop interview skills

COB5: Develop Leadership qualities and essentials

Course Outcomes:

Course outcomes	Statement
CO1 (L2)	Demonstrate Basic communication covering the topics like Meeting People Asking Questions
CO2 (L2)	Demonstrate Basic communication covering the topics like Making Friends
CO3 (L1)	Write about What did you do? Do's and Don'ts
CO4 (L2)	Explain nouns, Pronunciations like Consonant and vowel Sounds Describe Listening Comprehension / Direct and Indirect Speech and Figures of Speech
CO5 (L2)	Demonstrate Effective Communication Writing Skills Effective Writing
CO6 (L6)	Develop Interview Handling Skills E-Mail etiquette Presentation Skills

Course Content **2 Hours / Week**

List of Experiments:

Expt. No	Title	CO
1.	Demonstrate Basic communication covering the topics like Meeting People, and Asking Questions	**CO1**
2.	Demonstrate Basic communication covering the topics like Making Friends	**CO2**
3.	What did you do? Do's and Dont's	**CO3**
4.	Explain nouns, Pronunciations like Consonant and vowel Sounds, Describe Listening Comprehension / Direct and Indirect Speech and Figures of Speech	**CO4**
5.	Demonstrate Effective Communication, Writing Skills, Effective Writing	**CO5**
6.	Develop Interview Handling Skills, E-Mail etiquette, Presentation Skills	**CO6**

References:

1. Basic communicat ion skills for Techno logy, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communicat ion skills, Sanjay Kumar, Pushpalata, 1stEdit ion, Oxford Press, 2011
3. Organizat ional Behaviour, Stephen.P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communicat ion skills, Gill Hasson, 1stEdition, Pearson Life, 2011

5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edit ion, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communicat ion skills for professionals, Konar nira, 2nd Edit ion, New arrivals – PHI, 2011
8. Personalit ydevelopment and soft skills, Barun K Mitra, 1st Edit ion, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. So ft skills and professio nal communicat ion, Francis Peters SJ, 1st Edit ion, Mc Graw Hill Education, 2011
11. Effect ive communicat ion, John Adair, 4th Edit ion, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill, 1999

L	T	P	C
2	0	0	2

REMEDIAL BIOLOGY (Theory)

SUBJECT CODE: BP106RBT

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

COB1: Know the classification and salient features of five kingdoms of life.

COB2: Understand the basic components of anatomy & physiologyof plant.

COB3: Know understand the basic components of anatomy & physiology animal with special reference to human.

Course outcomes:

Course outcome	Statement
CO 1[L2]	**Demonstrate** about Cell biology(Basic Natureof Plant cell and Animalcell)
CO 2[L4]	**Classification** Systemof both Plants & Animals
CO3[L3]	**Determine** about various tissue systemand organ system in plant and animals
CO4 [L2]	**Explain** about theoryof evolution
CO 5[L5]	**Assess t**he Inflorescence and Pollination of flowers
CO 6[L1]	**Describe** about Anatomyand Physiology ofplants and animals

Course content: **30 HOURS**

UNIT I **07 Hours**

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, Morphology of Flowering plants
- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomyof Root, stem, leaf of monocotyledons & Dicotylidones.

UNIT II **07 Hours**

Body fluids and circulation :

- Composition ofblood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structureofhuman heart and blood vessels
- Cardiac cycle, cardiac output and ECG Digestion and Absorption
- Human alimentarycanal and digestive glands
- Role ofdigestive enzymes
- Digestion, absorption and assimilation ofdigested food Breathing and respiration
- Human respiratorysystem
- Mechanism ofbreathing and its regulation
- Exchange of gases, transport ofgases and regulation of respiration
- Respiratoryvolumes

UNIT III **07 Hours**

Excretory products and their elimination:

- Modes ofexcretion
- Human excretorysystem- structure and function
- Urine formation
- Rennin angiotensin system Neural controland coordination
- Definition and classification of nervous system
- Structure of a neuron
- Generation and conduction of nerve impulse
- Structure ofbrain and spinal cord
- Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation
- Endocrine glands and their secretions
- Functions of hormones secreted byendocrine glands Human reproduction
- Partsof female reproductive system
- Partsof male reproductive system
- Spermatogenesis and Oogenesis
- Menstrualcycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

- Essential mineral, macro and micronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation.

Photosynthesis

- Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNIT V **04 Hours**

Plant Respiration: glycolysis, fermentation (anaerobic). 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 ofcell and cell organelles. Cell division Tissues
- Definition, types of tissues, location and functions.

References:

1. Text book of Biology by S. B. Gokhale
2. AText book of Biology by Dr. Thulajappa and Dr. Seetaram
3. A Text book of Biology by B.V. Sreenivasa Naidu
4. A Text book of Biologyby Naidu and Murthy

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0	0	2	1

REMEDIAL BIOLOGY (Practical)

SUBJECT CODE: BP112RBP

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

COB1: Know the classification and salient features of five kingdoms of life.

COB2: Understand the basic components of anatomy & physiologyof plant.

COB3: Know understand the basic components of anatomy & physiologyanimal with special reference to human.

Course outcomes:

Course Outcome	Statement
CO 1[L2]	**Demonstrate** about a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation.
CO 2[L4]	**Analyse** celland its inclusions
CO3[L6]	**Set up** Detailed study of frog by using computer models
CO4 [L3]	**Operate** Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flowers
CO 5[L1]	**Identify** bones
CO 6[L3]	**Determination of** blood group, blood pressure, tidal volume

Course Content **2 Hours / Week**

LIST OF EXPERIMENTS:

EXP NO	TITLE	CO
1.	Introduction to experiments in biology, a) Studyof Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation.	**CO1**
2.	Study of cell and its inclusions	**CO2**
3.	Study ofStem, Root, Leaf, seed, fruit, flower and their modifications	**CO2**
4.	Detailed studyof frog by using computer models	**CO3**
5.	Microscopic studyand identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flowers	**CO4**
6.	Identification of bones	**CO5**
7.	Determination of blood group	**CO6**
8.	Determination ofblood pressure	**CO6**
9.	Determination oftidal volume	**CO6**

REFERENCES

1. Practical human anatomyand 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

L	T	P	C
2	0	0	2

Remedial Mathematics (Theory)

Subject Code:
BP106RMT

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

COB1: Know the theory and their application in Pharmacy

COB2: Solve the different types ofproblems by applying theory

COB3: Appreciatethe important applicationofmathematics in Pharmacy

Course Outcomes:

Course Outcome	Statement
CO1 (L3)	**Apply** the fractions, logarithms, functions.
CO2 (L3)	**Determine** the regarding matrices and determinants.
CO3 (L3)	**Solve** about calculus and differentiation.
CO4 (L3)	**Solve** the analyticalgeometry, straight line and integration.
CO5 (L6)	**Integrate** the differentialequations.
CO6(L5)	**Explain** the definition, properties of Laplace transform.

Course content: **30 Hours**

UNIT – I **06 Hours**

- **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
- **Logarithms**
  Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.
- **Function***:*
  RealValued function, Classification ofreal valued functions,
- **Limits and continuity** :
  Introduction , Limit ofa function, Definition of limit ofa function ($\in$ - δ definition),

$$\lim_{x\to}\frac{-a}{-a} = n.a^{n-1}, \lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1$$

UNIT –II **06 Hours**

- **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, Applicationof Matrices in solving Pharmacokinetic equations

UNIT – III **06 Hours**

- **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 x^n *w.r.t* x, where n is any rational number, Derivative of e^x , Derivative of $\log_e x$, Derivative of a^x, Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions to be a maximum or minimum at a point.

UNIT – IV **06 Hours**

- **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

Integration:

Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT-V **06 Hours**

- **Differential Equations** : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**
- **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**

REFERENCES:

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

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3	1	0	4

HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

SUBJECT CODE: **BP201T**

COURSE OBJECTIVE: Upon completion of the subject student shall be able to

COB1: Explain the gross morphology, structure and functions of various organs of the human body.

COB2: Describe the various homeostatic mechanisms and their imbalances.

COB3: Identify the various tissues and organs ofdifferent systems ofhuman body.

COB4: Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc., and also record blood pressure, heart rate, pulse and respiratory volume.

COB5: Appreciate coordinated working patternofdifferent organs of each system

COB6: Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of Human body.

Course outcomes:

Course outcome	Statement
CO1 (L2)	**Demonstrate** about Nervous systemand its functions in detail
CO2 (L2)	**Explain** about digestive systemand energetic in the human body
CO3 (L2)	**Explain** about respiratorysystem its role in the human body
CO4 (L1)	**Describe** about urinarysystemand its functions in the human body
CO5 (L1)	**Describe** about endocrine system its role in the human body
CO6 (L2)	**Explain** about reproductive system and genetics and their significance in the human Body

COURSE CONTENT: **45 Hours**

Unit I **10 hours**

- **Nervous system**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Unit II **06 hours**

- **Digestive system**

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- Energetics Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 hours**

- **Respiratory system**

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

- **Urinary system**

Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit IV **10 hours**

- **Endocrine system**

Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Unit V **09 hours**

- **Reproductive system** Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

- Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance.

References:

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.

2. Anatomyand 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 56 4. Text book of Medical Physiology- Arthur C,Guyton and John.E. Hall. Miamisburg, OH, U.S.A.

4. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

5. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.

6. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medicalpublishers, New Delhi.

7. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA

8. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata

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HUMAN ANATOMY & PHYSIOLOGY-II (Practical)

Subject Code: BP207P

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

COB1: Explain the gross morphology, structure and functions of various organs of human body

COB2: Describe the various homeostatic mechanisms and their imbalances.

COB3: Identify the various tissues and organs ofdifferent systems of human Body.

COB4: Perform the hematologicaltests like blood cellcounts, haemoglobin estimation, bleeding / clotting time etc and also record blood pressure, heart rate, pulse and respiratory;

COB5: Appreciate coordinated working patternof different organs ofeach system

COB6: Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human.

Course Outcomes:

Course Outcome	Statement
CO1(L2)	Demonstration about integumentarysystem, nervous system, endocrine systemand cranial nerves.
CO2(L4)	Analyse different types of taste, visualactivity**.**
CO3(L3)	Determination ofreflex activity, body temperature and feedback mechanism.
CO4(L3)	Determination oftidal and vital capacity, BMI.
CO5(L2)	Demonstration on familyplanning and pregnancy diagnosis.
CO6(L2)	Analyse organ slides observation, total blood count bycell analyser. ANALYSE indifferent dosage forms.

COURSE CONTENT: **4 HRS/WEEK**

LIST OF EXPERIMENTS:

S.NO	LIST OF EXPERIMENTS	CO
1	To study the integumentaryand special senses using specimen, models, etc.,	CO1
2	To study the nervous systemusing specimen, models, etc.,	CO1
3	To study the endocrine systemusing specimen, models, etc	CO1
4	To demonstratethe general neurological examination	CO1
5	To demonstrate the function ofolfactory nerve	CO2
6	To examine the different types oftaste.	CO2
7	To demonstrate the visual acuity	CO2
8	To demonstratethe reflex activity	CO3
9	Recording of body temperature	CO3
10	To demonstrate positive and negative feedback mechanism.	CO3
11	Determination of tidal volume and vital capacity	
12	Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.	CO4

13	Recording of basal mass index	**CO4**
14	Study of familyplanning devices and pregnancy diagnosis test.	**CO5**
15	Demonstration oftotal blood count bycell analyser	**CO6**
16	Permanent slides of vital organs and gonads.	**CO6**

REFERENCES:

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomyand 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 Anatomyand Physiology by Tortora Grabowski. Palmetto, GA, U.S.A
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. TextbookofPractical Physiology byC.L. Ghai, Jaypee brothers medicalpublishers, 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 bookofMedical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
11. Human Physiology (vol 1 and 2) byDr. C.C. Chatterrje ,Academic Publishers Kolkata.

L	T	P	C
3	1	0	3

PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

SUBJECT CODE: BP202T

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

COB1: write the structure, name and the type of isomerismofthe organic compound

COB2: write the reaction, name the reaction and orientation of reactions

COB3: account for reactivity/stability of compounds,

COB4: Identify/confirm the identification oforganic compound

Course Outcomes:

Course Outcomes	Statement
CO1 [L4]	**Understand** & **classify** the of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds.
CO2 [L1]	**Describe** Hybridization, Halogenation, E1 and E2 reactions, Markownikoff's orientation, free Anti Markownikoff's orientation.
CO3 [L5]	**Justify** the Stabilityof conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement
CO4 [L2]	**Understand** 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
CO5 [L3]	**Summarize** Alcohols Qualitative tests, Structure and uses of mentioned compounds
CO6 [L6]	**Prepare** Carboxylic acids, Aliphatic amines & understand the acidity of carboxylic acids, Aliphatic amines

Course Content: **45 Hours**

UNIT-I **07 Hours**

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 isomerisms in organic compounds

UNIT-II **10 Hours**

Alkanes*, Alkenes* and Conjugated dienes* SP3 hybridization in alkanes, Halogenation of alkanes, uses ofparaffins. Stabilities ofalkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order ofreactivityofalkyl 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. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III **10 Hours**

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 ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. • Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV **10 Hours**

Carbonyl compounds* (Aldehydes and ketones) Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

UNIT-V **08 Hours**

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

Aliphatic amines* - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

REFERENCES:

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

L	T	P	C
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PHARMACEUTICAL ORGANIC CHEMISTRY –I (Practical)

SUBJECT CODE: BP208P

Course Objectives: Upon completion ofthe course the student shall be able to

COB1: Concepts and the mechanisms for the synthetic tools in generating newer products can be correlated with novel drug design and development in future.

COB2: The mode of quality control procedures and applications of numerous organic compounds

COB3: The practical knowledge from the laboratory preparation of organic molecules and their qualitative organic analysis.

Course Outcomes:

Course Outcomes	Statement
CO1 [L5]	**Assess** Laboratory techniques
CO2[L2]	**Demonstrate** Purification techniques
CO3 [L3]	**Determine** melting & boiling points
CO4 [L1]	**Identify** /Confirm the unknown organic compounds by using systematic qualitative analysis.
CO5 [L4]	**Analyse** the Preparation of suitable solid derivatives from organic Compounds
CO6[L6]	**Construction** of molecular models

COURSE CONTENT **4hours/week**

List of experiments:

Expt. No	Title	CO
1.	Basic Laboratoryrules & Techniques	CO1
2.	Determination of Meling point	CO2
3.	Determination of Boiling point	CO2
4.	Purification techniques	CO3
5.	Qualitative analysis for organic sample-1	CO4
6.	Qualitative analysis for organic sample-2	CO4
7.	Qualitative analysis for organic sample-3	CO4
8.	Qualitative analysis for organic sample-4	CO4
9.	Qualitative analysis for organic sample-5	CO4
10.	Qualitative analysis for organic sample-6	CO4
11.	Qualitative analysis for organic sample-7	CO4
12.	Preparation of Acetanilide	CO5
13.	Preparation of Benzoic acid from Benzaldehyde	CO5

14.	Preparation of Picric Acid	CO5
15.	Preparation of m-dinitrobenzene	CO5
16.	Preparation of Benzyl alcohol from Benzaldehyde	CO5
17.	Preparation of Dibenzal acetone from Benzaldehyde	CO5
18.	Construction of Molecular models	CO6

REFERENCES:

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.

L	T	P	C
3	1	0	4

BIOCHEMISTRY (Theory)

SUBJECT CODE: BP203T

Course Objectives: Upon completion ofcourse student shell able to

COB1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.

COB2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.

COB3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Course Outcomes:

Course Outcomes	Statement
CO1 [L1]	**Describe** catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases.
CO2 [L2]	**Explain** the metabolic process of bi-omolecules in health and illness (metabolic disorders)
CO3 [L3]	**Determine** genetic organization of mammalian genome
CO4 [L4]	**Classify** protein synthesis: replication: mutation and repair mechanism
CO5 [L5]	**Conclude** biochemical principles oforgan function tests of kidney, liver and endocrine gland
CO6 [L6]	**Develop** qualitative analysis and determination of bio-molecules in the body fluids.

Course Content: **45 Hours**

UNIT I **08 Hours**

Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. • Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNIT II **10 Hours**

Carbohydrate metabolism Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus • Biological oxidation: Electron transport chain (ETC) and it's mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation. Inhibitors ETC and oxidative phosphorylation/Uncouplers.

UNIT III **10 Hours**

- Lipid metabolism β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

- Amino acid metabolism General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV **10 Hours**

Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **07 Hours**

• Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions

REFERENCES:

1. Principles of Biochemistryby Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbookof Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf

L	T	P	C
0	0	4	2

BIOCHEMISTRY (Practical)

SUBJECT CODE: BP209P

Course objectives: Upon completion ofcourse student shell able to

COB1: Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.

COB2: Understand the metabolism of nutrient molecules in physiologicaland pathological conditions.

COB3: Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

COB4: know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and exocrine gland.

COB5: Perform the qualitative analysis and determination of biomolecules in the body fluids

COURSE OUT COMES:

Course Outcome	Statement
CO1[L3]	**Determine** the Qualitative analysis of normal and abnormal constituents of urine.
CO2[L4]	**Categories** the urine creatinine by Jaffe's method and calcium by precipitation method.
CO3[L5]	**Assess** the blood sugar byFolin-Wu tube method.
CO4[L1]	**Identify** SGOT and SGPT in serum.
CO5[L4]	**Analyze** Urea, Proteins and serumbilirubin
CO6[L5]	**Predict** sodium, calciumand potassium in serum.

COURSE CONTENT **4 Hours/Week**

List of Experiments

Expt. No	Title	CO
1.	Qualitative analysis of normal constituents ofurine.	**CO1**
2	Qualitative analysis ofabnormal constituents of urine.	**CO1**
3	Quantitative estimation of blood sugar Folin-Wu tube method.	**CO2**
4	Determination ofcalcium in urine.	**CO2**
5	Quantitative estimation ofurine creatinine	**CO2**
6	Quantitative estimation ofurine sugar byBenedict's reagent method	**CO4**
7	Quantitative estimation ofblood creatinine.	**CO3**
8	Estimation ofSGOT in serum.	**CO3**

9	Preparation of Folin Wu filtrate from blood	**CO5**
10	Estimation of SGPT in serum	**CO6**
11	Estimation of Urea in Serum.	**CO2**
12	Estimation of Proteins in Serum.	**CO1**
13	Determination of serum bilirubin	**CO1**
14	Quantitative estimation of urine chlorides by Volhard's method.	**CO2**
15	Quantitative estimation of serum cholesterol by Libermann Burchard's method	**CO3**
16	Determination of Glucose by means of Glucose oxidase.	**CO2**
17	Quantitative estimation of urine calcium by precipitation method.	**CO1**
18	Enzymatic hydrolysis of Glycogen/Starch by Amylases.	**CO1**

REFERENCES:

1. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
2. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
3. Practical Biochemistry for Medical students by Rajagopaland Ramakrishna.
4. Practical Biochemistry by Harold Varley.

L	T	P	C
3	0	0	3

PATHOPHYSIOLOGY (Theory)

Subject Code: BP204T

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

COB1: Describe the etiology and pathogenesis of the selected disease states;

COB2: Name the signs and symptoms of the diseases; and

COB3: Mention the complications ofthe diseases

Course Outcomes:

Course outcomes	Statement
CO1(L2)	**Discuss** basic principal of cell injury and Adaptation
CO2(L1)	**Describe** about the inflammation and repair
CO3(L2)	**Explain** the cardiovascular system
CO4(L2)	**Summarize** the Hematological diseases
CO5(L1)	**Describe** the bone diseases
CO6(L2)	**Explain** the Infectious diseases

Course Content: **(45 Hours)**

Unit I **10 Hours**

- **Basic principles of Cell injury and Adaptation:**
  Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance
- **Basic mechanism involved in the process of inflammation and repair:**
  Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

Unit II **10 Hours**

- **Cardiovascular System:**
  Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)
- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure.

Unit III **10 Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia.
- **Endocrine system:** Diabetes, thyroid diseases, disorders ofsex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia, and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer

Unit IV **8 Hours**

- Inflammatoryboweldiseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis, Gout
- **Principles of Cancer:** Classification, etiologyand pathogenesis ofCancer

Unit V **7 Hours**

- **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinarytract infections
- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea

REFERENCES:

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.

2. Harsh Mohan; Textbook of Pathology; 6th edition; India; Jaypee Publications; 2010.

3. Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.

4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states.

5. William and Wilkins, Baltimore;1991 [1990 printing]. 6. Nicki R. College, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.

7. Guyton A, John. E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.

8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.

9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia;WB Saunders Company; 1997.

10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals:

1. The Journalof 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 Pathologyand Microbiology. ISSN-0377-4929.

L	T	P	C
3	0	0	3

COMPUTER APPLICATIONS IN PHARMACY (Theory)

Subject Code: BP205T Course Objectives: Upon completion of the course the student shall be able to

COB1: know the various types of application of computers in pharmacy

COB2: know the various types of databases

COB3: know the various applications of databases in pharmacy

Course Outcomes:

Course Outcome	Statement
CO1[L2]	**Illustrate** the concept of number system in computers.
CO2 [L1]	**Describe** use of web technologies such as HTML, XML, CSS, Programming languages, Web servers and pharmacydrug database.
CO3 [L2]	**Discuss** about different types of databases, applications of computers And databases in pharmacy.
CO4 [L5]	**Appraise** the applications of computers in pharmacy such as drug information services, pharmacokinetics, mathematical model in drug design, hospital and clinical pharmacy etc.,
CO5 [L2]	**Explain** about bioinformatics and its impact in vaccine discovery and database.
CO6 [L4]	**Analyses** computers as data analysis in preclinical development.

Course content: **30 hours**

UNIT-I **06 hours**

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division.

Concept of I**nformation Systems and Software: I**nformation gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

UNIT –II **06 hours**

Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products

Introductionto databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III **06 hours**

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

UNIT – IV **06 hours**

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

UNIT-V **06 hours**

Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)

REFERENCES:

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 Publishersand Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQLServer, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

L	T	P	C
0	0	2	1

COMPUTER APPLICATIONS IN PHARMACY (Practical)

Subject code: BP210P
Course Objectives: Upon completion ofthe course the student shall be able to
COB1: know howto use MS Office
COB2: knowthe various types of databases
COB3: knowthe various applications ofdatabases in pharmacy

Course Outcomes:

Course Outcomes	Statements
CO1 [L2]	**Demonstrate** and make use of MS Word suite and concepts of information systems and software.
CO2 [L2]	**Summarize** the report and to design a web page Using HTML and drug information system.
CO3 [L1]	**Describe** the adverse effects using online tools and paradigms of program languages and be exposed to at least one database (SQL)
CO4 [L6]	**Create** and make use of MS Access suite and bioinformatics
CO5 [L3]	**Determine** the knowledge ofcomputers in pharmacy, web and XML pages
CO6 [L6]	**Design** and make use of MS Excel and Power point suite and preclinical development.

Course Content: **2 Hours/Week**

List of Experiments:

Expt. No	Title of the Experiment	CO
1	Design a questionnaire using a word processing package to gather information about a particular disease.	CO1
2.	Create a HTML webpage to show personal information.	CO2
3.	Retrieve the information ofa drug and its adverse effects using online tools	CO3
4.	Creating mailing labels Using Label Wizard, generating label in MS WORD	CO4

5.	Create a database in MS Access to storethe patient information withthe required fields Using access	CO4
6.	Design a form in MS Access to view, add, delete and modify the patient record in the database	CO4
7.	Generating report and printing the report frompatient database	CO4
8.	Creating invoice table using – MS Access	CO4
9.	Drug information storage and retrievalusing MS Access	CO4
10.	Creating and working with queries in MS Access	CO4
11.	Exporting Tables, Queries, Forms and Reportsto web pages	CO5
12.	Exporting Tables, Queries, Forms and Reportsto XML pages	CO5
13.	Creating a Students Mark list	CO6
14.	Creating a power point presentation	CO6

REFERENCES:

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 Publishersand Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQLServer, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

L	T	P	C
3	0	0	3

ENVIRONMENTAL SCIENCE (Theory)

Subject code: BP206T

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

COB1: Create the awareness about environmental problems among learners.

COB2: Impart basic knowledge about the environment and its allied problems.

COB 3: Develop an attitude of concern for the environment.

COB4: Motivate learner to participate in environment protection and environment improvement.

COB5: Acquire skills to help the concerned individuals in identifying and solving environmental problems.

COB6: Strive to attain harmony with Nature

Course Outcomes:

Course outcomes	Statement
CO1[L4]	**Analyze** multidisciplinary nature of environmental studies
CO2 [L2]	**Understand i**mportance of various natural resources like forest, water, food
CO3 [L1]	**ENUMERATE** the concept, structure and functions of an ecosystem.
CO4 [L2]	**Illustrate** various types of ecosystems.
CO5 [L1]	**State** about environmental pollutions.
CO6 [L2]	**Explain** about pollution, control and preventive measures for pollutions

Course Content: 30 Hours

UNIT-I **10 HOURS**

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.

UNIT-II **10 HOURS**

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)

UNIT- III **10 HOURS**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

REFERENCES:

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

Semester III

L	T	P	C
3	1	0	4

PHARMACEUTICAL ORGANIC CHEMISTRY-II (Theory)

SUBJECT CODE: BP301T
Course Objectives: Upon completion of the course the student shall be able to
COB1: Write the structure, name and the type of isomerism of the organic compound
COB2: Write the reaction, name the reaction and orientation of reactions
COB3: Account for reactivity/stability ofcompounds,
COB4: Prepare organic compounds

Course Outcomes:

Course Outcomes	Statement
CO1 [L1]	**Describe** Benzene and its derivatives A. Analytical, synthetic and other evidences in the derivation of structure ofbenzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule, Reactions of benzene
CO2 [L2]	**Demonstrate** study and Phenols, Acidity ofphenols, effect ofsubstituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, Naphthols.
CO3 [L5]	**Justify** Aromatic amines, Aromatic acids
CO4 [L3]	**Determine** Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl(RM) value – significance and principle involved in their determination
CO5 [L6]	Polynuclear hydrocarbons: **Synthesis**, reactions Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane
CO6 [L4]	Cyclo alkanes* **Analyse** 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 Cyclobutene

Course Content: **45 Hours**

UNIT I **10 Hours**

Benzene and its derivatives

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel craft's alkylation- reactivity, limitations, Friedel craft's acylation.

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

D. Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II **10 Hours**

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

- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts
- **Aromatic Acids* –**Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III **10 Hours**

- **Fats and Oils**

a. Fattyacids reactions.

b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV **08 Hours**

Polynuclear hydrocarbons:

a. Synthesis, reactions

b. Structure and medicinaluses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V **07 Hours**

Cyclo alkanes*

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

REFERENCES:

1. Organic chemistryby I.L. Finar, Volume-I & II.
2. A text book oforganic chemistry – Arun Bahl, B.S. Bahl.
3. Organic Chemistry by Morrison and Boyd

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PHARMACEUTICAL ORGANIC CHEMISTRY-II (Practical)

SUBJECT CODE: BP305P

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

COB 1: Concepts and the mechanisms for the synthetic tools in generating newer products can be correlated with novel drug design and development in future.

COB 2: The mode of quality control procedures and applications of numerous medicinal agents help to adapt the students to focus on purity parameters pertaining to the drugs of choice.

COB 3: The practical knowledge from the laboratory synthesis of medicinal organic molecules and their qualitative organic analysis helps to interpret and arrive to valid conclusions.

Course Outcomes:

Course Outcomes	Statement
CO1 [L2]	**Demonstrate** the laboratorytechniques.
CO2 [L1]	**Describe** the Purification techniques
CO3 [L3]	**Determination** of acid value, Saponification value, Iodine value
CO4 [L6]	**Preparation** of acetanilide, 2,4,6-tribromoaniline, m-dinitrobenzene
CO5 [L6]	**Preparation** of various organic compounds by oxidation, diazotization and coupling reactions
CO6 [L3]	**Apply** the principles of named reactions in synthesis of organic Compounds

COURSE CONTENT **4 HOURS/WEEK**

LIST OF EXPERIMENTS:

Expt. No	Title	CO
1.	Introduction to Basic laboratory techniques	CO1
2.	Steam Distillation & Recrystallization	CO2
3.	Determination of Acid value	CO3
4.	Determination of Saponification value	CO3
5.	Determination of Iodine value	CO3
6.	Preparation of Acetanilide	CO3
7.	Preparation of 2,4,6-tri bromoaniline	CO4
8.	Preparation of m-dinitrobenzene	CO4
9.	Preparation of Benzoic acid from Benzyl chloride byoxidation reaction.	CO5
10.	Preparation of Benzoic acid from Ethyl benzoate	CO5
11.	Preparation Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.	CO5
12.	Preparation of Benzil from Benzoin byoxidation reaction.	CO5
13.	Preparation of Dibenzal acetone from Benzaldehyde by Claison Schmidt Reaction	CO6
14.	Preparation of Cinnammic acid from Benzaldehyde by Perkin reaction	CO6
15.	Preparation of P-Iodo benzoic acid from P-amino benzoic acid	CO6

REFERENCES:

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.

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PHYSICAL PHARMACEUTICS-I (Theory)

Subject Code: BP302T

Course Objective: Upon completion ofthe course the student shall be able to understand

COB1: To u Understand various physicochemical properties of drug molecules in the designing the dosage forms

COB2: To know the principles ofchemical kinetics & to use them for stability testing and determination of expiry date of formulations

COB3: To demonstrate use of physicochemicalproperties in the formulation development and evaluation of dosage forms.

Course outcomes:

Course Outcomes	Statement
CO1 (L2)	Explain the Definitions, solubility terms, principle ofdiffusion, Types of solutions .
CO2 (L1)	Describe the States of matter and properties of matter, Physico chemical properties of drug molecules.
CO3 (L1)	Tellabout the Surface and interfacial phenomenon .
CO4 (L4)	Classify Complexation and Recall Complexation and protein binding.
CO5 (L5)	Assess the methods ofanalysis.
CO6 (L5)	Assess the methods ofanalysis.

Course Content: **45 Hours**

UNIT-I **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications.

UNIT-II **10Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid- crystalline, amorphous & polymorphism.

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

UNIT-III **10 Hours**

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

UNIT-IV **08Hours**

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

UNIT-V **07 Hours**

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

References

1. Physical Pharmacy by Alfred Martin
2. ExperimentalPharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. StocklosamJ. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2,
3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. LaboratoryManual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test bookof Physical Phramacy, by Gaurav Jain & Roop K. Khar

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PHYSICAL PHARMACY-I (Practical)

Subject Code: BP306P
Course Objective: Upon completion ofthe course the student shall be able to understand
COB1: To learn about the determination of solubility, pH and partition coefficient of various drugs
COB2: To learn the determination of various surface tension and interfacial tension related parameter.
COB3: To learn the determination ofcomplexation related parameters.

Course Outcomes:

Course Outcomes	Statement
CO1[L2]	**Discuss** the importance and calculation of various solubility parameters to learn about solubility phenomenon
CO2 [L1]	**Describe** the importance and calculation of ionization parameters ofdrug solutions.
CO3 [L3]	**Calculate** ofpartition coefficient ofdrug between various solvents
CO4 [L5]	**Assessment** ofthe surface tension
CO5 [L5]	**Evaluate** the adsorption parameters
CO6 [L4]	**Analyze** the Complexation parameters

Course Content: **4 Hrs/week**

List of experiments:

Expt. No	Title	CO
1.	Determination of the solubility of drug at roomtemperature	**CO1**
2.	Determination of pKa value by Half Neutralization / Henderson Hasselbalch equation.	**CO2**
3.	Determination of Partition co- efficient of benzoic acid in benzene and water	**CO3**
4.	Determination of Partition co- efficient of Iodine in CCl_4 and water	**CO3**
5.	Determination of % composition of NaCl in a solution using phenol-water system by CST method	**CO1**
6.	Determination ofsurface tension ofgiven liquids by drop count and drop weight method	**CO4**
7.	Determination of HLB number ofa surfactant by saponification method	**CO5**
8.	Determination of Freundlich and Langmuir constants using activated char coal	**CO5**
9.	Determination of critical micellar concentration of surfactants	**CO5**
10.	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method	**CO6**
11.	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	**CO6**

REFERENCES:

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, 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.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

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PHARMACEUTICAL MICROBIOLOGY (Theory)

Subject Code: BP303T

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

COB1: Understand methods of identification, cultivation and preservation of various microorganisms.

COB2: To understand the importance and implementation of sterilization in pharmaceutical processing and industry and Learn sterility testing of pharmaceutical products. Carried out microbiological standardization of Pharmaceuticals

COB3: Understand the cell culture technology and its applications in pharmaceutical industries.

Course outcome	Statement
CO1(L2)	Explain Microbiology Compare prokaryotes and eukaryotes and describe ultra-structure, morphology, nutritional requirement of bacteria, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures. Explain cultivation of anaerobes, quantitative measurement of bacterial growth, different types of phase contrast microscopy, dark field microscopyand electron microscopy
CO2 (L1)	Identify bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests Explain principle, procedure, merits, demerits and applications of methods of sterilization and evaluate efficiency of sterilization methods. Demonstrate understanding of equipment employed in large scale sterilization and classify and describe Sterility indicators
CO3 (L1)	Describe the morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Explain classification, mode of action, factors affecting and evaluation of disinfection and antiseptics. Describe and evaluate bacteriostatic and bactericidal actions. Explain Sterility testing ofPharmaceutical products according to IP, BP and USP
CO4 (L4)	Classify aseptic area and laminar flow cabinet. Explain different sources of contamination and methods of prevention of an aseptic area and classify microbiological clean area. Explain Principles and methods of different microbiological assay, methods for standardization of antibiotics, vitamins and amino acids. Demonstrate understanding of standardization and assessment of a new antibiotic
CO5 (L2)	Explain types, sources, factors affecting and assessment of microbial contamination and spoilage of pharmaceutical products
CO6 (L1)	Describe Preservation of pharmaceutical products using antimicrobial agents and evaluation of microbial stability of formulations

Course Content: **45 Hours**

UNIT-I **10 Hours**

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

Introduction to Prokaryotes and Eukaryotes

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

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

UNIT-II **10 Hours**

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.
Equipments employed in large scale sterilization.
Sterility indicators

UNIT-III **10Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.
Classification and mode of action of disinfectants,
Factors influencing disinfection, antiseptics.
Evaluation of bactericidal & Bacteriostatic activity of disinfectants.
Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP

UNIT- IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.
Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.
Assessment of a new antibiotic.

UNIT-V **07 Hours**

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 industryand research.

REFERENCES:

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4 th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. MalcolmHarris, 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 Bookof Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manualofsystematic bacteriology, Williams and Wilkins- A Waverly Company.

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PHARMACEUTICAL MICROBIOLOGY (Practical)

Subject Code: BP307P

Course Objectives: Upon completion ofthe subject student shall be able to

COB1: Understand methods of identification, cultivation and preservation of various microorganisms

COB2: To understand the importance and implementation of sterilization in pharmaceutical processing and industry

COB3: Learn sterility testing ofpharmaceutical products

COB4: Carried out microbiological standardization of Pharmaceuticals.

COB5: Understand the cell culture technology and its applications in pharmaceutical industries.

Course Outcomes:

Course Outcomes	Statement
CO1 (L2)	Demonstrate different equipment and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology
CO2 (L6)	Prepare and sterilize culture media and perform Sterilization ofglassware
CO3 (L6)	Prepare Sub culturing of bacteria and fungus on nutrient slants and explain Isolation ofpure culture of micro-organisms by multiple streak plate technique and other techniques
CO4 (L6)	Develop different Staining methods (simple, Gram's & Acid fast staining) and identification of microorganisms
CO5 (L4)	Analyze Microbiological assay of antibiotics by cup plate method and other methods
CO6 (L3)	Determine bacterial motility by Hanging drop method and qualityofwater by bacteriological analysis

Course Content: **4 Hrs/week**

List of experiments:

Expt. No	Title	CO
1.	Introduction To Microbiology	**CO1**
2.	Study of Equipements and Instruments Used In Experimental Pharmaceutical Microbiology	**CO1**
3.	Preparation And Sterilization Nutrient Broth	**CO2**
4.	Preparation And Sterilization Nutrient Ager	**CO2**
5.	Sterilization Of Glassware	**CO2**
6.	Aseptic Transfer Of Microbial Cultures Into Different Types Of Media	**CO3**
7.	Preparation And Sub Culturing Of Nutrient Agar Slants And Stabs	**CO3**
8.	Isolation Of Pure Culture	**CO3**
9.	Staining Techniques	**CO4**

10.	Simple Staining	**CO4**
11.	Gram Staining	**CO4**
12.	Acid Fast Staining	**CO4**
13.	Motility Of Bacteria By Hanging Drop Method	**CO6**
14.	Microbiological Assay Of Antibiotics By Cup Plate Method	**CO5**
15.	Test For Sterility For Water For Injection	**CO6**
16.	Bio Chemical Test For The Identification Of Microorganisms-IMViC Tests	**CO4**
17.	Microbiological Examination Of Water	**CO6**

REFERENCES:

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4 th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. MalcolmHarris, 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 Bookof Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manualofsystematic bacteriology, Williams and Wilkins- A Waverly company.

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PHARMACEUTICAL ENGINEERING (Theory)

SUBJECT CODE: BP304T

COURSE OBJECTIVES: Upon completion ofthe course the student shall be able to

COB1: To know various unit operations used in pharmaceutical industries.

COB2: To understand the material handling techniques.

COB3: To performvarious processes involved in pharmaceutical manufacturing process.

COB4: To carryout various test to prevent environmentalpollution.

COB5: To appreciate and comprehend significance of plant lay out design for optimum use of resources.

COB6: To appreciate the various preventive methods used for corrosion control in pharmaceutical industries.

Course Outcomes:

Course Outcome	Statement
CO1 [L2]	**Demonstrate** the ability to integrate knowledge from fluid mechanics, size reduction, and size separation to solve complex engineering problems.
CO2 [L3]	**Apply** theoretical concepts to practical scenarios in the design and optimization of heat exchange systems.
CO3 [L3]	**Apply** the acquired knowledge to real-world scenarios, addressing challenges and optimizing processes in evaporation and distillation units.
CO4 [L2]	**Demonstrate** proficiency in selecting appropriate mixing equipment based on the characteristics of materials and the requirements of the process.
CO5 [L5]	**Develop** problem-solving skills in addressing challenges related to filtration and centrifugation processes in various industrial settings.
CO6 [L1]	**Describe** significance of plant lay out design for optimum use of resources. various and preventive methods used for corrosion control in pharmaceutical industries

Course Content: **45 Hours**

UNIT-I **10 Hours**

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

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

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

UNIT II **10 Hours**

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

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

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

UNIT III **10 Hours**

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

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

UNIT IV **08 Hours**

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

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

UNIT V **07 Hours**

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

REFERENCES:

1. Introductionto chemicalengineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation ofchemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice ofpharmacy- Martin, Latest edition.
6. Theoryand practice of industrial pharmacy by Lachmann., Latest edition.
7. Physicalpharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

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PHARMACEUTICAL ENGINEERING (Practical)

SUBJECT CODE: BP308P

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

COB1: To measure and determine the radiation constants of brass, iron, unpainted and painted glass to understand and compare their thermal radiation properties.

COB2: To calculate the efficiency of steam distillation, providing insight into the effectiveness of the process and its application in separating components from mixtures.

COB3: To determine the overall heat transfer coefficient in a heat exchanger, facilitating an understanding of heat exchange efficiency in industrial processes.

COB4: To develop drying curves for calcium carbonate and starch to analyze and optimize drying processes for these substances.

COB5: To determine the moisture content and loss on drying of a substance, crucial for quality control in various industries, especially pharmaceuticals.

COB6: To measure air humidity using wet and dry bulb temperatures, employing the Dew point method, to understand the moisture content in the air.

Course Outcomes:

Course Outcome	STATEMENTS
CO1 [L2]	**Demonstrate** the proper technique for measuring the radiation constant.
CO2 [L5]	**Design** an experiment to determine the heat transfer coefficient under various conditions.
CO3 [L1]	**List** the common methods used for measuring moisture content in substances.
CO4 [L1]	**Describe** the principles behind the sieving process and how it helps in size analysis.
CO5 [L3]	**Examine** the factors affecting the rate of evaporation, including temperature, surface area, and concentration.
CO6 [L4]	**Assess** the reliability of the experimental setup in measuring the rate of crystallization over time.

Course Content: **4 Hours/week**

List of Experiments

Expt. No	Title	CO
1.	Determination ofradiation constant of brass, iron, unpainted and painted glass	**CO1**
2.	Steamdistillation – To calculate the efficiency of steamdistillation.	**CO1**
3.	To determine the overall heat transfer coefficient by heat exchanger.	**CO2**
4.	Construction ofdrying curves (for calcium carbonate and starch).	**CO2**
5.	Determination of moisture content and loss on drying.	**CO3**
6.	Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.	**CO3**

7.	Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.	**CO4**
8.	Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.	**CO4**
9.	Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.	**CO5**
10.	Demonstration ofcolloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.	**CO5**
11.	Factors affecting Rate ofFiltration and Evaporation (Surface area, Concentration and Thickness/ viscosity)	**CO5**
12.	To studythe effect oftime on the Rate of Crystallization.	**CO6**
13.	To calculate the uniformity Index for given sample byusing Double Cone Blender.	**CO6**

SEMESTER IV

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PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

SUBJECT CODE: BP401T

Course Objectives: Upon completion ofthis course the student will able to

COB1: understand the methods ofpreparation and properties oforganic compounds

COB2: explain the stereo chemical aspects oforganic compounds and stereo chemical reactions

COB3: knowthe medicinal uses and other applications oforganic compounds

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L1]	Enumerate the phenomenons of Optical isomerism, Optical activity, enantiomerism, diastereoisomerism, meso compounds, Elements of symmetry, chiral and achiral molecules with examples. Designate the type and existence of an optical isomer in space byapplying concept of DL system of nomenclature, sequence rules, RS systemofnomenclature ofoptical isomers.
CO2 [L2]	Illustrate the chemical Reactions of chiral molecules, methods and types of approaches involved in the synthesis of asymmetric compounds and illustrate different methods of resolution of racemic mixture.
CO3 [L4]	Explain the phenomenons Geometrical isomerism, Conformational isomerism in Ethane, n-Butane and Cyclohexane, Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity, Methods of determination of configuration of geometrical isomers. Compare the type and existence of an geometrical isomer by applying concept of Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Antisystems).Outline the types of Stereospecific and stereoselective reactions with examples.
CO4 [L3]	Name and classify heterocyclic compounds. Outline the Synthetic,chemical reactions and medicinal uses of Pyrrole, Furan, and Thiophene and their derivatives. Explain the Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene.
CO5 [L6]	Synthesize,chemical reactions and medicinal uses of Pyrazole, Imidazole, Oxazole, Thiazole, Pyridine, Quinoline, Isoquinoline, Acridine and Indole, Pyrimidine, Purine, azepines and their derivatives. Illustrate the Basicity of pyridine.
CO6 [L5]	Justify the reaction mechanisms of Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction, Oppenauer-oxidation and Dakin reaction, Beckmanns rearrangement, Schmidt rearrangement, Claisen-Schmidt condensateion and utilize those concepts in different types of chemical conversions.

Course Contents: **45 Hours**

UNIT-I **10 Hours**

Stereo isomerism

Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules

DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers.

Reactions ofchiral molecules

Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute.

UNIT-II **10 Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

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

Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivityof Pyrrole, Furan and Thiophene

UNIT-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole.Pyridine, Quinoline, Isoquinoline, Acridine & Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives.

UNIT-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation

REFERENCES:

1. Organic chemistryby I.L. Finar, Volume-I & II.
2. A text bookoforganic chemistry– Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

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MEDICINAL CHEMISTRY-I (Theory)

Subject code: BP402T

Course objectives: Upon completion of this course the student will able to

COB1: understand the chemistryofdrugs with respect to their pharmacological activity

COB2: understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

COB3: knowthe Structural Activity Relationship (SAR) ofdifferent class ofdrugs

COB4: write the chemical synthesis ofsome drugs

Course Outcomes:

Course outcome	Statement
CO1[L1]	Describe the history of profession of pharmacy, fundamental knowledge on the structure, chemistry and therapeutic value of drugs.
CO2[L1]	Illiustrate the structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs.
CO3[L4]	Classify the chemistry of drugs with respect to their pharmacological activity metabolic pathways, adverse effect and therapeutic value ofdrugs
CO4[L3]	Apply Structural Activity Relationship (SAR) for different class ofdrugs
CO5[L3]	Determine Phenothiazine's and its SAR
CO6[L5]	Justify the techniques involved in the synthesis of drugs, purification methods applied.

Course Content: **45 HOURS**

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolismprinciples- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters:

Biosynthesis and catabolism ofcatecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxy amphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism ofacetylcholine.
Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents
Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.
Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV **08 Hours**

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*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital
Miscelleneous:
Amides & imides: Glutethmide.
Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde
Antipsychotics
Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.
Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.
Fluro buterophenones: Haloperidol, Droperidol, Risperidone.
Beta amino ketones: Molindone hydrochloride.
Benzamides: Sulpieride.
Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action.
Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione
Succinimides: Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam
Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **07 Hours**

Drugs acting on Central Nervous System General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

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

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

REFERENCES:

1. Wilsonand Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, VolI to IV.
4. Introduction to principles ofdrug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistryof Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text bookofpractical organic chemistry- A.I.Vogle

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MEDICINAL CHEMISTRY-I (Practical)

Course code: BP406P

Course objectives: Upon completion of this course the student will able to

COB1: understand the chemistry of drugs with respect to their pharmacological activity

COB2: understand the drug metabolic pathways, adverse effect and therapeutic value ofdrugs

COB3: know the Structural Activity Relationship (SAR) of different class of drugs

COB4: write the chemical synthesis ofsome drugs

Course Outcomes:

Course Outcome	Statement
CO1[L2]	Understand the chemistry of drugs with respect to their pharmacological activity.
CO2[L3]	Determination of Partition Coefficient of drugs.
CO3[L4]	Elaborate the Structural Activity Relationship (SAR) of different class of drugs
CO4[L6]	Preparation and characterisation of various medicinal molecules
CO5[L5]	Assess the percentage purityof medicinal molecules.
CO6[L4]	Characterisation of medicinal molecules byusing software tools.

Course Content: **4 Hours/week**

List of Experiments:

Expt. No	Title	CO
1.	Preparation of 1, 3-Pyrazole,	**CO1**
2.	Preparation 1,3-oxazole,	**CO1**
3.	Preparation Benzimidazole,	**CO1**
4.	Preparation Benztriazole,	**CO1**
5.	Preparation 2,3- diphenyl quinoxaline,	**CO1**
6.	Preparation Benzocaine,	**CO1**
7.	Preparation Phenytoin,	**CO1**
8.	Preparation Phenothiazine,	**CO1**
9.	Preparation Barbiturate.	**CO1**
10.	Determine the Percentage purityof Chlorpromazine,	**CO2**
11.	Determine the Percentage purityof Phenobarbitone,	**CO2**
12.	Determine the Percentage purityof Atropine,	**CO2**
13.	Determine the Percentage purityof Ibuprofen,	**CO2**
14.	Determine the Percentage purityof Aspirin,	**CO2**
15.	Determine the Percentage purityof Furosemide.	**CO2**
16.	Determination ofpartition co-efficient of medicinal molecules.	**CO3**

REFERENCES:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogels

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PHYSICAL PHARMACY-II (Theory)

Subject Code: BP403T

Course Objectives: Upon completion ofthis course the student will able to

COB1: Understand various physicochemical properties of drug molecules in the designing the dosage forms

COB2: Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations

COB3: Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Outcomes:

Course outcome	Statement
CO1[L1]	**Define** about the coarse and colloidal dispersions
CO2 [L5]	**Assess** the rheological properties and applythem in pharmaceutical sciences.
CO3 [L2]	**Explain** the deformation of Solids
CO4 [L2]	**Demonstrate** use of physicochemical properties in the formulation development and evaluation of dosage forms.
CO5 [L1]	**Describe** about the micromeritic properties ofdrug molecules.
CO6 [L2]	**Characterize** the principles ofchemical kinetics for stability testing

Course Content: **45 Hours**

UNIT-I **7 Hours**

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

UNIT-II **08 Hours**

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

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

UNIT-III **10 Hours**

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

UNIT-IV **10 Hours**

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

UNIT-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, 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.

References

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimentalpharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. StocklosamJ. 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, Pharmaceuticaldosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. PhysicalPharmaceutics by Ramasamy C, and Manavalan R.

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PHYSICAL PHARMACY-II (Practical)

Subject Code: BP407P
Course Objectives: Upon completion of this course the student will able to
COB1: To understand the determination of powder properties of drug mixtures**.**
COB2: To understand the determination of liquid and dispersion characteristics.
COB3: To understand the assessment of stability for drug product.

Course Outcomes:

Course Outcomes	Statement
CO1[L1]	**Describe** the various methods for determination of particle size and distribution (Understand)
CO2 L1]	**Explain** the determination methods for physical properties of a drug
CO3 [L4]	**Characterize** the viscosity by using different viscometers
CO4 L2]	**Demonstrate** the effect of suspending agent on sedimentation volume
CO5 L3]	**Calculate** the rate constants for order of reactions
CO6 L5]	**Evaluate** the accelerated stability studies

Course Content **4 Hours / Week**

List of experiments:

Expt. No	Title	CO
1.	Determination of particle size, particle size distribution using sieving method	**CO1**
2.	Determination of particle size, particle size distribution using Microscopic method	**CO1**
3.	Determination of bulk density, true density and porosity	**CO2**
4.	Determine the angle of repose and influence of lubricant on angle of repose	**CO2**
5.	Determination of viscosity of liquid using Ostwald's viscometer	**CO3**
6.	Determination sedimentation volume with effect of different suspending agent	**CO4**
7.	Determination sedimentation volume with effect of different concentration Of single suspending agent	**CO4**
8.	Determination of viscosity of semisolid by using Brookfield viscometer	**CO3**
9.	Determination of reaction rate constant first order.	**CO5**
10.	Determination of reaction rate constant second order	**CO5**
11.	Accelerated stability studies	**CO6**

References

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimentalpharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. StocklosamJ. 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. PhysicalPharmaceutics by Ramasamy C, and Manavalan R.

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PHARMACOLOGY-I (Theory)

Subject Code: BP404T

Course Objectives: On completion of this course, the student will able to

COB1: To understand what drugs, do to living organisms and how their effects can be applied to therapeutics.

COB2: To understand the 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 routes of administration of different classes of drugs.

COB3: To understand the pharmacological actions ofdifferent categories ofdrugs.

COB4: To explain the mechanism of drug action at organ system/sub-cellular/ macromolecular levels.

COB5: To apply the basic pharmacological knowledge in the prevention and treatment of various diseases.

Course Outcomes:

Course Outcome	Statement
CO 1 (L1)	**Understand** the basics of pharmacology & Pharmacokinetics
CO 2 (L3)	**Demonstrate** the basics of Pharmacodynamics and Drug Interactions
CO 3 (L3)	**Illustrate** the Pharmacology of Drugs acting on the Peripheral Nervous System.
CO 4 (L4)	**Explain** the Pharmacology of the drugs acting on Neurohumoral transmission related disorders
CO 5 (L4)	**Analyze** the Pharmacology of the Drugs acting on Psychopharmacological Disorders
CO 6 (L4)	**Explain** the rational drug treatment of geriatric, pediatric, pregnancy, and lactation patients.

Course Contents: **45 Hours**

UNIT-I **08 Hours**

1. General Pharmacology

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism, and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II **12 Hours**

General Pharmacology

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptors, transmembrane enzyme-linked receptors, transmembrane JAK-STAT binding receptors and receptors that regulate transcription factors, dose-response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

b. Adverse drug reactions.
c. Drug interactions (pharmacokinetic and pharmacodynamics)
d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials, and Pharmacovigilance.

UNIT-III **10 Hours**

Pharmacology of drugs acting on Peripheral Nervous System

a. Organization and function of ANS.
b. Neurohumoraltransmission, co-transmission, and classification of neurotransmitters.
c. Parasympathomimetics, Parasympatholytics, Sympathomimetic, sympatholytic.
d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
e. Localanesthetic agents.
f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV **8 Hours**

Pharmacology of drugs acting on the Central Nervous System

a. Neurohumoral transmission in the C.N.S. Special emphasis on the importance of various neurotransmitters like GABA, Glutamate, Glycine, serotonin, and dopamine.
b. General anesthetics and pre-anesthetics.
c. Sedatives, hypnotics, and centrallyacting muscle relaxants.
d. Anti-epileptics
e. Alcohols and disulfiram

UNIT-V **7 Hours**

Pharmacology of drugs acting on the Central Nervous System

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxietyagents, anti-manics, and hallucinogens.
b. Drugs used in Parkinson's disease and Alzheimer's disease.
c. CNS stimulants and nootropics.
d. Opioid analgesics and antagonists
e. Drug addiction, drug abuse, tolerance, and dependence.

REFERENCES:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang, and Dale's Pharmacology, Churchill 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 medicalpublisher
8. Modern Pharmacologywith Clinical Applications, by Charles R. Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. KulkarniSK. Handbook ofexperimentalpharmacology. Vallabh Prakashan

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PHARMACOLOGY-I (Practical)

SUBJECT CODE: BP408P

COURSE OBJECTIVES: On completion ofthis course, the student will able to

COB1: To gain knowledge of instruments and laboratory animals used in Experimental Pharmacology

COB2: To understand the practical aspects of Common laboratory techniques used for animal studies, different routes of drug administration in mice/rats, and pharmacological actions of different categories of drugs.

COB3: To understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases.

COURSE OUTCOMES:

Course Outcome	Statement
CO1 (L1)	**Summarize** the basic concept of Pharmacology.
CO2 (L3)	**Demonstrate** the effect of drugs on animals by using simulated experiments.
CO3 (L6)	**Adapt** knowledge about recent developments in Pharmacology.
CO4 (L1)	**Relate** the in vivo and in vitro experiments, and use of software for the study of experiments.
CO5 (L3)	**Construct** correlation of Pharmacologywith other bio-medical sciences.
CO6 (L1)	**Correlate** experimental observations with clinical scenarios to propose rational drug treatments.

Course Content **4 Hours / Week**

LIST OF EXPERIMENTS:

Exp. No.	Title of the Experiment	CO
1	Introduction to experimentalpharmacology.	CO 1
2	Commonly used instruments in experimentalpharmacology.	CO 1
3	Study of common laboratory animals	CO 1
4	Maintenance of laboratoryanimals as per CPCSEA guidelines	CO 2
5	Common laboratory techniques. Blood withdrawal, serum, and plasma separation, Anesthetics and euthanasia are used for animal studies.	CO 2
6	Study of different routes of drug administration in mice/rats.	CO 2
7	Studyof the effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.	CO 2
8	Effect ofdrugs on ciliary motilityof Frog Esophagus	CO 2
9	Effect ofdrugs on rabbit eye.	CO 2
10	Effects ofskeletal muscle relaxants using rota-rod apparatus.	CO 2
11	Effect ofdrugs on Locomotor Activityusing actophotometer	CO 2
12	Anticonvulsant effect ofdrugs by MES and PTZ method	CO 2
13	Study of stereotype and anti-catatonic activity of drugs on rats/mice.	CO 4
14	Study of anxiolytic activity of drugs using rats/mice.	CO 4
15	Study of localanesthetics by different methods	CO 4

REFERENCES:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang, and Dale's Pharmacology, Churchill Livingstone Elsevier

2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinicalpharmacology, 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 medicalpublisher

8. Modern Pharmacologywith Clinical Applications, by Charles R. Craig& Robert,

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

10. KulkarniSK. Handbook ofexperimentalpharmacology. Vallabh Prakashan

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PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Theory)

SUBJECT CODE: BP405T

Course Objectives: Upon completion ofthe course, the student shall be able

COB1: To know the techniques in the cultivation and production ofcrude drugs

COB2: To know the crude drugs, their uses and chemical nature. Know the evaluation techniques for the herbal drugs

COB3: To carryout the microscopic and morphological evaluation ofcrude drug

Course Outcomes:

Course outcomes	Statement
CO1 (L1)	**Define** Pharmacognosy, organized and unorganized drugs and describe the history, scope and development of Pharmacognosy.
CO2 (L2)	**Discuss** the methods of quality controlof crude drugs
CO3 (L3)	**Analyse** the methods for the cultivation and collection of medicinal plants, plant hormones.
CO4 (L2)	**Explain** plant tissue culture and classify types ofplant tissue culture.
CO5 (L5)	**Appraise** the role oftraditional systems of medicine in India.
CO6 (L1)	**Evaluate** the microscopic and morphological evaluation ofcrude drugs.

Course Content: **45 HOURS**

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

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

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

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

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

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

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

UNIT-II **10 Hours**

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.

UNIT-III **07 Hours**

Plant tissue culture:

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

Applications of plant tissue culture in pharmacognosy.
Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:
Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.
Introduction to secondary metabolites:
Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V **08 Hours**
Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs Plant Products:
Fibers - Cotton, Jute, Hemp
Hallucinogens, Teratogens, Naturalallergens
Primary metabolites:
General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:
Acacia, Agar, Tragacanth, Honey
Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase
Carbohydrates:, urokinase, streptokinase, pepsin).
Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax
Marine Drugs: Novel medicinal agents from marine sources

REFERENCES:

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

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PHARMACOGNOSY AND PHYTOCHEMISTRY I – (Practical)

SUBJECT CODE: BP409P

Course Objectives: Upon completion ofthe course, the student shall be able

COB1: To know the techniques in the cultivation and production ofcrude drugs

COB2: To know the crude drugs, their uses and chemical nature 3. Know the evaluation techniques for the herbal drugs

COB3: To carry out the microscopic and morphological evaluation ofcrude drug

Course Outcomes:

Course Outcomes	Statement
CO1 (L1)	**Describe** the Qualitative identification of crude drugs by macroscopical, microscopical and chemical tests
CO2 (L2)	**Demonstration** of Camera Lucida and eyepiece micrometer and determination of leaf constants of crude drugs.
CO3 (L2)	**Determination** ofphytochemical constituents of crude drugs.
CO4 (L3)	**Analyse** the physical constants ofcrude drugs.
CO5 (L4)	**Evaluate** the number ofstarch grains present by Lycopodium spore method.
CO6 (L5)	**Design** the calibration ofeyepiece micrometer with stage micrometer.

Course Content **4 Hours / Week**

List of Experiments:

Expt. No	Title	CO
1.	Analysis ofcrude drugs bychemical tests: (i)Tragacanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil	**CO1**
2.	Determination ofstomatal number and index	**CO1**
3.	Determination ofvein islet number, vein islet termination and palisade ratio.	**CO2**
4.	Determination ofsize of starch grains, calcium oxalate crystals by eye piece Micrometer	**CO3**
5.	Determination of Fiber length and width	**CO2**
6.	Determination of number ofstarch grains by Lycopodium spore method	**CO5**
7.	Determination of Ash value	**CO4**
8.	Determination of Extractive values ofcrude drugs	**CO2**
9.	Determination of moisture content ofcrude drugs	**CO4**
10.	Determination ofswelling index and foaming	**CO4**

REFERENCES:

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.

2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.

3. Text Book of Pharmacognosy by T.E. Wallis.

4. Mohammad Ali. Pharmacognosyand Phytochemistry, CBS Publishers & Distribution, New Delhi.

5. Text bookof Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.

6. Herbal drug industryby R.D. Choudhary(1996), Ist Edn, Eastern Publisher, New Delhi.

7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007

8. PracticalPharmacognosy: C.K. Kokate, Purohit, Gokhlae

9. Anatomyof Crude Drugs by M.A. Iyengar.

SEMESTER V

L	T	P	C
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MEDICINAL CHEMISTRY-II (Theory)

SUBJECT CODE: BP501T

Course Objectives: Upon completion ofthe course the student shall be able to

COB1: Understand the chemistry of drugs with respect to their pharmacological activity

COB2: Understand the drug metabolic pathways, adverse effect and therapeutic value ofdrugs

COB3: Know the Structural Activity Relationship of different class of drugs

COB4: Study the chemical synthesis of selected drugs

Course Outcomes:

Course outcome	Statement
CO1 (L1)	Describe the chemistry of antihistaminic agents with respect to pharmacological activity. To understand the concept of cancer and anti neoplastic agents chemistry
CO2 (L2)	Explain the drug metabolic pathways, adverse effect and therapeutic value of antinginal drugs, vasodilators and calcium channel blockers. Diuretics classification, MOA and SAR of anti-hypertensive agents.
CO3 (L4)	Classify about cardiovascular diseases and drugs to treat cardiovascular problems.
CO4 (L2)	Explain the nomenclature, stereochemistry and metabolism of steroids and drugs acting on endocrine system
CO5 (L4)	Classify and the antidiabetic agents and explain the preparation of drugs
CO6 (L6)	Synthesis ofantidiabetic agents and SAR of local anaesthetics.

Course Content: **45 Hours**

UNIT- I **10 Hours**

Antihistaminic agents: Histamine, receptors and their distribution in the human body

H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartarate,

Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine, Cromolyn sodium.

H2-antagonists: Cimetidine*, Famotidine, Ranitidine

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole, esomeprazole

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*,Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors:Acetazolamide*,Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, fenofibrate, gemfibrozil, Atorvastatin, Rosuvastatin, Lovastatin, Simvastatin, Cholesteramine and Cholestipol.

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel.

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistryand metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrone, Diethylstilbestrol.

Drugs forerectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone Betamethasone, Dexamethasone

Thyroid and antithyroid drugs: L-Thyroxine, Triiodothyronine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride,Glibenclamide. Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Localanesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine, Bupivacaine

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

REFERENCES:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, VolI to IV.
4. Introduction to principles ofdrug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistryof Drug Synthesis by Lednicer, Vol. 1to 5.
9. Indian Pharmacopoeia.
10. Text bookofpractical organic chemistry- A.I.Vogel.

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INDUSTRIAL PHARMACY I (Theory)

Course Code: BP502T
Course Objective: At the end of the course students will be able to
COB 1: Know the various pharmaceutical dosage forms and their manufacturing techniques.
COB 2: Know various considerations in development of pharmaceutical dosage forms
COB 3: Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality.

Course Outcomes:

Course Outcome	Statement
CO1(L2)	**Illustrate** Preformulation
CO2(L2)	**Interpret** pharmaceutical dosage forms and their manufacturing techniques
CO3(L6)	**Develop** pharmaceutical dosage forms
CO4(L6)	**Formulate** solid, liquid and semisolid dosage forms and evaluate them for their quality
CO5(L6)	**Formulate** cosmetics, pharmaceutical aerosols and
CO6(L5)	**Evaluate** the packaging materials

Course Content: **45 Hours**

UNIT-I **07 Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT-II **10 Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia.

UNIT-III **08 Hours**

Capsules:

a. **Hard gelatin capsules:** Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.

b. **Soft gelatin capsules:** Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

c. **Pellets:** Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV **10 Hours**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b. Productionprocedure, production facilities and controls, aseptic processing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10 Hours**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

REFERENCES:

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage formdisperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theoryand Practice of Industrial Pharmacy by Liberman & Lachman

7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition

8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition, 2005

9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

Text Books:

1. The theoryand practice of Industrial Pharmacy by Libermann and Lachmann
2. Ansels Pharmaceutical Dosage formand drug Delivery system by Loyd.N.Allen,J.R
3. Copper and Gunn's Dispensing for pharmaceutical students byS J Carter

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INDUSTRIAL PHARMACY - I (Practical)

Subject Code: BP506P
Course Objective: At the end ofthe course students will be able to
COB1: Know the various pharmaceutical dosage forms and their manufacturing techniques.
COB2: Know various considerations in development ofpharmaceuticaldosage forms
COB3: Formulate solid, liquid and semisolid dosage forms and evaluatethem for their quality.

Course Outcomes:

CO1(L5)	**Evaluate** Preformulation studies ofparacetamol/aspirin/or anyother drug.
CO2(L6)	**Preparation** and **Evaluation** of Solid dosage forms and coating oftablets.
CO3(L6)	**Formulate** and **Evaluate** the capsules and parenteraldosage forms.
CO4(L5)	**Evaluation** tests (Quality control tests (as per IP)) for marketed tablets and capsules.
CO5(L6)	**Formulate** the Eye drops/ and Eye ointments, Creams (cold / vanishing cream).
CO6(L5)	**Evaluation** of Glass containers (as per IP).

Course Content **4 Hours / Week**

List Of Experiments:

Expt. No	TITLE	CO
1.	Preparation of Paracetamol tablets bywet Granulation method	**CO1**
2.	Evaluation of Formulated Paracetamol Tablets	**CO2**
3.	Formulation ofsoluble Acetyl Salicylic acid tablets	**CO2**
4.	Evaluation of Formulated Acetyl Salicylic Acid Tablets	**CO2**
5.	Preparation & Evaluation ofTetracycline Capsules	**CO2**
6.	FormulationofAscorbic Acid Injection	**CO3**
7.	Formulation of Calcium Gluconate Injection	**CO3**
8.	Evaluation of Marketed Paracetamol Tablets	**CO4**
9.	Evaluation of Marketed Loperamide Capsules	**CO4**
10.	Preparation & Evaluation of Chloramphenicol Eye ointment	**CO5**
11.	Preparation & Evaluation of Pilocarpine Eye Drops	**CO5**
12.	Preparation of Cold Creams	**CO5**
13.	PreparationofVanishing Cream	**CO5**
14.	Preparation of Face powder	**CO5**
15.	Evaluation of Glass Containers	**CO6**
16.	Film coating of Compressed Tablets	**CO2**

REFERENCES:

1. Preparation Pharmaceutical dosage forms - Tablets, volume 1 -3 byH.A. Liberman, Leon Lachman & J. B. Schwartz.
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman.
3. Pharmaceuticaldosage formdisperse system VOL-1 by Liberman & Lachman

4. Modern Pharmaceutics byGilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)

6. Theoryand Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5th edition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107. ion of Creams (cold / vanishing cream).
10. Evaluation ofGlass containers (as per IP)

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PHARMACOLOGY – II (Theory)

SUBJECT CODE: BP503T

Course Objectives: Upon completion ofthis course the student should be able to

COB1: Understand the mechanismofdrug actionand its relevance inthe treatment ofdifferent diseases

COB2: Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments

COB3: Demonstratethe various receptor actions using isolated tissue preparation

COB4: Appreciate correlation of pharmacology with related medical sciences

Course Outcomes:

Course outcomes	Statement
CO1 (L1)	Write the fundamentals of regulatory processes, pathophysiology in relation to CVS illnesses and disorders, and the pharmacology of drugs used to treat CVD.
CO2 (L2)	Illustrate the drugs acting on hematopoietic system, shock, diuretics and antidiuretics.
CO3 (L2)	Discuss the synthesis, metabolism, and pharmacologyofautocoids.
CO4 (L2)	Explain the pharmacology and rational use of drugs used for the treatment of various endocrine disorders.
CO5 (L5)	Appraise the physiological role of sex hormones and to assess the effects of oral contraceptives and drugs acting on the Uterus
CO6 (L1)	Describe the principles, applications and types of bioassays, Evaluate the potency of unknown compound with reference to standard

Course Content: **45HRS**

UNIT-I **10hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamic and electrophysiology of heart.

b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Anti-hyperlipidemic drugs.

UNIT-II **10hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Drug used in the therapyof shock.
b. Hematinics, coagulants and anticoagulants.
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT-III **10hours**

Autocoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

UNIT-IV **08hours**

Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitaryhormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
e. Insulin, Oral Hypoglycemic agents and glucagon.
f. ACTH and corticosteroids.

UNIT-V **07hours**

Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.
b. Estrogens, progesterone and oralcontraceptives.
c. Drugs acting on the uterus.

Bioassay

a. Principles and applications of bioassay. b. Types of bioassays
b. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5- HT.

REFERENCES

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 ofMedicalPharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacologywith clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. KulkarniSK. Handbook ofexperimentalpharmacology. Vallabh Prakashan.

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PHARMACOLOGY –II (Practical)

SUBJECT CODE: BP507P

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

COB1: Understand the mechanism of drug action and its relevance in the treatment of different diseases

COB2: Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments

COB3: Demonstrate the various receptor actions using isolated tissue preparation

COB4: Appreciate correlation of pharmacology with related medical sciences

Course Outcomes:

Course outcomes	Statement
CO1 (L2)	Explain in-vitro pharmacological studies, importance ofphysiological salt solutions and to find out effect of various drugs isolated frog heart, BP & heart rate in laboratoryanimals
CO2 (L2)	Illustrate the diuretic activityof drugs in mice/rats
CO3 (L2)	Demonstrate the Dose Response Relationship, effect of drugs DRC and find out concentrations of drugs various Bioassay methods
CO4 (L2)	Determine the PA2 & PD2 value of drugs using rat anococcygeus muscle and guinea pig ileum
CO5(L2)	Interpret the effect ofspasmogens and spasmolytics using rabbit jejunum
CO6 (L5)	Predict various screening models for analgesic and anti-inflammatory activities

Course Content **4 Hours / Week**

List of Experiments:

Expt.No	Title	CO
1.	Introductionto *in-vitro* pharmacologyand physiological salt solutions.	**CO1**
2.	Effect ofdrugs on isolated frog heart.	**CO2**
3.	Effect ofdrugs on blood pressure and heart rateofdog.	**CO2**
4.	Studyof diuretic activity of drugs using rats/mice.	**CO2**
5.	DRC ofacetylcholine using frog rectus abdominis muscle.	**CO2**
6.	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.	**CO3**
7.	Bioassayof histamine using guinea pig ileum by matching method.	**CO4**
8.	Bioassayofoxytocin using rat uterine horn by interpolation method.	**CO4**
9.	Bioassayofserotonin using rat fundus strip bythree point bioassay.	**CO4**
10.	Bioassayofacetylcholine using rat ileum/colon by four point bioassay.	**CO4**
11.	Determination ofPA_2 value ofprazosin using rat anococcygeus muscle (by Schilds plot method).	**CO5**
12	Determination ofPD_2 value using guinea pig ileum.	**CO6**
13.	Effect ofspasmogens and spasmolytics using rabbit jejunum.	**CO5**
14	Anti-inflammatoryactivityofdrugs using carrageenan induced paw-edema model.	**CO7**
15	Analgesic activity ofdrug using centraland peripheral methods	**CO8**

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

REFERENCES:

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. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

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PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

SUBJECT CODE: BP504T

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

COB1: The course aims to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially.

COB2: Will be able to learn the producing the plants phytochemicals through plant tissue culture and, drug interactions and basic principles of traditional system of medicine.

COB3: To understand the preparation and development of herbal formulation.

Course Outcomes:

Course Outcomes	Statement
CO1 (L1)	**Describe** the general metabolic pathways in higher plants and their study.
CO2 (L2)	**Explain** the composition, chemistry, chemical classes, chemical constituents and therapeutic &commercial uses of crude drugs.
CO3 (L3)	**Experimental** isolation and identification tests of chemical classes of crude Drugs
CO4 (L4)	**Analyze** the various classes of phytochemical constituents present in crude drugs.
CO5 (L5)	**Evaluation** and estimation of phytochemical constituents and their industrial production.
CO6 (L6)	**Design** various modern methods of extraction.

Course Content: **45 Hours**

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

a. Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.

b. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14 Hours**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following

secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a. Terpenoids: Menthol, Citral, Artemisin

b. Glycosides: Glycyrhetinic acid & Rutin
c. Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d. Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V **8 Hours**

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

TEXT BOOKS:

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, Brady & Robert, Pharmacognosy.
3. Wallis, Text book of Pharmacognosy.
4. Quadry, Pharmacognosy.
5. Kokate C.K , Purohit AP & Gokhale, Pharmacognosy
6. S.L.Deore, et.al., Pharmacognosy and Phytochemistry, A comprehensive approach.
7. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
8. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
9. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
10. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
11. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
12. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.

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1. Atal C.K & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. Of India
3. Khare C.P, Indian Medicinal plants – An Illustrated dictionary
4. Arya Vaidya Sala, Indian Medicinal Plants, University Press
5. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
6. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
7. The formulation and preparation of cosmetic, fragrances and flavours.
8. Remington*f*s Pharmaceutical sciences.
9. Text Book of Biotechnology by Vyas and Dixit.
10. Text Book of Biotechnology by R.C. Dubey.

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PHARMACOGNOSY AND PHYTOCHEMISTRY -II (Practical)

Course code: BP508P

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

COB1: To know the modern extraction techniques, characterization and identification of the Herbal drugs and phytoconstituents.

COB2: To understand the preparation and development of herbal formulation.

COB3: To understand the herbal drug interactions.

Course outcomes:

Course outcomes	Statement
CO1 (L1)	Qualitative identification ofmorphology, histologyand powder characteristics.
CO2 (L2)	Explain the extraction ofcrude drugs and detection ofcrude drugs bychemical tests.
CO3 (L3)	Determination of phytochemical constituents of crude drugs crude drugs by Chromatographic techniques.
CO4 (L4)	Analysis of crude drugs bychemical tests
CO5 (L5)	Evaluation of volatile oils by Chromatographic techniques.
CO6 (L6)	Design the method ofextraction of volatile oils

Course Content **4 Hours / Week**

List of Experiments:

S.NO.	Name of the experiment	CO'S
1.	Morphology, histologyand powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander	**CO1**
2.	Exercise involving isolation & detectionofactive principles a. Caffeine - fromtea dust. b. Diosgenin from Dioscorea c. Atropine from Belladonna d. Sennosides from Senna	**CO2**
3.	Separation ofsugars byPaper chromatography	**CO3**
4.	TLC of herbal extract	**CO5**
5.	Distillation of volatile oils and detection of phytoconstitutents byTLC	**CO6**
6.	Analysis ofcrude drugs bychemical tests: **i.** Asafoetida **ii.** Benzoin **iii.** Colophony **iv.** Aloes **v.** Myrrh	**CO4**

REFERENCES:

1. C.K. Kokate et.al, Practical Pharmacognosy.

2. Kandhelwal, Practical Pharmacognosy.

3. G.Krishna Mohan, K.N.Jayaveera, G.S.Kumar, Practical Pharmacognosy, A laboratory Handbook.

REFERENCES:

1. T.E. Wallis, Practical Pharmacognosy 4th Edition.

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3	1	0	4

PHARMACEUTICAL JURISPRUDENCE (Theory)

SUBJECT CODE: BP505T

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

COB1: The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.

COB2: Various Indian pharmaceutical Acts and Laws.

COB3: The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

COB4: The code ofethics during the pharmaceuticalpractice.

Course Outcomes:

CO1 (L2)	**Discuss** about Drugs act, Import, Manufacture ofdrugs, and its license.
CO2 (L2)	**Demonstrate** Various Schedules, labelling and packing, offences and penalties.
CO3 (L2)	**Illustrate** the Pharmacy Act, Medicinal and Toilet Preparation Act.
CO4 (L2)	**Demonstrate** Narcotic Drugs and Psychotropic substances Act.
CO5 (L1)	**Describe** the Salient Features of Drugs and Magic Remedies Act, Prevention of Cruelty acts and National Pharmaceutical Pricing Authority.
CO6 (L2)	**Discuss** Various Pharmaceutical legislation, code, medical termination and Intellectual property rights.

Course Content: **45 Hours**

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legaldefinitions of schedules to the Act and Rules

Import ofdrugs – Classes ofdrugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufactureofdrugs – Prohibition of manufacture and sale ofcertain drugs,

Conditions for grant oflicense and conditions of license for manufactureofdrugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and penalties

Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **08 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacists oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

REFERENCES:

1. Forensic Pharmacy by B. Suresh
2. Text bookof Forensic Pharmacy by B.M. Mithal
3. Hand bookof drug law-by M.L. Mehra
4. Atext bookof Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules byGovt. ofIndia publications.
6. Medicinaland Toilet preparations act 1955 byGovt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act byGovt. of India publication

SEMESTER VI

L	T	P	C
3	1	0	4

MEDICINAL CHEMISTRY – III (Theory)

SUBJECT CODE: BP601T

COURSE OBJECTIVE: Upon completion of the subject student shall be able to

COB1: Understand the importance ofdrug design and different techniques ofdrug design.

COB2: Understand the chemistryof drugs with respect to their biological activity.

COB3: Know the metabolism, adverse effects and therapeutic value ofdrugs.

COB4: Know the importance of SAR ofdrugs.

Course outcomes:

Course outcome	STATEMENT
CO1 [L4]	Characterise the history, classification of antibiotics
CO2 [L2]	Illustrate chemical degradation, MOA, SAR of antibiotics
CO3 [L3]	Applications of Prodrugs, Synthesize ofantimarlarial
CO4 [L6]	Synthesize the Anti T.B agents, UTI,Antiviral & importance of antifungal, antiprotozoal
CO5 [L5]	Justifythe Syntesis of Antihelmintics & sulphonamides
CO6 [L2]	Explain Various approaches used in drug design and Pharmacophore modeling and docking techniques.

Course Content: **45 Hours**

UNIT-I **10 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and important productsofthe following classes.

β -Lactam antibiotics: Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin, Clindamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT-II **I0 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation, classification and important products of the following classes.

Macrolide: Erythromycin, Clarithromycin, Azithromycin, Roxithromycin, Tilithromycin

Miscellaneous: Chloramphenicol*.

Prodrugs: Basic concepts and application ofprodrug design.

Antimalarials: Etiologyof malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para aminosalicylic acid.*

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate.

Urinary tract anti-infective agents

Quinolones and fluoroquinolines: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Levofloxacin, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdin, Ribavirin, Saquinavir, Indinavir, Ritonavir

UNIT – IV **08 Hours**

Antifungal agents:

Antifungalantibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **7 Hours**

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications of of combinatorial chemistry: solid phase and solution phase synthesis

REFERENCE:

1. Wilsonand Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles ofdrug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.

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MEDICINAL CHEMISTRY – III (Practical)

SUBJECT CODE: BP607P

COURSE OBJECTIVE: Upon completion ofthe subject student shall be able to

COB1: Understand the importance of drug design and different techniques of drug design.

COB2: Understand the chemistryof drugs with respect to their biological activity.

COB3: Know the metabolism, adverse effects and therapeutic value ofdrugs.

COB4: Know the importance of SAR ofdrugs.

Course Outcomes:

Course Outcomes	Statement
CO1 (L4)	**Characterise** the importance of drug design and different techniques of drug design.
CO2 (L2)	**Elaborate** the chemistryof drugs with respect to their biological activity.
CO3 (L5)	**Justify** the assay of imported drugs
CO4 (L1)	**Describe** the importance of SAR ofdrugs.
CO5 (L5)	**Justify** the Synthetic anti tubercular agents and Urinary tract antiinfective agents.
CO6 (L2)	**Explain** Various approaches used in drug design and Pharmacophore modeling and docking techniques.

Course Content **4 Hours / Week**

List of Experiments:

S. No	Experiment Name	CO's
I	**Preparation of drugs and intermediates**	**CO1**
1	Sulphanilamide	**CO1**
2	7-Hydroxy, 4-methyl coumarin	**CO1**
3	Chlorobutanol	**CO2**
4	Triphenyl imidazole	**CO2**
5	Tolbutamide	**CO2**
6	Hexamine	**CO3**
II	**Assay of drugs**	**CO3**
1	Isonicotinic acid hydrazide	**CO3**
2	Chloroquine	**CO3**
3	Metronidazole	**CO3**
4	Dapsone	**CO4**
5	Chlorpheniramine maleate	**CO4**
6	Benzyl penicillin	**CO4**
III	Preparation of medicinally important compounds or intermediates by Microwave irradiation technique	**CO5**
IV	Drawing structures and reactions using chem draw®	**CO6**
V	Determination of physicochemical properties such as logP, clogP, MR Molecular weight, Hydrogen bond donors and acceptors for class of drug cours content using drug design software Drug likeliness screening (LipinskiesRO5)	**CO6**

References:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, VolI to IV.
4. Introduction to principles ofdrug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistryof Drug Synthesis by Lednicer, Vol.1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel

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PHARMACOLOGY- III (Theory)

SUBJECT CODE: BP602T

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

COB1: understand the mechanism of drug action and its relevance in the treatment of different infectious diseases

COB2: comprehend the principles oftoxicologyand treatment ofvarious poisonings

COB3: appreciate correlation ofpharmacologywith related medical sciences.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L1]	Describe the pharmacological management of Respiratory & Gastrointestinal problems.
CO2 [L2]	Explain various infectious agents, mechanisms, sensitivity, and resistance of different anti-infective agents.
CO3 [L1]	List the different antiviral drugs, antitubercular, antileprotics, antimalarial and antiamoebics..
CO4 [L4]	Classify anticancer drugs, Immunosupressants, drugs used to treat UTI & STD
CO5 [L5]	Assess various types of toxicity studies, principles of treatment and management of various poisoned conditions.
CO6 [L2]	Explain about chronopharmacologyand chronotherapy.

Course Content: **45 HOURS**

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratory system

a. Anti-asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives
d. Nasaldecongestants
e. Respiratorystimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhoea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy.
b. Sulfonamides and cotrimoxazole.
c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III **10hours**

4. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents
d. Antiviraldrugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

UNIT-IV **08hours**

5. Chemotherapy

a. Urinary tract infections and sexually transmitted diseases.
b. Chemotherapyof malignancy.

6. Immunopharmacology

a. Immunostimulants
b. Immunosuppressants

Protein drugs, monoclonal antibodies, target drugsto antigen, biosimilars

UNIT-V **07hours**

7. Principles of toxicology

a. Definition and basic knowledge ofacute, subacute and chronic toxicity.
b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity
c. General principles oftreatment ofpoisoning
d. Clinical symptoms and management of barbiturates, morphine, organo phosphosphorus compound and lead, mercury and arsenic poisoning.

8. Chronopharmacology

a. Definition ofrhythm and cycles.
b. Biologicalclock and their significance leading to chronotherapy.

REFERENCES:

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 Pharmacologywith clinical Applications, by Charles R.Craig& Robert

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PHARMACOLOGY-III (Practical)

SUBJECT CODE: BP608P

Course Objectives: Upon completion ofthe course the student shall be able to

COB1: accurately calculate doses required for pharmacological experiments, ensuring precision and safety in drug administration.

COB2: evaluate antiallergic activity through mast cell stabilization assays, providing g insightsinto mechanisms and potential therapeutic applications.

COB3: study the anti-ulcer activity of drugs using both pylorus ligand (SHAY) rat models and NSAIDs induced ulcer models, fostering a deeper understanding of gastrointestinal health and drug effects.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L1]	Recall dose calculations in pharmacological experiments and to relate the antiallergic activity and anti-ulcer activity in animals
CO2 [L2]	Demonstrate the effect of drugs on gastrointestinal motility and the agonistic/antagonistic effect on guinea pig ileum
CO3 [L4]	Analyze serum biochemical parameters byusing semi- autoanalyzer
CO4 [L3]	Determine the effect of saline purgative on frog intestine, hypoglycemic effect and test for pyrogens using Rabbits
CO5 [L3]	Determine LD50, acute skin irritation & acute eye irritation
CO6 [L5]	Predict the pharmacokinetic parameters and adapt the biostatistical methods in experimental pharmacology

Course Content **4 Hours / Week**

LIST OF EXPERIMENTS:

Expt. No	Title	CO
1.	Dose calculation in pharmacological experiments	**CO1**
2.	Antiallergic activity by mast cell stabilization assay	**CO1**
3.	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model	**CO1**
4.	Study of effect of drugs on gastrointestinal motility	**CO2**
5.	Effect ofagonist and antagonists on guinea pig ileum	**CO2**
6.	Estimation of serum biochemical parameters by using semi- autoanalyzer	**CO3**
7.	Effect ofsaline purgative on frog intestine	**CO4**
8.	Insulin hypoglycemic effect in rabbit	**CO4**
9.	Test for pyrogens (rabbit method)	**CO4**
10.	Determination of acute oral toxicity(LD50) ofa drug from a given data	**CO5**
11.	Determination ofacute skin irritation / corrosion of a test substance	**CO5**
12.	Determination ofacute eye irritation / corrosion of a test substance	**CO5**
13.	Calculation of pharmacokinetic parameters froma given data	**CO6**
14.	Biostatistics methods in experimental pharmacology(student's t test, ANOVA)	**CO6**
15.	Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)	**CO6**

REFERENCES:

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

2. Kulkarni SK. Handbook ofexperimentalpharmacology. VallabhPrakashan

3. Macleod, L.J. Pharmacological experiments on intact preparations. Latest edition, Publisher: Churchill livingstone.
4. Macleod, L.J. Pharmacological experiments on isolated preparations. Latest edition, Publisher: Churchill livingstone.
5. Ian Kitchen. Textbook of in vitro practical pharmacology. Latest edition, Publisher: Black well Scientific.

L	T	P	C
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HERBAL DRUG TECHNOLOGY-I (Theory)

SUBJECT CODE: BP603T

Course Objectives: Upon completion ofthe course, the student shall be able

COB1: understand raw material as source of herbal drugs from cultivation to herbal drug product

COB2: knowthe WHO and ICH guidelines for evaluation of herbal drugs

COB3: know the herbal cosmetics, natural sweeteners, nutraceuticals

COB4: appreciate patenting of herbal drugs, GMP.

COURSE OUTCOMES:

Course outcomes	Statement
CO1 (L1)	Describe herbal raw materials as source of herbal drugs from cultivation to herbal products.
CO2 (L2)	Explain Good Agriculturalpractices and Indian systems of medicine.
CO3 (L2)	Use of herbs and herbal products as health food and nutraceuticals and determine herb-food and herb-drug interactions.
CO4 (L4)	Classify herbal cosmetics and categorize herbal excipients used in herbal formulations.
CO5 (L5)	Evaluate and assess the herbal drugs and their stability according to WHO&ICH guidelines.
CO6 (L6)	Design Good manufacturing practices for the herbal drugs used in Indian systems of medicine.

Course Content: **45 Hours**

UNIT-I **10 HOURS**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs

Selection, identification and authentication of herbal materials Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unaniand Homeopathy

b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasm

UNIT-II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.

Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions:

General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III **10 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products

Herbal excipients: Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. **Herbal formulations:** Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT IV **10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:

a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT V **08 Hours**

General Introduction to Herbal Industry

Herbaldrugs industry: Present scope and future prospects.

A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives

Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

REFERENCES:

1. Textbookof Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady& Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essentialof Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Controlof Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

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0	0	4	2

HERBAL DRUG TECHNOLOGY (Practical)

SUBJECT CODE: BP609P

Course Objectives: Upon completion ofthis course the student should be able to:

COB1: Understand raw material as source of herbal drugs from cultivation to herbal drug product

COB2: know the WHO and ICH guidelines for evaluation of herbal drugs

COB3: know the herbal cosmetics, natural sweeteners, nutraceuticals 4. appreciate patenting of herbal drugs, GMP.

Course Outcomes:

Course Outcomes	Statement
CO1 (L1)	**Describe** the Qualitative identification of extractsofcrude drugs.
CO2 (L2)	**Summarize** the standard parameters of Ayurvedic preparations
CO3 (L2)	**Summarize** the standard parameters ofherbal formulations.
CO4 (L4)	**Analyse** the Quantitative analysis ofextracts ofcrude drugs.
CO5 (L5)	**Evaluate** the crude drugs by monographic analysis
CO6 (L6)	**Design** and **formulate** the herbal product preparations and evaluate them.

Course Content **4 Hours / Week**

List of experiments:

Expt. No	Title	CO
1.	To performpreliminary phytochemical screening of crude drugs.	**CO1**
2.	Determination ofthe alcoholcontent of Asava and Arista	**CO2**
3.	Evaluation of excipients of naturalorigin	**CO3**
4.	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.	**CO4**
5.	Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.	**CO4**
6.	Monograph analysis of herbal drugs fromrecent Pharmacopoeias	**CO5**
7.	Determination of Aldehyde content	**CO6**
8.	Determination of Phenolcontent	**CO6**
9.	Determination oftotal alkaloids	**CO6**

REFERENCES:

1. Textbookof Pharmacognosy by Trease & Evans.
2. Textbookof Pharmacognosy by Tyler, Brady& Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essentialof Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Controlof Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

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BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

Subject Code: BP604T

Course Objectives: Upon completion ofthis course the student should be able to:

COB1: Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.

COB2: Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.

COB3: To understand the concepts of bioavailability and bioequivalence of drugproducts and their significance and understand various pharmacokinetic parameters, their significance & applications.

Course Outcomes:

Course outcome	Statement
CO1 (L1)	Describe about the concepts, factors and study models of absorption, distribution and protein binding.
CO2 (L1)	Describe about the concepts, factors and study models ofelimination.
CO3 (L2)	Discuss about protocols ofthe bioavailability and bioequivalence studies
CO4 (L2)	Explain about the various pharmacokinetic models, assessment of parameters using one compartment model and their significance.
CO5 (L2)	Explain about the two-compartment model, assessment of parameters and understand the calculation of loading dose, maintenance dose and describe the clinical setting.
CO6 (L1)	Describe about the concepts of non-linear pharmacokinetics and assessment of parameters.

Course Content: **45 Hours**

Unit-I **10 Hours**

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volumeof drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

Unit-II **10 Hours**

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

Unit-III **10 Hours**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartmentmodels, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E ,t1/2,Vd,AUC,Ka, Clt andCL_R- definitions methods of eliminations, understanding of their significance and application.

Unit-IV **8 Hours**

Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

Unit-V **7 Hours**

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.

C. Michaelis-menton method ofestimating parameters, Explanation with example of drugs.

REFERENCES:

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: ByMilo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, ByMilo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. ClinicalPharmacokinetics, Concepts and Applications: ByMalcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, ByMack Publishing Company, Pennsylvnia

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PHARMACEUTICAL BIOTECHNOLOGY (Theory)

Subject Code: BP605T

Course Objective: Upon completion ofthis course the student should be able to:

COB1: The course aims to provide comprehensive understanding of biotechnological principles and techniques relevant to pharmaceutical sciences.

COB2: Will understand the drug development process, and explore the production

COB3: Understand regulatory aspects of biopharmaceuticals, equipping them with the skills and knowledge necessary for a career in the pharmaceutical industry.

Course Outcomes:

Course Outcomes	Statement
CO1(L1)	**Describe** basics of biotechnology including genetic engineering, Protein Engineering and Production of Enzymes, enzymes immobilization and biosensors.
CO2(L2)	**Summarize** the concept of Genetic engineering, Study of Recombinant DNA technology, PCR and production of biotechnological products.
CO3(L4)	**Classify** about the immune system, Hypersensitivity reactions, Monoclonal antibodies and vaccines.
CO4(L2)	**Explain** the importance of various immunological techniques i.e., Microbial genetics, Microbial biotransformation and Mutation.
CO5(L1)	**Describe** fermentation technology, production of various pharmaceutical products.
CO6(L2)	**Discuss** about the Collection, Processing and Storage of Blood Products.

Course Content: **45 Hours**

Unit I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
b) Enzyme Biotechnology- Methodsofenzyme immobilization and applications.
c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
d) Brief introduction to Protein Engineering.
e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
f) Basic principles ofgenetic engineering.

Unit – II **10 Hours**

a) Studyofcloning vectors, restriction endonucleases and DNA ligase.
b) Recombinant DNAtechnology. Application ofgenetic engineering in medicine.
c) Application ofr DNAtechnologyand genetic engineering in the production of:
i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
d) Brief introduction to PCR

Unit - III **10 Hours**

Types of immunity- humoral immunity, cellular immunity
a) Structure of Immunoglobulins
b) Structure and Function of MHC

c) Hypersensitivityreactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stabilityofofficial vaccines
f) Hybridoma technology- Production, Purification and Applications
g) Blood products and Plasma Substituties.

Unit IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Genetic organization of Eukaryotes and Prokaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
d) Introductionto Microbial biotransformation and applications.
e) Mutation: Types of mutation/mutants.

Unit V **07 Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
b) large scale production fermenter design and its various controls.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

REFERENCES:

1.B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2. RA Goldshyet. al.,: Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

Text Books:

1. Pharmaceutical Biotechnology (Concepts and Applications) by Gary Walsh.
2. Atextbook of Biotechnology by Dr. R.C. Dubey.
3. Biotechnology by U.Satyanarayana

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PHARMACEUTICAL QUALITY ASSURANCE (Theory)

Subject Code: BP606T

Course Objectives: Upon completion of the subject student shall be

COB1: Understand the cGMP aspects in pharmaceutical industry

COB2: Importance of documentation in pharmaceutical industry

COB3: Understand the scope ofqualitycertifications applicable to pharmaceutical industries

COB4: Understand the responsibilities of QA & QC.

Course Outcomes:

Course Outcome	Statement
CO1 [L1]	**Enumerate** Quality Assurance and Quality Management concepts Total Quality Management (TQM), Quality bydesign (QbD)
CO2 [L2]	**Understand** The ICH Guidelines, ISO 9000 & ISO14000: NABL accreditation.
CO3 [L2]	**Classify** the Organization and personnel, Premises, Equipment's and raw materials.
CO4 [L1&2]	**Evaluate** the pharmaceutical Quality Control, Good Laboratory Practices.
CO5 [L5]	**Determine & Solve** Document maintenance in pharmaceutical industry, Complaints
CO6 [L1&2]	**Integrate:** Calibration and Validation

Course Content: **45 HOURS**

UNIT-I **10 Hours**

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

Quality by design (QbD): Definition, overview, elements ofQbD program, tools

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration

NABL accreditation: Principles and procedures -

UNIT-II **10 Hours**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records. **Premises:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipment's and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT-III **10 Hours**

Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Non clinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT- IV **08 Hours**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT-V **07 Hours**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

REFERENCES:

1] Quality Assurance guide by organisation of pharmaceutical products of India. **2]** Good Laboratory Practice Regulations, 2nd Edition, Sandy Weingberg Vol.69. **3]** How to practice GMPs -P P Sharma

4] B. T. Loftus & R. A. Nash, "Pharmaceutical Process Validation", Drugs and Pharm Sci. Series, Vol. 129, 3rd Ed., Marcel Dekker Inc.,

5] Analytical Method validation and Instrument Performance Verification by Churg Chan, Heiman Lam, Y.C. Lee, Yue. Zhang, Wiley Inter Science.

Semester: VII

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INSTRUMENTAL METHODS OF ANALYSIS (Theory)

SUBJECT CODE: BP701T

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

COB1: Understand the interaction of matter with electromagnetic radiations and its applications in drug.

COB2: Understand the chromatographic separation and analysis of drugs.

COB3: Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L2]	**Demonstrate** and **explain** about UV - Visible Spectroscopy and Fluorimetry along with its applications.
CO2 [L1]	**Describe** about Infra-red Spectroscopy, Flame Photometry along with its applications.
CO3 [L3]	**Determine** about Atomic Absorption Spectroscopy and Nephelo turbidometry along with its applications.
CO4 [L4]	**Classify** about Types of Chromatography like Column and Paper.
CO5 [L6]	**Develop** the techniques of TLC and Electrophoresis.
CO6 [L5]	**Recommend** the Principles, Instrumentation & Applications of Gas Chromatography, and High-Performance Liquid Chromatography, Ion – Exchange Chromatography, Gel and Affinity Chromatography.

Course Content **45 HOURS**

UNIT-I **10 Hours**

UV Visible Spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multicomponent analysis.

Fluorimetry - Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, Instrumentation and applications.

UNIT-II **10 Hours**

IR Spectroscopy - Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations.**Instrumentation** - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications.

Flame Photometry - Principle, interferences, instrumentation and applications.

Atomic Absorption Spectroscopy- Principle, interferences, instrumentation and applications.

Nepheloturbidometry- Principle, instrumentation and applications.

UNIT-III **10 Hours**

INTRODUCTION TO CHROMATOGRAPHY

Adsorption and Partition Column Chromatography - Methodology, advantages, disadvantages and applications.

Thin Layer Chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper Chromatography - Introduction, methodology, development techniques, advantages, disadvantages and applications.

Electrophoresis – Introduction, factors affecting electrophoretic mobility, Techniques of paper, Gel, capillary electrophoresis, applications.

UNIT- IV **08 Hours**

Gas Chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and application.

High Performance Liquid Chromatography (HPLC) - Introduction, theory, instrumentation, advantages and applications.

UNIT-V **07 Hours**

Ion Exchange Chromatography - Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel Chromatography - Introduction, theory, Instrumentation and applications.

Affinity Chromatography - Introduction, Theory, Instrumentation and applications.

REFERENCES:

1] Instrumental Methods of Chemical Analysis by B.K Sharma.

2] Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake.

3] Instrumental Methods of chemical Analysis by G. R. Chatwal & K. Anand.

4] Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel.

5] Organic spectroscopy by Y.R. Sharma.

6] Text book of Pharmaceutical Analysis by Kenneth A. Connors.

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INSTRUMENTAL METHOD OF ANALYSIS (Practical)

Subject Code: BP705P

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

COB1: Understand the interaction of matter with electromagnetic radiations and its applications in drug.

COB2: Understand the chromatographic separation and analysis of drugs.

COB3: Perform quantitative & qualitative analysis of drugs using various analytical Instruments.

Course Outcomes:

Course Outcome	Statement
CO1 [L1]	**State** the Calibration of UV – Visible Spectrophotometer.
CO2 [L3]	**Determination** of Absorption Maxima of Potassium Permanganate and effect of solvent on absorption spectrum of Phenol using UV – Visible Spectrophotometer.
CO3 [L3]	**Calculation** of the Qualityand Quantity of the various drug substances by using UV – Visible Spectrophotometer.
CO4 [L5]	**Evaluation** of Quality and Quantity of the various drug substances by using Fluorimetry, Nephelometry and Flame Photometry.
CO5 [L4]	**Characterization** and Separation of Amino acids and sugars by various techniques of chromatography like Column, Paper and TLC.
CO6 [L2]	**Demonstration** on HPLC and GC.

Course Content **4 Hours / Week**

List Of Experiments:

Expt. No	Title	CO
1.	Calibration of UV – Visible Spectrophotometer.	**CO1**
2.	Determination of Absorption Maxima of Potassium Permanganate	**CO2**
3.	Effect of Solvent on Absorption Spectrum of Phenol using UV – Visible Spectrophotometer.	**CO2**
4.	Assay of Paracetamol by using Specific Absorbance value.	**CO3**
5.	Assay of Paracetamol by Chemical Derivatization Method.	**CO3**
6.	Estimation of Salicylic Acid by Calibration Curve Method.	**CO3**
7.	Estimation of Sulphanilamide eye drops by Colorimetry.	**CO3**
8.	Estimation of Quinine Sulphate by Fluorimetry.	**CO4**
9.	Estimation of Sulphates by Nephelometry.	**CO4**
10.	Determination of Sodium Ion Concentration in unknown sample by Flame Photometry.	**CO4**
11.	Determination of Potassium Ion Concentration in unknown sample by Flame Photometry.	**CO4**
12.	Separation and Identification of amino acids by using Ascending paper chromatography.	**CO5**

13.	Separation and Identification of amino acids by using Radial paper chromatography.	**CO5**
14.	Preparation of Thin Layer Chromatographic Plates.	**CO5**
15.	Separation and Identification of Sugars byusing Thin Layer Chromatography.	**CO5**
16.	Separation and Identification of Plant Pigments by Column chromatography.	**CO5**
17.	Demo on HPLC.	**CO6**
18.	Demo on Gas Chromatography.	**CO6**

REFERENCES:

1] Instrumental Methods of Chemical Analysis by B.K Sharma.

2] Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake.

3] Instrumental Methods of chemical Analysis by G. R. Chatwal & K. Anand.

4] Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel.

5] Organic spectroscopy by Y.R. Sharma.

6] Text bookof Pharmaceutical Analysis by Kenneth A. Connors.

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INDUSTRIAL PHARMACY-II (Theory)

SUBJECT CODE: BP702T

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

COB1: Know the process of pilot plant and scale up of pharmaceutical dosage

COB2: Understand the process oftechnology transfer from lab scale to commercial batch

COB3: Know different Laws and Acts that regulate pharmaceutical industry

COB4: Understand the approval process and regulatory requirements for drug product

Course Outcomes:

Course Outcome	STATEMENT
CO1(L1)	**Identify** various concept of Pilot plant general considerations, scale up considerations for solids, liquid orals, semi solids, SUPAC guidelines, platform technology(Remember)
CO2(L2)	**Demonstrate** the guidelines for Technology Transfer, Commercialization - practical aspects, Technology Transfer agencies, MoUs. (Understand)
CO3(L5)	**Assess** historical overview , Role & responsibilities of Regulatory Affairs & Regulatory authorities (Evaluate)
CO4(L2)	**Explain** the bio-equivalence studies and data submission for FDA (Understand)
CO5(L2)	**Discuss** various keyconcepts to develop Quality management & Certifications and Quality by Designs. (Understand)
CO6(L2)	**Explain** the Indian Regulatoryrequirements. (Understand)

Course Content **45 HOURS**

UNIT I **10Hours**

Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology

UNIT II **10 Hours**

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues

UNIT III **10 Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General

considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies

UNIT IV **08 Hours.**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

UNIT V **07 Hours**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

References

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs
2. International Regulatory Affairs Updates, 2005 Available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text bookof FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought bylearning plus, inc. available at http.//www.cgmp.com/ra.html

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PHARMACY PRACTICE (Theory)

SUBJECTCODE: BP703T

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

COB1: Know various drug distribution methods in a hospital

COB2: Appreciate the pharmacy stores management and inventory control

COB3: Monitor drug therapy of patient through medication chart review and clinical review

COB4: Obtain medication history interview and counsel the patients

COB5: Identify drug related problems

COB6: Detect and assess adverse drug reactions

COB7: Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states

COB8: Know pharmaceutical care services

COB9: Do patient counseling in community pharmacy;

COB10: Appreciate the concept of Rational drug therapy.

Course Outcomes:

Course Outcome	STATEMENT
CO1(L1)	**Describe** Hospital organization and detect and assess adverse drug reactions, reporting and its management. (REMEMBER)
CO2(L2)	**Explain** various drug distribution methods system in the hospital, and monitor drug therapy of patient, role pharmacist in medication adherence and community pharmacy management. (REMEMBER)
CO3(L2)	**Explain** how to obtain medication history interview, Pharmacyand Therapeutic committee, information services, counselling. (REMEMBER)
CO4(L2)	**Explain** Education and training program in the hospital, Prescribed medication order and communication skills. (REMEMBER)
CO5(L1)	**Describe** medication of management, budget preparation and its implementation, and also help in rational use of common over the counter medication. (REMEMBER)
CO6(L2)	**Explain** pharmacy stores and inventory control management and able to interpret selected laboratory results of specific disease states and controlling of investigational use of drug. (REMEMBER)

Course Content **45 Hours**

Unit I: **10 Hours**

a) **Hospital and it's organization**

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

b) **Hospital pharmacy and its organization**

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) **Adverse drug reaction**

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden

Withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: 10 Hours

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing ofcontrolled drugs.

b) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during theTherapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence,and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III: 10 Hours

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stoporder, and emergency drug list preparation.

b) Drug information service

Drug and Poison information centre, Sources of drug information, Computerisedservices, and storage and retrieval of information.

c) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Specialcases that require the pharmacist

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills-communication with prescribers and patients

Unit IV **8 Hours**

a) **Budget preparation and implementation**

Budget preparation and implementation

b) **Clinical Pharmacy**

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) **Over the counter (OTC) sales**

Introduction and sale of over the counter, and Rational use of common over thecounter medications.

Unit V **7 Hours**

a) **Drug store management and inventory control**

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

b) **Investigational use of drugs**

Description, principles involved, classification, control, identification, role of hospitalpharmacist, advisory committee.

c) **Interpretation of Clinical Laboratory Tests**

Blood chemistry, hematology, and urinalysis

References:

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4thed.Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of ClinicalPharmacy Practice- essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5thed. Philadelphia: Lea & Febiger;1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society ofHealth System Pharmacists Inc; 2009.
6. Parmar N.S. *Health Education and Community Pharmacy,* 18th ed. India: CBSPublishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacypractice. ISSN : 0974-8326
3. American journal of health systempharmacy. ISSN: 1535-2900 (online)
4. Pharmacytimes (Monthly magazine)

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NOVEL DRUG DELIVERY SYSTEM (Theory)

Course Code: BP704T
Course Objective: At the end of the course students will be able to
COB 1: To understand various approaches for development of novel drug delivery systems.
COB 2: To apply the criteria for selection of drugs and polymers in novel formulations
COB3: To formulate and evaluate Novel drug delivery systems effectively.

Course Outcomes:

Course Outcomes	Statement
CO1(L1)	**Describe** the Concepts various approaches for development ofnoveldrug delivery systems. Know various polymers used in formulation of controlled release drug delivery systems.
CO2(L2)	**Summarize** the salient features of methods of microencapsulation, formulation considerations of buccal delivery systems, implants and osmotic pumps.
CO3(L2)	**Explain** the importance of formulation approaches of Transdermal Drug Delivery Systems, Gastroretentive drug delivery systems, Naso pulmonary drug delivery system.
CO4(L4)	**Classify** and **explain** approaches and applications of liposome's, noisome, nanoparticles etc.
CO5(L1)	**Describe** the salient features of methods to Overcome Preliminary study, ocular formulations and ocuserts,
CO6(L6)	**Development** of intra uterine devices (IUDs) and applications.

Course Content: **45 Hours**

Unit-I **10 Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles.

Physicochemical and biological properties of drugs relevant to controlled release Formulations.
Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II **10 Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications.
Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems.
Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implantsand osmotic pump.

Unit-III **10 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches.

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers.

Unit-IV **08 Hours**

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications.

Unit-V **07 Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and ocuserts.

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

References:

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery-concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Text Books:

1. Controlled Drug Delivery by Suresh P .Vyas and Roop k Khar
2. Novel Drug Delivery System by N K Jain
3. Biodegradable Polymers as Drug Delivery systems by Mark Chasin, Robert Langer.

Semester: VIII

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BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)

SUBJECT CODE: BP801T

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

COB1: Understand and apply basic statistical measures like correlation, mean, median, mode, range, and standard deviation in biostatistics contexts.

COB2: Utilize advanced statistical methods applicable to pharmacy, including regression analysis, probability theory, sampling techniques, and parametric/non-parametric tests.

COB3: Develop proficiency in designing and conducting experiments, especially in clinical trials and observational/experimental studies, to contribute effectively to pharmaceutical research.

Course outcomes:

Course Outcome	Statement
CO1 [L2]	**Discuss** the applications of Biostatics such as Correlation, Mean, Median, Mode, Range and standard deviation.
CO2 [L2]	**Discuss** the applications of Biostatics in Pharmacy such as Regression,Probability-theory, Sampling technique, Parametric tests and Non Parametric tests
CO3 [L4]	**Apprehend** the design of experiments for Phases of clinical trials and observational and experimental studies.
CO4 [L3]	**Accomplish** the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of experiment).
CO5 [L5]	**Accomplish** the statistical techniques in Design ofexperiments.
CO6 [L2]	**Explain** the statistical techniques in analysis of experiments.

Course contents **45 Hours**

Unit-I **10 Hours**

a. Introduction: Statistics and Biostatistics, Frequency Distribution
b. Measures of Central Tendency: Mean, Median, Mode -Pharmaceutical Examples
c. Measures of Dispersion: Dispersion, Range, Standard Deviation - Pharmaceutical Problems
d. Correlation: Definition, Karl Pearson's Coefficient of Correlation, Multiple Correlation-Pharmaceuticals Examples

Unit-II: **10 Hours**

a. Regression: Curve Fitting by the Method of Least Squares, Fitting the lines y= a + bx and x = a + by, Multiple Regression, Standard Error of Regression with Pharmaceutical Examples
b. Probability: Definition of Probability, Binomial Distribution, Normal Distribution, Poisson's Distribution, Properties with Problems
c. Sample, Population, Large Sample, Small Sample
d. Null Hypothesis, Alternative Hypothesis, Sampling, Essence of Sampling, Types of Sampling, Error-I type, Error-II type, Standard Error of Mean (SEM) with Pharmaceutical Examples
e. Parametric Tests: t-test, ANOVA, Least Significance Difference

Unit-III: **10 Hours**

a. Non-Parametric Tests: Wilcoxon Rank Sum Test, Mann-Whitney U Test, Kruskal-Wallis Test, Friedman Test

b. Introduction to Research: Need for Research, Need for Design of Experiments, Experiential Design Technique, Plagiarism
c. Graphs: Histogram, Pie Chart, Cubic Graph, Response Surface Plot, Counter Plot Graph
d. Designing the Methodology: Sample Size Determination and Power of a Study, Report Writing and Presentation of Data, Protocol, Cohort Studies, Observational Studies, Experimental Studies, Designing Clinical Trial, Various Phases

Unit-IV: **8 Hours**

a. Blocking and Confounding System for Two-Level Factorials
b. Regression Modeling: Hypothesis Testing in Simple and Multiple Regression Models
c. Introduction to Practical Components of Industrial and Clinical Trials Problems
d. Statistical Analysis Using Excel, SPSS, MINITAB, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V: **7 Hours**

a. Factorial Design (Definition, 2^2, 2^3 design, Advantage of Factorial Design)
b. Response Surface Methodology: Central Composite Design, Historical Design, Optimization Techniques.

References:

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2. Fundamentalof Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

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SOCIAL AND PREVENTIVE PHARMACY (Theory)

SUBJECT CODE: BP802T

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

COB1: Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.

COB2: Have a critical way of thinking based on current healthcare development.

COB3: Evaluate alternative ways of solving problems related to health and pharmaceutical issues

Course Outcomes:

Course Outcome	Statement
CO1 [L2]	Explain the concepts of health and diseases, Social and health education, Health and hygiene.
CO2 [L2]	Discuss about Prevention and control of diseases.
CO3 [L2]	Discuss about National health programs for HIV AND AIDS, TB, Integrated disease surveillance program (IDSP) & leprosy.
CO4 [L2]	Discuss about mentalhealth, deafness, Universal immunization programme, blindness, Pulse polio programme.
CO5 [L2]	Demonstrate about National health intervention programs for mother and child, family welfare, tobacco control, Malaria Prevention Programmes.
CO6 [L2]	Discuss about Community services and Functions of PHC, Improvement in rural, urban sanitation, Health promotion and education in school.

Course contents **45 HOURS**

UNIT I: **10 Hours**

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

UNIT II: **10 Hours**

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

UNIT III: **10 Hours**

National health programs, its objectives, functioning and outcome of the following:

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

UNIT IV: **08 Hours**

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

UNIT V: **07 Hours**

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

REFERENCES:

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

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PHARMA MARKETING MANAGEMENT (Theory)

Subject Code: BP803ET

Course Objective

COB1: To develop a comprehensive understanding of marketing principles, consumer behavior, and market analysis, with specific emphasis on the pharmaceutical industry.

COB2: To provide in-depth knowledge of product decision-making, including product lifecycle management, branding, and portfolio analysis, tailored to pharmaceutical products.

COB3: To equip students with the skills to design effective promotional strategies, manage pharmaceutical marketing channels, and implement pricing strategies while addressing regulatory frameworks like DPCO and NPPA.

Course Outcomes:

Course Outcome	Statement
CO1 [L1]	**Define** the fundamental concepts of marketing and differentiate between marketing and selling in the context of the pharmaceutical industry.
CO2 [L2]	**Explain** the components of the pharmaceutical market, including market segmentation, consumer profiles, and prescribing behaviors.
CO3 [L3]	**Apply** knowledge of product decisions such as product lifecycle management, branding, and packaging to develop strategies for pharmaceutical products.
CO4 [L4]	**Analyze** promotional strategies, including advertising, personal selling, and online techniques, to enhance pharmaceutical product outreach.
CO5 [L5]	**Evaluate** the design and management of pharmaceutical marketing channels, including conflict resolution and physical distribution tasks.
CO6 [L6]	**Design** pricing strategies and address challenges in price management, considering regulatory frameworks like DPCO and NPPA, and emerging marketing concepts.

Course contents **45Hours**

Unit I **10 Hours**

Marketing: Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research.

Unit II **10 Hours**

Product decision: Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit III **10 Hours**

Promotion: Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **08 Hours**

Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **07 Hours**

Pricing: Meaning, importance, objectives, and determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing: Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

References

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt: Global Perspective, IndianContext, Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) ExcelPublications.

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PHARMA REGULATORY SCIENCE (Theory)

Subject Code: BP 804 ET

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

COB1: Know about the process of drug discovery and development

COB2: Understand the regularatory authorities governing the manufacture and sale the pharmaceuticals.

COB3: Know the regulatory approval process and their registration in Indian and international markets.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L4]	**Analyze** the stages of drug discovery and development, including pre-clinical and clinical studies.
CO2 [L2]	**Explain** the regulatory approval processes and timelines for IND, NDA, and ANDA applications in various regions
CO3 [L2]	**Demonstrate** the procedures for exporting pharmaceutical products, including technical documentation and drug registration requirements
CO4 [L6]	**Develop** clinical trial protocols and outline the roles and responsibilities of investigators, sponsors, and monitors in clinical trials
CO5 [L5]	**Evaluate** pharmacovigilance practices and the importance of safety monitoring in clinical trials
CO6 [L1]	**Enumerate** basic regulatory concepts, terminologies, and the importance of regulatory documents such as the Orange Book and Purple Book

Course Content **45 HOURS**

UNIT-I **10 Hours**

New Drug Discovery and development

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT-II **10 Hours**

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

UNIT-III **10 Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research

UNIT- IV **08 Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.

UNIT-V **07 Hours**

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

REFERENCES:

1) Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2) The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3) New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4) Guidebook for drug regulatory submissions / Sandy Weinberg. ByJohn Wiley & Sons. Inc.
5) FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6) Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7) Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8) Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9) Drugs: From Discovery to Approval, Second Edition

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PHARMACOVIGILANCE (Theory)

Subject Code: BP 805ET

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

COB1: To provide a comprehensive understanding of the science and activities related to the detection, assessment, understanding, and prevention of adverse effects or any drug-related problems.

COB2: To familiarize with the methods and practices used in monitoring drug safety and the regulatory requirements for Pharmacovigilance.

COB3: To recognize the significance of Adverse Drug Reactions (ADRs) and their impact on public health.

Course Outcomes:

Course Outcome	STATEMENT
CO1 (L1)	**Describe** the principles and importance of Pharmacovigilance in ensuring the safety and efficacy of medications.
CO2 (L2)	**Classify** Adverse Drug Reactions (ADRs) and **explain** their mechanisms and management strategies.
CO3 (L3)	**Demonstrate** the ability to report ADRs using standard guidelines and tools, such as CDSCO forms and WHO forms.
CO4 (L4)	**Analyze** Pharmacovigilance data to identify trends and patterns that contribute to improving drug safety.
CO5 (L5)	**Evaluate** the role of national and international regulatory authorities in Pharmacovigilance and their frameworks
CO6 (L6)	**Collaborate** in the design and **implement** Pharmacovigilance programs in healthcare settings.

Course Content **45 Hours**

Unit I **10 Hours**

Introduction to Pharmacovigilance

- History and Development of Pharmacovigilance
- Importance of Safety Monitoring of Medicine
- WHO International Drug Monitoring Programme
- Pharmacovigilance Program of India (PvPI)

Introduction to adverse drug reactions

- Definitions and classification of ADRs
- Detection and reporting
- Methods in Causality Assessment
- Severity and seriousness assessment
- Predictability and preventability assessment
- Management of adverse drug reactions

Basic terminologies used in Pharmacovigilance

- Terminologies of adverse medication-related events
- Regulatory terminologies

Unit II **10 Hours**

Drug and disease classification

- Anatomical, therapeutic and chemical classification of drugs

- International classification of diseases
- Daily defined doses
- International Non-proprietary Names for Drugs

Drug dictionaries and coding in Pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and Standardized MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in Pharmacovigilance

- Basic drug information resources
- Specialized resources for ADRs

Establishing Pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of a drug safety department in industry
- Contract Research Organizations (CROs)

Unit III **10 Hours**

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross-sectional study, case-control study and cohort study
- Targeted Clinical Investigations

Communication in Pharmacovigilance

- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis Management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Unit IV **8 Hours**

Safety data generation

- Pre-clinical phase
- Clinical phase

Post-approval phase (PMS)

- ICH Guidelines for Pharmacovigilance
- Organization and objectives of ICH
- Expedited reporting
- Individual case safety reports
- Periodic safety update reports
- Post-approval expedited reporting
- Pharmacovigilance planning
- Good clinical practice in Pharmacovigilance studies

Unit V **7 Hours**

Pharmacogenomics of adverse drug reactions

- Genetics-related ADR with example focusing PK parameters**.**

Drug safety evaluation in special population

- Pediatrics

- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Group
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and Schedule Y
- Differences in Indian and global Pharmacovigilance requirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z by Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller, Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones & Bartlett Publishers.
7. Textbook of Pharmacoepidemiology edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy, and Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills: G. Parthasarathi, Karin Nyfort Hansen, Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Textbook of Pharmacovigilance: concept and Practice by GP Mohanta and PK Manna

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QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Subject Code: BP 806 ET

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

COB1: Know WHO guidelines for quality control of herbal drug

COB2: know Quality assurance in herbal drug industry

COB3: know the regulatory approval process and their registration in Indian and international markets , EU and ICH guidelines for quality control of herbal drugs

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L1]	**Recall** the basic tests for drugs, pharmaceutical substances, and medicinal plant materials.
CO2 [L2]	**Comprehend** the WHO guidelines for quality control of herbal drugs and medicinal plants.
CO3 [L3]	**Analyze** the quality assurance parameters in the herbal drug industry, including cGMP, GAP, and GLP
CO4 [L4]	**Apply** EU and ICH guidelines for quality control of herbal drugs in research and development.
CO5 [L5]	**Synthesize** information to design stability testing protocols for herbal medicines.
CO6 [L6]	**Evaluate** the regulatory requirements for herbal medicines, including pharmacovigilance and pharmacopoeias.

Course Content **45 HOURS**

UNIT-I **10 Hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms
WHO guidelines for quality control of herbal drugs.
Evaluation of commercial crude drugs intended

UNIT-II **10 Hours**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine.
WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines
WHO Guidelines on GACP for Medicinal Plants.

UNIT-III **10 Hours**

EU and ICH guidelines for quality control of herbal drugs.
Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

UNIT- IV **08 Hours**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.
Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.

UNIT-V **07 Hours**

Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.
Role of chemical and biological markers in standardization of herbal products

REFERENCES:

1. "Pharmacognosy" by Trease and Evans (Latest Edition) - A classic textbook covering pharmacognosy fundamentals.
2. "Pharmacognosy" by Kokate, Purohit, and Gokhale (Latest Edition) - Comprehensive coverage of pharmacognosy and phytochemistry.
3. "Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals" by P.W. Mukherjee (2002) - Focuses on quality control aspects of herbal drugs.
4. "Herbal Drug Technology" by S.S. Aggrawal (2002) - Covers herbal drug technology and application.
5. "Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products" by EMEA (Latest Edition) - Essential for understanding European regulatory guidelines.
6. "Quality Control Methods for Medicinal Plant Materials" by WHO (1998) - Provides WHO guidelines on quality control methods.
7. "WHO Guidelines for the Appropriate Use of Herbal Medicines" by WHO (1998) - Offers global guidelines for herbal medicine use.

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COMPUTER AIDED DRUG DESIGN (Theory)

Subject Code: BP 807 ET

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

COB1: To understand the stages of drug discovery and development, including lead identification, bioisosterism , and analog-based drug design.

COB2: To explore the principles of SAR, QSAR, and molecular modeling techniques for virtual screening and drug optimization.

COB3: To apply bioinformatics and chemoinformatics tools, along with molecular mechanics and quantum mechanics, for efficient drug design and analysis.

Course Outcomes

Course Outcome	Statement
CO1[L2]	**Understand** the stages of drug discovery and development, including rational and serendipitous approaches to lead discovery.
CO2[L3]	**Apply** knowledge of bioisosterism and its classification to perform analog-based drug design, including case study analysis.
CO3[L4]	**Analyze** the relationship between SAR and QSAR, and evaluate physicochemical parameters using experimental and theoretical methods.
CO4[L6]	**Develop** skills in molecular modeling techniques, including pharmacophore mapping, virtual screening, and docking-based screening.
CO5[L6]	**Design** new drug candidates using de novo drug design methods, leveraging ADME and biochemical databases.
CO6[L5]	**Evaluate** molecular mechanics and quantum mechanics principles for energy minimization and conformational analysis in drug design.

Course contents **45 Hours**

UNIT-I **10 Hours**

Introduction to Drug Discovery and Development Stages of drug discovery and development Lead discovery and Analog Based Drug Design Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies

UNIT-II **10 Hours**

Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III **10 Hours**

Molecular Modeling and virtual screening techniques Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design.

UNIT-IV **08 Hours**

Informatics & Methods in drug design Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT-V **07 Hours**

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.

References:

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.Martin YC. "Quantitative Drug Design" Dekker, New York.
2. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
3. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
4. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" WileyInterscience.
5. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
6. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford UniversityPress.
7. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design"Wright Boston.
8. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action"Academic Press New York.

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CELL AND MOLECULAR BIOLOGY (Theory)

Subject Code: BP808ET

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

COB1: Summarize the history of cell and molecular biology, cellular functioning and composition, the chemical foundations of cell biology

COB2: Describe DNA properties and its relevance to cell biology& protein structure, function, and synthesis mechanisms

COB3: Describe cellular membrane structure and basic molecular genetic mechanisms and summarize the cell cycle processes

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L2]	**Explain** the basics, history, and applications of cell and molecular biology.
CO2 [L3]	**Compare** prokaryotic and eukaryotic cells and describe cellular reproduction mechanisms.
CO3 [L4]	**Analyze** DNA, RNA types, and their transcription and translation processes.
CO4 [L5]	**Evaluate** protein structures and their pathways in cellular processes.
CO5 [L2]	**Understand** the cell cycle, checkpoints, and cellular activities.
CO6 [L4]	**Analyze** cell signaling pathways, their misregulation, and receptor functioning.

Course Content: **45Hours**

UNIT I: Introduction to Cell and Molecular Biology **10 Hours**

- Definitions, theory, basics, and applications.
- History and summation of cell and molecular biology.
- Properties of cells and the cell membrane.
- Prokaryotic vs. Eukaryotic cells.
- Cellular reproduction.
- Chemical foundations, reactions, and types.

UNIT II: Molecular Information Flow **10 Hours**

- DNA structure, functioning, and flow of molecular information.
- Types of RNA and their roles.
- Processes of transcription and translation.

UNIT III: Proteins and Cellular Processes **10 Hours**

- Protein definition and amino acids.
- Protein structure and pathway regularities.
- Positive control and the significance of protein synthesis.

UNIT IV: Genetics and the Cell Cycle **08 Hours**

- Fundamentals of genetics and genomic analysis.
- Transgenics and its applications.
- Cell cycle analysis, mitosis, and meiosis.
- Cellular activities and checkpoint mechanisms.

UNIT V: Cell Signaling **07 Hours**

- Introduction to cell signals and receptors.
- Overview of signaling pathways and their misregulation.
- Functions of protein kinases.

References:

1.W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientificpublications, 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. Edward: Fundamentals of Microbiology.

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COSMETIC SCIENCE (Theory)

SUBJECT CODE: BP 809ET

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

COB1: Theoretical Principles and applications covers the fundamental aspects of cosmetic science that are necessary to understand material development, formulation, and the dermatological effects that result from the use of these products.

COB2: The role by offering a comprehensive view of cosmetic science and technology, including environmental and dermatological concerns.

Course Outcomes:

Course Outcome	Statement
CO1 [L1]	Identify the key ingredients used in cosmetics and cosmeceuticals.
CO2 [L1]	List out various formulations of cosmetics and cosmeceuticals, determine principles of formulation and building blocks of skin, hair, oralcare products.
CO3 [L3]	Determine current technologies, mechanisms in the market for selection And developing cosmetics and cosmeceuticals.
CO4 [L4]	Categorize key ingredients, analytical cosmetics and basic science to develop cosmetics and cosmeceuticals.
CO5 [L6]	Construct Scientific knowledge to develop cosmetics and cosmeceuticals, principles of cosmetic Evaluation.
CO6 [L2]	Discuss Cosmetic problems associated with hair and scalp, skin.

Course contents **45Hours**

UNIT I **10Hours**

Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II **10 Hours**

Principles of formulation and building blocks of skin care products:

Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. **Antiperspants & deodorants**- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner,anti-dandruff shampoo. Hair oils.

Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:
Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove **Analytical cosmetics:** BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**

UNIT IV **08 Hours**.
Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Colour, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.

UNIT V **07 Hours**
Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.
Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odour. Antiperspirants and Deodorants- Actives and mechanism of action

REFERENCES:

1) Harry's cosmetology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4 th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmetology, by Sanju Nanda & Roop K. Khar, Tata Publishers.

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PHARMACOLOGICAL SCREENING METHODS (Theory)

SUBJECT CODE: BP810ET

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

COB1: Appreciate the applications of various commonly used laboratory animals.
COB2: Appreciate and demonstrate the various screening methods used in preclinical research
COB3: Appreciate and demonstrate the importance of biostatistics and research methodology
COB4: Design and execute a research hypothesis independently

Course Outcomes:

Course Outcome	Statement
CO1 [L2]	**Recall** the applications of commonly used laboratory animals.
CO2 [L3]	**Understand** various screening methods used in preclinical research.
CO3 [L4]	**Apply** ethical and regulatory guidelines in laboratory animal research.
CO4 [L5]	**Analyze** research data using biostatistical tools.
CO5 [L2]	**Evaluate** scientific literature to design research hypotheses.
CO6 [L4]	**Create** research findings for presentation and publication.

Course Content: **45 Hours**

UNIT I: Laboratory Animals: **10 Hours**

- Study of CPCSEA and OECD guidelines for maintenance, breeding
- and conduct of experiments on laboratory animals, Common lab
- animals: Description and applications of different species and strains
- of animals. Popular transgenic and mutant animals.
- Techniques for collection of blood and common routes of drug
- administration in laboratory animals, Techniques of blood collection
- and euthanasia.

UNIT II: Preclinical screening models **10 Hours**

- Introduction: Dose selection, calculation and conversions,
- Preparation of drug solution/suspensions, grouping of animals and
- Importance of sham negative and positive control groups.
- Rationale for selection of animal species and sex for the study.
- Study of screening animal models for Diuretics,
- Nootropics, anti-Parkinson's, antiasthmatics,
- Preclinical screening models: for CNS activity- analgesic,
- Antipyretic,anti-inflammatory, general anaesthetics, sedative and
- Hypnotics, antipsychotic, antidepressant, antiepileptic,
- Antiparkinsonism, alzheimer's disease

UNIT III: Preclinical screening models: for ANS activity, **10 Hours**

- Sympathomimetics,
- Sympatholytics
- Parasympathomimetics
- Parasympatholytics,
- Skeletal muscle relaxants,

- Drugs acting on eye, local anaethetics

UNIT IV: Preclinical screening models: 08 Hours

- Preclinical screening models: for CVS activity- antihypertensives,
- diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory,
- coagulants, and anticoagulants
- Preclinical screening models for other important drugs like antiulcer,
- antidiabetic, anticancer and antiasthmatics.

UNIT V: Research methodology and Bio-statistics 07 Hours

- Selection of research topic, review of literature, research hypothesis
- and study design
- Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA.
- Graphical representation of data.

References:

1. Fundamentals of experimental Pharmacology-by M.N. Ghosh
2. Hand book of Experimental Pharmacology-S.K. Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J. Richard

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ADVANCED INSTRUMENTATION TECHNIQUES (Theory)

Subject Code: BP 811 ET

Course Objectives:

Upon completion of the course the student shall be able to

COB1: Understand the advanced instruments used and its applications in drug analysis.

COB2: Understand the chromatographic separation and analysis of drugs.

COB3: Understand the calibration of various analytical Instruments, analysis of drugs using various analytical Instruments.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L1]	**Describe** about Nuclear Magnetic Resonance Spectroscopy and Mass Spectroscopy along with its applications.
CO2 [L1]	**State** about Introduction, Principle, Theory, Instrumentation and Thermal Method of Analysis.
CO3 [L2]	**Explain** about X – Ray Diffraction Methods – origin of X- Rays and its concept, crystallography along with its applications.
CO4 [L5]	**Summarize** about Calibration and Validation as per ICH and USFDA guidelines.
CO5 [L3]	**Choose** the calibration of Instruments like Electronic balance, UV – Visible Spectrophotometer, IR, Fluorimeter, Flame Photometer, HPLC and GC.
CO6 [L4]	**Classify** about and types of Radio Immuno Assays and Extraction Techniques, Hyphenated Techniques like LC – MS/MS, GC – MS/MS, HPTLC – MS/MS.

Course contents **45 HOURS**

UNIT-I **10 Hours**

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications.

MASS SPECTROMETRY - Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers -Time of flight and Quadrupole, instrumentation, applications.

UNIT-II **10 Hours**

THERMAL METHODS OF ANALYSIS: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry.

X-RAY DIFFRACTION METHODS: Origin of X-rays, basic aspects of crystals, X - ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT-III **10 Hours**

CALIBRATION AND VALIDATION - as per ICH and USFDA guidelines

CALIBRATION OF FOLLOWING INSTRUMENTS

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC.

UNIT- IV **08 Hours**

RADIO IMMUNE ASSAY: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno Assay.

EXTRACTION TECHNIQUES: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction.

UNIT-V **07 Hours**

HYPHENATED TECHNIQUES - LC-MS/MS, GC-MS/MS, HPTLC-MS.

REFERENCES:

1] Instrumental Methods of Chemical Analysis by B.K Sharma.
2] Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake.
3] Instrumental Methods of chemical Analysis by G. R. Chatwal & K. Anand.
4] Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel.

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DIETARY SUPPLEMENTS AND NUTRACEUTICALS (Theory)

Subject Code: BP 812 ET

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

COB1: Understand the need of supplements by the different group of people to maintain healthy life.

COB2: Understand the outcome of deficiencies in dietary supplements.

COB3: Appreciate the components in dietary supplements and the application and the regulatory and commercial aspects of dietary supplements including health claims.

Course Outcomes:

Course Outcome	STATEMENT
CO1 [L2]	**Explain** about Nutraceuticals, Public health nutrition and Medicinal uses and health benefits of as nutraceuticals/functional foods.
CO2 [L1]	**Describe** about Phytochemicals as nutraceuticals: Occurrence and characteristic features.
CO3 [L3]	**Describe** free radicals and Dietary fibres & complex carbohydrates as functional food ingredients.
CO4 [L4]	**Discuss** the free radical mechanism in various diseases and disorders, Various Antioxidants and Functional foods for chronic disease prevention
CO5 [L6]	**List** the Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.
CO6 [L5]	**Summarize** the Regulatory aspects on food safety and adulteration and Pharmacopoeial Specifications for dietary supplements and nutraceuticals

Course Contents **45 HOURS**

UNIT-I **07 Hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT-II **15 Hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin
b) Sulfides: Diallyl sulfides, Allyl trisulfide.
c) Polyphenolics: Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans
g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats,

wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT-III **07 Hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional food ingredients.

UNIT- IV **10 Hours**

a. Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b. Antioxidants: Endogenous antioxidants– enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α-Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c. Functional foods for chronic disease prevention

UNIT-V **06 Hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals

REFERENCES:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).

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PHARMACEUTICAL PRODUCT DEVELOPMENT (Theory)

Subject Code: BP813ET

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

COB1: To understand the pharmaceutical product development manufacturing, quality tests performed and excipients in the pharmaceutical product development.

COB2: To explore the Optimization techniques in pharmaceutical product development. Optimization by factorial designs and QbD and its applications in pharmaceutical product development.

COB3: To evaluate the regulatory considerations for pharmaceutical product development.

Course Outcomes:

Course Outcome	Statement
CO1[L2]	Understand.to understand the pharmaceutical product development manufacturing and quality tests performed.
CO2[L3]	Apply knowledge of excipients in the pharmaceutical product developfmedment.
CO3[L3]	Apply knowledge of excipients in the pharmaceutical product development for the advanced formulations also
CO4[L6]	Develop the Optimization techniques in pharmaceutical product development.
CO5[L6]	Design. Optimization by factorial designs and QbD and its applications in pharmaceutical product development.
CO6[L5]	Evaluate- to evaluate the regulatory considerations for pharmaceutical product development.

Course contents **45HOURS**

Unit-I **10Hours**

Introduction to pharmaceutical product development, objectives, and regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms.

Unit-II **10Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Solvents and solubilizers ii. Cyclodextrins and their applications iii. Non - ionic surfactants and their applications iv. Polyethylene glycols and sorbitols v. Suspending and emulsifying agents vi. Semi solid excipients.

Unit-III **10Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Tablet and capsule excipients ii. Directly compressible vehicles iii. Coat materials iv. Excipients in parenteral and aerosols products v. Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications.

Unit-IV **08Hours**

Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.

Unit-V **07Hours**

Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.

References:

1. Pharmaceutical Statistics Practical and Clinical Applications byStanford Bolton, CharlesBon; Marcel Dekker Inc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition, Informa Healthcare publishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A. Lieberman andLeon Lachman; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop kKhar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt.Ltd. 2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt. Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansel, 9th Ed. 40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, Michael E. Aulton,3rd Ed.
9. Remington – The Science and Practice of Pharmacy, 20th Ed.
10. Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman andJoseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis andH.A. Libermann.
13. Advanced Review Articles related to the topics.