



JNTUK KAKINADA

Rules & Syllabus for the Bachelor
of Pharmacy (B. Pharm) Course
as approved by
Pharmacy Council of India
New Delhi

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




PRINCIPAL
Aditya Pharmacy College
SURAMPALAM-533 437

CHAPTER- I: REGULATIONS

1. Short Title and Commencement

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

2. Minimum qualification for admission

2.1 First year B. Pharm:

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

2.2. B. Pharm lateral entry (to third semester):

A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

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

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 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/January to May/June in every calendar year.

6. Attendance and progress

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



7. Program/Course credit structure

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

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

7.2. Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Project over the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

8. Academic work

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



9. Course of study

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

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	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^s/36[#]	4	27/29^s/30[#]

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

^sApplicable 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 Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – 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 Physiology II –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	Physical Pharmaceutics 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	Physical Pharmaceutics 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 Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – 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	Pharmacology I – 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 PharmacyI– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
Total		27	5	26



Table-VI: Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – 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	Medicinal chemistry 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 for semester VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial PharmacyII – 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: Semester wise 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.



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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 Sessionalexam (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 semester examinations

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 University Examination (NUE)



Semester II

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

* The subject experts at college level shall conduct examinations



Semester III

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

Semester IV


Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Marks	Exams Duration	Total	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

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Semester V

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


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Semester VI

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Marks	Duration	Total	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



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Semester VII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Marks	Exams Duration	Total	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



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Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Marks	Duration	Total	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 Herbs – Theory							
BP807ET	Computer Aided Drug Design – Theory	-	-	-	-	150	4 Hrs	150
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory	-	-	-	-	150	4 Hrs	150
BP812PW	Project Work							

Total	40	60	4 Hrs	100	450	16 Hrs	550
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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 of 2)	=	1 x 10 = 10
II. Short Answers (Answer 4 out of 6)	=	4 x 5 = 20

Total	=	30 marks

Question paper pattern for practical sessional examinations

I. Synopsis	=	10
II. Experiments	=	25
III. Viva voce	=	05

Total	=	40 marks

12. Promotion and award of grades

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

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessments 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 semester examinations

Reexamination of end semester examinations 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 paper pattern for end 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 students’ 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 AB grade awarded in that semester. For example if a learner has a F or AB 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, \dots is the total number of credits for semester I, II, III, and S_1, S_2, S_3, \dots 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
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Evaluation of Presentation:

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

Total	75 Marks
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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 after break of study

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

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



CHAPTER - II: SYLLABUS



Semester I



BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

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

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

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

Course Content:

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, hemopoiesis, 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 heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.



BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones
6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books (Latest Editions)

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 Taylor. Williams & Wilkins Co, Riverview, MI USA
4. Text book of Medical Physiology- Arthur C, Guyton and John E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.



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

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata



BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

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

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

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- develop analytical skills

Course Content:

UNIT-I

10 Hours

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

- i) Different techniques of analysis
- ii) Methods of expressing 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

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 calcium gluconate.
- **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 diazotisation titration.

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UNIT-IV

08 Hours

Redox titrations

- (a) Concepts of oxidation and reduction
- (b) Types of redox 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



BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

- I **Limit Test of the following**
 - (1) Chloride
 - (2) Sulphate
 - (3) Iron
 - (4) Arsenic

- II **Preparation and standardization of**
 - (1) Sodium hydroxide
 - (2) Sulphuric acid
 - (3) Sodium thiosulfate
 - (4) Potassium permanganate
 - (5) Ceric ammonium sulphate

- III **Assay of the following compounds along with Standardization of Titrant**
 - (1) Ammonium chloride by acid base titration
 - (2) Ferrous sulphate by Cerimetry
 - (3) Copper sulphate by Iodometry
 - (4) Calcium gluconate by complexometry
 - (5) Hydrogen peroxide by Permanganometry
 - (6) Sodium benzoate by non-aqueous titration
 - (7) Sodium Chloride by precipitation titration

- IV **Determination of Normality by electro-analytical methods**
 - (1) Conductometric titration of strong acid against strong base
 - (2) Conductometric titration of strong acid and weak acid against strong base
 - (3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

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.



BP103T. PHARMACEUTICS- I (Theory)

45 Hours

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

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

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

Course Content:

UNIT – I

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:** Introduction to 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

08 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 dosage forms



BP109P. PHARMACEUTICS I (Practical)

3 Hours / week

1. Syrups

- a) Syrup IP'66
- b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs

- a) Piperazine citrate elixir
- b) Paracetamol pediatric elixir

3. Linctus

- a) Terpin Hydrate Linctus IP'66
- b) Iodine Throat Paint (Mandles Paint)

4. Solutions

- a) Strong solution of ammonium acetate
- b) Cresol with soap solution
- c) Lugol's solution

5. Suspensions

- a) Calamine lotion
- b) Magnesium Hydroxide mixture
- c) Aluminium Hydroxide gel

6. Emulsions

- a) Turpentine Liniment
- b) Liquid paraffin emulsion

7. Powders and Granules

- a) ORS powder (WHO)
- b) Effervescent granules
- c) Dusting powder
- d) Divided powders

8. Suppositories

- a) Glycero gelatin suppository
- b) Cocoa butter suppository
- c) Zinc Oxide suppository

8. Semisolids

- a) Sulphur ointment
- b) Non staining-iodine ointment with methyl salicylate
- c) Carbopol gel

9. Gargles and Mouthwashes

- a) Iodine gargle
- b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)



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.



BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of course student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

Course Content:

UNIT 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: Ammonium chloride* 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, Sodium nitrite³³³

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.



BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

- I **Limit tests for following ions**
 - Limit test for Chlorides and Sulphates
 - Modified limit test for Chlorides and Sulphates
 - Limit test for Iron
 - Limit test for Heavy metals
 - Limit test for Lead
 - Limit test for Arsenic
- II **Identification test**
 - Magnesium hydroxide
 - Ferrous sulphate
 - Sodium bicarbonate
 - Calcium gluconate
 - Copper sulphate
- III **Test for purity**
 - Swelling power of Bentonite
 - Neutralizing capacity of aluminum hydroxide gel
 - Determination of potassium iodate and iodine in potassium Iodide
- IV **Preparation of inorganic pharmaceuticals**
 - Boric acid
 - Potash alum
 - Ferrous sulphate

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia



BP105T.COMMUNICATION SKILLS (Theory)

30 Hours

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

Objectives:

Upon completion of the course the student shall be able to

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

Course content:

UNIT – I

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



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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 of an interview, Do's and Dont's of an 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



BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

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

Basic communication covering the following topics

Meeting People

Asking Questions

Making Friends

What did you do?

Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills




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Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1st Edition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1st Edition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2nd Edition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009
12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill, 1999



BP 106RBT.REMEDIAL BIOLOGY (Theory)

30 Hours

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

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

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

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, Protista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

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

UNIT II

07 Hours

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and Absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes



UNIT III

07 Hours

Excretory products and their elimination

- Modes of excretion
- Human excretory system- structure and function
- Urine formation
- Rennin angiotensin system

Neural control and coordination

- Definition and classification of nervous system
- Structure of a neuron
- Generation and conduction of nerve impulse
- Structure of brain and spinal cord
- Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

- Endocrine glands and their secretions
- Functions of hormones secreted by endocrine glands

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV

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: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 of cell and cell organelles.Cell division

Tissues

- Definition, types of tissues, location and functions.



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Text Books

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

Reference Books

- a. A Text book of Biology by B.V. Sreenivasa Naidu
- b. A Text book of Biology by Naidu and Murthy
- c. Botany for Degree students By A.C.Dutta.
- d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
- e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate



BP112RBP.REMEDIAL BIOLOGY (Practical)

30 Hours

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

Reference Books

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



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BP 106RMT.REMEDIAL MATHEMATICS (Theory)

30 Hours

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

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

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT – I

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:**

Real Valued function, Classification of real valued functions,

- **Limits and continuity :**

Introduction, Limit of a function, Definition of limit of a function ($\epsilon - \delta$ definition), $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$, $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$,

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, Application of Matrices in solving Pharmacokinetic equations



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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 for a function to be a maximum or a minimum at a point. Application

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**

Recommended Books (Latest Edition)

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



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Semester II




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BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

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

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

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

Course Content:

Unit 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

- **Respiratory system** 10 hours

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



BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
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.
13. Recording of basal mass index
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

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



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4. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

1. Physiological basis of Medical Practice-Best and Taylor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterje, Academic Publishers Kolkata



BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. identify/confirm the identification of organic compound

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

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

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 of paraffins.

Stabilities of alkenes, SP² hybridization in alkenes

E₁ and E₂ reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E₁ versus 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



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- **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



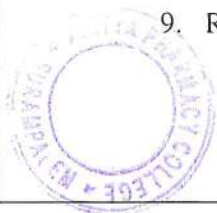
BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

1. Systematic qualitative analysis of unknown organic compounds like
 1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
 3. Solubility test
 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
 5. Melting point/Boiling point of organic compounds
 6. Identification of the unknown compound from the literature using melting point/ boiling point.
 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
 8. Minimum 5 unknown organic compounds to be analysed systematically.
2. Preparation of suitable solid derivatives from organic compounds
3. Construction of molecular models

Recommended Books (Latest Editions)

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. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K. Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwalia/Chatwal.



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BP203 T. BIOCHEMISTRY (Theory)

45 Hours

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

Objectives: Upon completion of course student shall be able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Course Content:

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 its mechanism.



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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 (Phenylketonuria, Albinism, alcaptonuria, 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

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity.



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Recommended Books (Latest Editions)

1. Principles of Biochemistry by 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. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

BP 204T.PATHOPHYSIOLOGY (THEORY)

45Hours

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

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

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

Course content:

Unit I

10Hours

- **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

10Hours

- **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 II

10Hours

- **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 of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer
-

Unit IV

8 Hours

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer
- **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis, Gout
- **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

Unit V

7 Hours

- **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis

Urinary tract infections

- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)



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1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book 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. Colledge, 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 Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.



BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

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

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

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

Course content:

UNIT – I

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

UNIT –II

06 hours

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

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

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




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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)



BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

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

Recommended books (Latest edition):

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



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BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

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

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

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

Course content:

Unit-I

10hours

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

10hours

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

10hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution



Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment




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SEMESTER III



BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

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

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, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts 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. Fatty acids – reactions.



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- 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 medicinal uses 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



BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

II Determination of following oil values (including standardization of reagents)

- Acid value
- Saponification value
- Iodine value

III Preparation of compounds

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
- Acetanilide by halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by oxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction
- Cinnamic acid from Benzaldehyde by Perkin reaction
- *p*-Iodo benzoic acid from *p*-amino benzoic acid

Recommended Books (Latest Editions)

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. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.




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8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

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

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

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

08 Hours

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions,

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



UNIT-IV

08Hours

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

UNIT-V

07 Hours

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



BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

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

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. 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



BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Scope:

- Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc..

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

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

Course content:

Unit I

10 Hours

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

Introduction to Prokaryotes and Eukaryotes

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

Study of different types of phase contrast 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

10 Hours

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.

Classification and mode of action of disinfectants

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

Evaluation of bactericidal & Bacteriostatic.

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

Unit IV

08 Hours

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

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

Assessment of a new antibiotic.

Unit V

07Hours

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

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

Growth of animal cells in culture. general procedure for cell culture, Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.



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BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

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

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company



BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

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

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

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

Course content:

UNIT-I

10 Hours

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II

10 Hours

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



- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator.
- **Distillation:** Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT- III

08 Hours

- **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.
- **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier,

UNIT-IV

08 Hours

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V

07 Hours

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



Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – 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 of chemical engineering – McCabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.



BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

- I. Determination of radiation constant of brass, iron, unpainted and painted glass.
- II. Steam distillation – To calculate the efficiency of steam distillation.
- III. To determine the overall heat transfer coefficient by heat exchanger.
- IV. Construction of drying curves (for calcium carbonate and starch).
- V. Determination of moisture content and loss on drying.
- VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
- VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
- VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
- IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
- X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
- XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
- XII. To study the effect of time on the Rate of Crystallization.
- XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.




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SEMESTER IV



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BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. know the medicinal uses and other applications of organic compounds

Course Content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

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 of chiral 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



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Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of 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 and 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 (NaBH_4 and LiAlH_4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic 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



BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

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

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

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

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 metabolism principles- 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 of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,



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Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

- Indirect acting agents: Hydroxymphetamine, 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 of acetylcholine.

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, Isofluorophate, Echothiophate iodide, Parathion, 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



A. Sedatives and Hypnotics:

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

Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital

Miscellaneous:

Amides & imides: Glutethimide.

Alcohol & their carbamate derivatives: Meprobumate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluorobutyrophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates: Phenobarbital, Methobarbital. **Hydantoins:**

Phenytoin*, Mephentyoin, 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



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General anesthetics:

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

Ultra short acting barbiturates: 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, Anileridine 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, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.



BP406P. MEDICINAL CHEMISTRY – I (Practical)

4 Hours/Week

I Preparation of drugs/ intermediates

- 1 1,3-pyrazole
- 2 1,3-oxazole
- 3 Benzimidazole
- 4 Benztriazole
- 5 2,3- diphenyl quinoxaline
- 6 Benzocaine
- 7 Phenytoin
- 8 Phenothiazine
- 9 Barbiturate

II Assay of drugs

- 1 Chlorpromazine
- 2 Phenobarbitone
- 3 Atropine
- 4 Ibuprofen
- 5 Aspirin
- 6 Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

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.




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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.Vogel.



BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45Hours

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

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

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I

07 Hours

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

UNIT-II

10 Hours

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

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

10Hours

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



BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

3 Hrs/week

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.



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BP 404 T. PHARMACOLOGY-I (Theory)

45 Hrs

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, 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.

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

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

Course Content:

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 receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor 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 pharmacodynamic)
- 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****2. Pharmacology of drugs acting on peripheral nervous system**

- a. Organization and function of ANS.
- b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.
- c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.
- d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
- e. Local anesthetic agents.
- f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV**08 Hours****3. Pharmacology of drugs acting on central nervous system**

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

UNIT-V**07 Hours****3. Pharmacology of drugs acting on central nervous system**

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




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BP 408 P.PHARMACOLOGY-I (Practical)

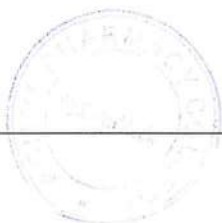
4Hrs/Week

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

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

Recommended Books (Latest Editions)

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 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. VallabhPrakashan,




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BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

45 Hours

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

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

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

Course Content:

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 lucida.

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, Natural allergens

Primary metabolites:

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

Carbohydrates: Acacia, Agar, Tragacanth, Honey

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

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources




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BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

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

Recommended Books: (Latest Editions)

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




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SEMESTER V




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BP501T. MEDICINAL CHEMISTRY – II (Theory)

45 Hours

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

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

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I

10 Hours

Antihistaminic agents: Histamine, receptors and their distribution in the humanbody

H₁-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelemamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H₂-antagonists: Cimetidine*, Famotidine, Ranitidin.

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

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan,



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Chlorambucil, Busulfan, Thiotepea

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, Dichlorophenamide.

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, Lorcinide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholestamine 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, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestones, Oestriol, Oestradiol, Oestrone, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V

07 Hours

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acarbose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

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

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

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

Miscellaneous: Phenacaine, Dipreron, Dibucaine.*

Recommended Books (Latest Editions)

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. I to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.





BP 502 T. Industrial PharmacyI (Theory)

45 Hours

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

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

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course content:

3 hours/ week

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.

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. Production procedure, 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.



BP 506 P. Industrial PharmacyI (Practical)

4 Hours/week

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Qulaity control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

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 form disperse 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. Theory and 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, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.



BP503.T. PHARMACOLOGY-II (Theory)

45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

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

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Content:

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 therapy of 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

3. Autocoids and related drugs

- a. Introduction to autocoids 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




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UNIT-IV

08hours

5. Pharmacology of drugs acting on endocrine system

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

UNIT-V

07hours

5. Pharmacology of drugs acting on endocrine system

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

6. Bioassay

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



BP 507 P. PHARMACOLOGY-II (Practical)

4Hrs/Week

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schild's plot method).
12. Determination of PD_2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

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

Recommended Books (Latest Editions)

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 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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BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

45Hours

Scope: The main purpose of subject is 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. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

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

1. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. to understand the preparation and development of herbal formulation.
3. to understand the herbal drug interactions
4. to carryout isolation and identification of phytoconstituents

Course Content:

UNIT-I

7 Hours

Metabolic pathways in higher plants and their determination

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

- Terpenoids: Menthol, Citral, Artemisin
- Glycosides: Glycyrrhetic acid & Rutin
- Alkaloids: Atropine, Quinine, Reserpine, Caffeine
- 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.

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)
4 Hours/Week


1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
 - a. Caffeine - from tea dust.
 - b. Diosgenin from Dioscorea
 - c. Atropine from Belladonna
 - d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstituents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.






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BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

Scope: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

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

1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:

UNIT-I

10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

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

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, 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

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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, Pharmacist's oath
- **Medical Termination of Pregnancy Act**
- **Right to Information Act**
- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh



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2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government. Reference books (Theory)



SEMESTER VI




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BP601T. MEDICINAL CHEMISTRY – III (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

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

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted by (*)

UNIT – I

10 Hours

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II

10 Hours

Antibiotics

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



Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

UNIT – III

10 Hours

Anti-tubercular Agents

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

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

Urinary tract anti-infective agents

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

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

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

UNIT – IV

08 Hours

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole, Tioconazole, 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.

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Sulphonamides and Sulfones

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

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V

07 Hours

Introduction to Drug Design

Various approaches used in drug design.

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

Pharmacophore modeling and docking techniques.

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



BP607P. MEDICINAL CHEMISTRY- III (Practical)

4 Hours / week

I Preparation of drugs and intermediates

- 1 Sulphanilamide
- 2 7-Hydroxy, 4-methyl coumarin
- 3 Chlorobutanol
- 4 Triphenyl imidazole
- 5 Tolbutamide
- 6 Hexamine

II Assay of drugs

- 1 Isonicotinic acid hydrazide
- 2 Chloroquine
- 3 Metronidazole
- 4 Dapsone
- 5 Chlorpheniramine maleate
- 6 Benzyl penicillin

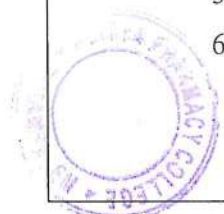
III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

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.Vogel.



PSX

BP602 T. PHARMACOLOGY-III (Theory)

45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chronopharmacology.

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

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisonings and
3. appreciate correlation of pharmacology with related medical sciences.

Course Content:

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. Nasal decongestants
- e. Respiratory stimulants

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 fluoroquinolones, tetracycline and aminoglycosides


UNIT-III

10hours

3. Chemotherapy

- a. Antitubercular agents
- b. Antileprotic agents




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- c. Antifungal agents
- d. Antiviral drugs
- e. Anthelmintics
- f. Antimalarial drugs
- g. Antiamoebic agents

UNIT-IV

08hours

3. Chemotherapy

- l. Urinary tract infections and sexually transmitted diseases.
- m. Chemotherapy of malignancy.

4. Immunopharmacology

- a. Immunostimulants
 - b. Immunosuppressant
- Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V

07hours

5. Principles of toxicology

- a. Definition and basic knowledge of acute, subacute and chronic toxicity.
- b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity
- c. General principles of treatment of poisoning
- d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.

6. Chronopharmacology

- a. Definition of rhythm and cycles.
- b. Biological clock and their significance leading to chronotherapy.



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BP 608 P. PHARMACOLOGY-III (Practical)

4Hrs/Week


1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

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 medical publisher
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.




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BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

45 hours

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

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

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .

Course content:

UNIT-I

11 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, Unani and Homeopathy

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

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

07 Hours

General Introduction to Herbal Industry

Herbal drugs 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.




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BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

4 hours/ week

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of 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 Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.



AX

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS
(Theory)

45 Hours

Scope: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arising therein.

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

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

**Course
Content:**

UNIT-I
Hours

10

**Introduction to
Biopharmaceutics**

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of 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
Hours

10

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, Compartment models, 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 , $t_{1/2}$, V_d , AUC , K_a , Cl and CL_R - definitions methods of eliminations, understanding of their significance and application



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UNIT- IV**08 Hours**

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

UNIT- V**07 Hours**

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.
c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

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 International edition. USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmkar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Gibaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, Lea and Febiger, 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 Robert F Notari Marcel Dekker Inc, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania



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BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

45 Hours

Scope:

- Biotechnology has a long promise to revolutionize the biological sciences and technology.
- Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.
- Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.
- Biotechnology has already produced transgenic crops and animals and the future promises lot more.
- It is basically a research-based subject.

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

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

Unit I

10 Hours

- a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
- b) Enzyme Biotechnology- Methods of enzyme 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 of genetic engineering.

Unit II

10 Hours

- a) Study of cloning vectors, restriction endonucleases and DNA ligase.
- b) Recombinant DNA technology. Application of genetic engineering in medicine.
- c) Application of r DNA technology and 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) Hypersensitivity reactions, 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 stability of official vaccines
- f) Hybridoma technology- Production, Purification and Applications
- g) Blood products and Plasma Substitutes.

Unit IV

08Hours

- 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) Introduction to 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 Substitutes.

Recommended Books (Latest edition):


1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal



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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



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BP606TPHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries
- understand the responsibilities of QA & QC departments

Course content:

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

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

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

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.

Equipments 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 Nonclinical 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

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Dekker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines



SEMESTER VII




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BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Content:

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 multi component 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 applications

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



BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4 Hours/Week

- 1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
- 2 Estimation of dextrose by colorimetry
- 3 Estimation of sulfanilamide by colorimetry
- 4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
- 5 Assay of paracetamol by UV- Spectrophotometry
- 6 Estimation of quinine sulfate by fluorimetry
- 7 Study of quenching of fluorescence
- 8 Determination of sodium by flame photometry
- 9 Determination of potassium by flame photometry
- 10 Determination of chlorides and sulphates by nephelo turbidometry
- 11 Separation of amino acids by paper chromatography
- 12 Separation of sugars by thin layer chromatography
- 13 Separation of plant pigments by column chromatography
- 14 Demonstration experiment on HPLC
- 15 Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein



BP 702 T. INDUSTRIAL PHARMACYII (Theory)

45 Hours

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

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

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercial batch
3. Know different Laws and Acts that regulate pharmaceutical industry
4. Understand the approval process and regulatory requirements for drug products

Course Content:

UNIT-I

10 Hours

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.

Recommended Books: (Latest Editions)

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 book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at <http://www.cgmp.com/ra.htm>.



BP 703T. PHARMACY PRACTICE (Theory)

45 Hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

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

1. know various drug distribution methods in a hospital
2. appreciate the pharmacy stores management and inventory control
3. monitor drug therapy of patient through medication chart review and clinical review
4. obtain medication history interview and counsel the patients
5. identify drug related problems
6. detect and assess adverse drug reactions
7. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
8. know pharmaceutical care services
9. do patient counseling in community pharmacy;
10. appreciate the concept of Rational drug therapy.

Unit I:

10 Hours

a) Hospital and its 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 of controlled 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 the Therapeutic 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 stop order, and emergency drug list preparation.

b) information services

Drug



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

c) **Patient**

counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases 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 the counter 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 hospital pharmacist, advisory committee.

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

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

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine)



BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

45 Hours

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

Objectives: Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course content:

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 implants and 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

Recommended Books: (Latest Editions)

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.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)



SEMESTER VIII



BP801T. BIOSTATISTICS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Scope: To understand the applications of Biostatistics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

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

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

Course content:

Unit-I

10 Hours

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples

Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples

Unit-II

10 Hours

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- Pharmaceutical Examples

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test (Sample, Pooled or Unpaired and Paired), ANOVA, (One way and Two way), Least Significance difference

Unit-III

10 Hours

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test



Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Unit-IV

8 Hours

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regression models

Introduction to Practical components of Industrial and Clinical Trials Problems:

Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V

7Hours

Design and Analysis of experiments:

Factorial Design: Definition, 2^2 , 2^3 design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. New York.
2. Fundamental of 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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BP 802T SOCIAL AND PREVENTIVE PHARMACY

Hours: 45

Scope:

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives:

After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related to health and pharmaceutical issues

Course content:

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.

Recommended Books (Latest edition):

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

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland



BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

45 Hours

Scope:

The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Course Objective: The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

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.



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Unit IV

10 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

10 Hours

Pricing:

Meaning, importance, objectives, 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.

Recommended Books: (Latest Editions)

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
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.






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BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45Hours

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

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

1. Know about the process of drug discovery and development
2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
3. Know the regulatory approval process and their registration in Indian and international markets

Course content:

Unit I

10Hours

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

10Hours

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

10Hours

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

08Hours

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

07Hours

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

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. By John 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 By Rick Ng



BP 805T: PHARMACOVIGILANCE (Theory)

45 hours

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

At completion of this paper it is expected that students will be able to (know, do, and appreciate):

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
12. CIOMS requirements for ADR reporting
13. Writing case narratives of adverse events and their quality.

Course Content

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 Standardised MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Contract Research Organisations (CROs)
- Establishing a national programme

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

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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

- Paediatrics
- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- 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, 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



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11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna

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12. <http://www.who.unc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297>
13. <http://www.ich.org/>
14. <http://www.cioms.ch/>
15. <http://cdsco.nic.in/>
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html



BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Scope: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

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

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

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 for use

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.



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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

Recommended Books: (Latest Editions)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I, Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.




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BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

45 Hours

Scope: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

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

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modeling software

Course Content:

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, Hammett's substituent constant and Taft's 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.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Park Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5. Koro I kovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.




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BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

45 Hours

Scope:

- Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function.
- This is done both on a microscopic and molecular level.
- Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges.

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

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

Course content:

Unit I

10Hours

- a) Cell and Molecular Biology: Definitions theory and basics and Applications.
- b) Cell and Molecular Biology: History and Summation.
- c) Properties of cells and cell membrane.
- d) Prokaryotic versus Eukaryotic
- e) Cellular Reproduction
- f) Chemical Foundations – an Introduction and Reactions (Types)

Unit II

10 Hours

- a) DNA and the Flow of Molecular Information
- b) DNA Functioning
- c) DNA and RNA
- d) Types of RNA
- e) Transcription and Translation

Unit III

10 Hours

- a) Proteins: Defined and Amino Acids
- b) Protein Structure



- c) Regularities in Protein Pathways
- d) Cellular Processes
- e) Positive Control and significance of Protein Synthesis

Unit IV

08 Hours

- a) Science of Genetics
- b) Transgenics and Genomic Analysis
- c) Cell Cycle analysis
- d) Mitosis and Meiosis
- e) Cellular Activities and Checkpoints

Unit V


07 Hours

- a) Cell Signals: Introduction
- b) Receptors for Cell Signals
- c) Signaling Pathways: Overview
- d) Misregulation of Signaling Pathways
- e) Protein-Kinases: Functioning

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Pepler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
13. RA Goldshy et. al., : Kuby Immunology.




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BP809ET. COSMETIC SCIENCE(Theory)

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.

Antiperspirants & 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-phenylene 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 Color, 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 odor.

Antiperspirants and Deodorants- Actives and mechanism of action

References

- 1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
- 2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
- 3) Text book of cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers.




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BP810 ET. PHARMACOLOGICAL SCREENING METHODS

45 Hours

Scope: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives

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

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research
- Appreciate and demonstrate the importance of biostatistics and research methodology
- Design and execute a research hypothesis independently

Unit –I	08 Hours
Laboratory Animals: 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	10 Hours
Preclinical screening models a. 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. b. 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	

PT



Unit –III Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics	
Unit –IV 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.	
Research methodology and Bio-statistics 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	05 Hours

Recommended Books (latest edition):

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



BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

- understand the advanced instruments used and its applications in drug analysis
- understand the chromatographic separation and analysis of drugs.
- understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

Course Content:

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 (DSC)

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,

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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.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein



BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of hours :3

Tutorial:1

Credit point:4

Scope :

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objective:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to :

1. Understand the need of supplements by the different group of people to maintain healthy life.
2. Understand the outcome of deficiencies in dietary supplements.
3. Appreciate the components in dietary supplements and the application.
4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

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, Ginkgo, 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: Resveratrol
- d) Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones
- e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
- f) Phyto estrogens : Isoflavones, daidzein, Geobustan, 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.



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- 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: BSPublication.
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).
6. G. Gibson and C.williams Editors 2000 *Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger



Semester VIII – Elective course on Pharmaceutical Product Development

No of Hours: 3

Tutorial:1

Credit points:4

Unit-I

10 Hours

Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms

Unit-II

10 Hours

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

10 Hours

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

08 Hours

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

07 Hours

Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.



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Recommended Books (Latest editions)

1. Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, Charles Bon; 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 and Leon Lachman; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by R. K. Khar, 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 and Joseph 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 and H.A. Libermann.
13. Advanced Review Articles related to the topics.



COURSE STRUCTURE AND SYLLABUS

For

B. PHARMACY

(Applicable for batches admitted from 2016-2017)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India




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I Year I Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16111	English	4	1	-	3
2	PHR16112	Remedial Mathematics / Remedial Biology	4	-	-	0
3	PHR16113	Human Anatomy & Physiology – I	4	1	-	3
4	PHR16114	General & Dispensing Pharmacy	4	1	-	3
5	PHR16115	Pharmaceutical Organic Chemistry-I	4	1	-	3
6	PHR16116	English Communications Skills Lab	-	-	3	2
7	PHR16117	Remedial Biology Lab	-	-	2	0
8	PHR16118	General & Dispensing Pharmacy Lab	-	-	3	2
9	PHR16119	Pharmaceutical Organic Chemistry-I Lab	-	-	3	2
		Total	20	4	11	18

I Year II Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16121	Human Anatomy & Physiology – II	4	1	-	3
2	PHR16122	Pharm. Inorganic Chemistry	4	1	-	3
3	PHR16123	Pharm. Organic Chemistry – II	4	1	-	3
4	PHR16124	Physical Pharmacy – I	4	1	-	3
5	PHR16125	Computer Applications & Biostatistics	4	1	-	3
6	PHR16126	Human Anatomy & Physiology Lab	-	-	3	2
7	PHR16127	Physical Pharmacy – I Lab	-	-	3	2
8	PHR16128	Computer Applications Lab	-	-	3	2
		Total	20	5	9	21




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II Year I Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16211	Pharmaceutical Unit Operations - I	4	1	-	3
2	PHR16212	Pharmaceutical Biochemistry	4	1	-	3
3	PHR16213	Physical Pharmacy - II	4	1	-	3
4	PHR16214	Pharmaceutical Microbiology	4	1	-	3
5	PHR16215	Health Education & Pathophysiology	4	1	-	3
6	PHR16216	Pharmaceutical Biochemistry Lab	-	-	3	2
7	PHR16217	Physical Pharmacy – II Lab	-	-	3	2
8	PHR16218	Pharmaceutical Microbiology Lab	-	-	3	2
		Total	20	5	9	21

II Year II Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16221	Pharmaceutical Unit Operations –II	4	1	-	3
2	PHR16222	Pharmaceutical Analysis - I	4	1	-	3
3	PHR16223	Pharmacognosy -I	4	1	-	3
4	PHR16224	Medicinal Chemistry - I	4	1	-	3
5	PHR16225	Pharmacology - I	4	1	-	3
6	PHR16226	Pharmaceutical Unit Operations Lab	-	-	3	2
7	PHR16227	Pharmaceutical Analysis – I Lab	-	-	3	2
8	PHR16228	Pharmacognosy – I Lab	-	-	3	2
		Total	20	5	9	21



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III Year I Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16311	Pharmacognosy -II	4	1	-	4
2	PHR16312	Medicinal Chemistry - II	4	1	-	4
3	PHR16313	Pharmaceutical Technology - I	4	1	-	4
4	PHR16314	Environmental Sciences	4	1	-	2
5	PHR16315	Pharmaceutical Management	4	1	-	3
6	PHR16316	Pharmacognosy –II Lab	-	-	3	2
7	PHR16317	Medicinal Chemistry Lab	-	-	3	2
8	PHR16318	Pharmaceutical Technology-I Lab	-	-	3	2
		Total	20	5	9	23

III Year II Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16321	Pharmaceutical Technology -II	4	1	-	4
2	PHR16322	Pharm. Biotechnology	4	1	-	4
3	PHR16323	Pharmacology - II	4	1	-	4
4	PHR16324	Medicinal Chemistry - III	4	1	-	4
5	PHR16325	Regulatory Affairs, IPR & Patents	4	1	-	2
6	PHR16326	Pharmaceutical Technology –II Lab	-	-	3	2
7	PHR16327	Pharm. Biotechnology Lab	-	-	3	2
8	PHR16328	Pharmacology Lab	-	-	3	2
		Total	20	5	9	24



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IV Year I Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16411	Pharmaceutical Analysis -II	4	1	-	4
2	PHR16412	Biopharmaceutics & Pharmacokinetics	4	1	-	4
3	PHR16413	Chemistry of Natural Products	4	1	-	4
4	PHR16414	Hospital & Community Pharmacy	4	1	-	3
5	PHR16415	Pharmaceutical Jurisprudence	4	1	-	3
6	PHR16416	Pharmaceutical Analysis – II Lab	-	-	3	2
7	PHR16417	Biopharmaceutics & Pharmacokinetics Lab	-	-	3	2
8	PHR16418	Chemistry of Natural Products Lab	-	-	3	2
9		Project Commencement	-	-	-	-
		Total	20	5	9	24

IV Year II Semester

S. No.	Sub Code	Subject	L	T	P	Credits
1	PHR16421	Bioassays & Toxicology	4	1	-	3
2	PHR16422	Clinical Pharmacy, Therapeutics & Pharmacovigilance	4	1	-	3
3	PHR16423	Controlled release & Novel Drug Delivery Systems	4	1	-	4
4	PHR16424	Quality Assurance, GMP, GLP	4	1	-	2
5	PHR16425	Bioassays & Toxicology Lab	-	-	3	2
6	PHR16426	Seminar on selected topic	-	-	-	2
7	PHR16427	Project Work *	-	-	-	8
8.	PHR16428	Comprehensive Viva voce	-	-	-	4
		Total	16	4	3	28

*Project work evaluation includes dissertation, seminar and viva voce




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ENGLISH

DETAILED TEXT-I : Recommended Topics :

1. **THE KNOWLEDGE SOCIETY- APJ KALAM (RAVINDRA PUBLISHERS) 07**
OBJECTIVE: To make the learners rediscover India as a land of Knowledge.
OUTCOME: The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.
2. **MAN'S PERIL (RAVINDRA PUBLISHERS) 06**
OBJECTIVE: To inform the learner that all men are in peril.
OUTCOME: The learner will understand that all men can come together and avert the peril.
3. **IN LONDON: M.K.GANDHI (RAVINDRA PUBLISHERS) 06**
OBJECTIVE: To apprise the learner how Gandhi spent a period of three years in London as a student.
OUTCOME: The learner will understand how Gandhi grew in introspection and maturity.
4. **PRINCIPLES OF GOOD WRITING: L.A.HILL (RAVINDRA PUBLISHERS) 06**
OBJECTIVE: To inform the learners how to write clearly and logically.
OUTCOME: The learner will be able to think clearly and logically and write clearly and logically.

Text Book : 'Sure Outcomes' by Orient Black Swan Pvt. Ltd Publishers

NON-DETAILED TEXT: (From Modern Trailblazers of Orient Blackswan)

(Common single Text book for two semesters)

(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons))

1. **G.D.Naidu 07**
OBJECTIVE: To inspire the learners by G.D.Naidu's example of inventions and contributions.
OUTCOME: The learner will be in a position to emulate G.D.Naidu and take to practical applications.
2. **G.R.Gopinath 06**
OBJECTIVE: To inspire the learners by his example of inventions.
OUTCOME: Like G.R.Gopinath, the learners will be able to achieve much at a low cost and help the common man.
3. **Sudhamurthy 06**
OBJECTIVE: To inspire the learners by the unique interests and contributions of Sudha Murthy.
OUTCOME: The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.



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4. Vijay Bhatkar

06

OBJECTIVE: To inspire the learner by his work and studies in different fields of engineering and science.

OUTCOME: The learner will emulate him and produce memorable things.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers




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I Year - I Semester

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REMEDIAL MATHEMATICS
(For Biology stream students)

UNIT – I **10**

Algebra:

Arithmetic Progression-Geometric Progression- Permutations & combinations-Binomial theorem partial fractions-Matrices-Determinants-Application of determinants to solve simultaneous equations (Cramer's Rule).

UNIT II **10**

Trigonometry: Trigonometric ratios and the relations between them Sin (A+B), Cos (A+B), Tan (A+B) formulae only. Trigonometric ratios of multiple angles-Heights and distances (simple problems there on).

UNIT III **10**

Co-ordinate Geometry: Distances between points-Area of a triangle, Co-ordinates of a point dividing a given segment in a given ratio-locus-equation to a straight line in different forms-Angle between straight lines-point of intersection.

UNIT IV **05**

Differential Calculus: Continuity and limit: Differentiation, derivability and derivative, R.H. derivatives and L.H. derivatives, Differentiation, General theorems of derivation.

UNIT V **10**

Integral Calculus: Integration as on inverse process of differentiation, definite integrals, integration by substitution, integration by parts, integration of algebraic function of E^x evolution of area in simple cases.

UNIT VI **05**

Differential equations: Formation of a differential equation, order and degree, solution of first order differential equations, Laplace transformation.

TEXT BOOKS

1. Intermediate first Year mathematics
2. Intermediate Second year mathematics, printed and published by Telugu Academy, Himayatnagar, Hyderabad
3. Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor, New Delhi.
4. Higher Engineering Mathematics by Grewal.
5. A text book of remedial mathematics, 2nd Ed. by P. Seshagiri Rao.
6. Pharmaceutical Statistics by Gopala Krishna Murthy, Srinivasa Babu and Seshagiri Rao

REMEDIAL BIOLOGY – I
(For Maths stream students)




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UNIT –I: Cell biology, histology and anatomy.**10**

Prokaryotic and eukaryotic cells.

Ultra structure of plant cell and its organelles, differences between plant and animal cells.

Detailed study of ergastic substances, chromosomes, nucleic acids. Introduction to cell cycle, mitosis and meiosis. Different types of plant tissues and their functions. Plant tissue systems. Histology and anatomy of root, stem, bark, wood, leaf, flower, fruit and seed

UNIT –II: Morphology**10**

General characteristics, types, functions and modifications of root, stem and leaf, Venation. Morphology of bark and wood. Inflorescence, Structure and general description of flower, insertion of floral parts on the thalamus, Placentation. Morphology and classification of fruits, Morphology of seed.

UNIT –III: Plant Taxonomy**09**

Functions and principles of Taxonomy, methods of classification of plants. Binomial nomenclature. Technical description of a flowering plant. Eichler's system of classification. Bentham and Hooker's system of classification. Description of selected families - Malvaceae, Solanaceae and Liliaceae.

UNIT –IV: General survey of Animal kingdom**10**

Basics of Classification (levels of organization, Symmetry, Diploblastic, Triploblastic organization, Coelom, Segmentation, Notochord), concept of species and taxonomic hierarchy. Classification of animal kingdom.

General characters of Non-chordates (Protozoa, Porifera, Cnidaria, Platyhelminthes, Nemathelminthes, Annelida, Arthropoda, Mollusca and Echinodermata).

General characters of Hemichordata and Chordata.(Pisces, Amphibians, Reptiles, Aves and Mammals).

UNIT –V:**07**

Parasitism and Parasitic adaptations.

Structure and life history of Protozoans: Amoeba, Entamoeba, Trypanosoma and Plasmodium.

Structure and life history of Helminthic parasites: Taenia solium, Wuchereia bancrofti and Ascaris lumbricoides.

UNIT- VI:**04**

General characters of phylum Arthropoda.

General structure and life history of insects: Cockroach, Mosquito and Silk worm.




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TEXT BOOKS

1. Intermediate first year and second year Botany / Zoology Text books printed and published by Telugu Academy, Himayatnagar, Hyderabad.
2. A.C. Dutta, Text Book of Botany
3. Botany for Degree students Vol. - I & II by B.P. Pandey




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HUMAN ANATOMY & PHYSIOLOGY - I

UNIT-I

Scope of Anatomy and physiology: 05

Structure of cell, its components and their functions.

Elementary Tissues of the human body: Epithelial, connective, muscular and nervous tissues, their sub- types and properties.

Skeletal muscles: 04

Gross anatomy, physiology of muscle contraction, physiological properties of skeletal muscles and their disorders.

Skeletal system: 04

Structure, composition and functions of skeleton. Classification of joints, types of movements at joints, disorders of joints.

LO: To understand different tissues are involved in the formation of organs and perform different functions. For example skeletal muscle produce by way of its contraction and relaxation produce movement of the skeletal, nerves are involved in the transmission of electrical impulses, bones form body frame, muscles produce contraction and help in movement, circulation, digestion and excretion. Epithelial tissues protect and secrete juices.

UNIT-II 08

Haemopoietic system:

Composition and functions of blood, Genesis and regulation of red blood cells production, blood groups, transfusion of blood. Leukocytes, properties of white blood cells, reticulo endothelial system, blood coagulation and its mechanism, formation and circulation of lymph. Disorders of blood.

Formed elements of blood: WBC, RBC and Platelets,

Haemopoiesis and blood hormones, Blood groups and their significance, Coagulating factors, Pathways of coagulation and Mechanism of coagulation, Disorders of blood.

LO: Blood is involved in oxygen and carbon dioxide transport, maintenance of B.P, defense immunity and excretion.

UNIT III

Cardiovascular system: 08

Basic anatomy, structure and functions of the heart and blood vessels, action potential. Excitatory and conductive system of the heart, cardiac cycle, nervous regulation of heart. Systemic coronary and hepatic blood circulation, cardiac output, blood pressure in different blood vessels, blood pressure regulations and measurements. ECG of heart. Brief outline of cardiovascular disorders



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like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

Lymph and Lymphatic System:

03

Composition, formation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

LO: Heart and blood vessels maintain BP, transport gases, nutrients and waste products. Their function is essential to sustain circulation.

UNIT IV

07

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

LO: To know about external and internal respiration exchanging of gases, need of oxygen for metabolism of nutrients and generation of energy and its essential for life process.

UNIT V

06

Digestive System: Anatomy, structure and functions of different parts of gastrointestinal tract, motility of alimentary canal and its regulation. Gastrointestinal secretions, their compositions, function and regulations. Digestion of food in mouth, stomach and small intestine and its absorption.

LO: To understand digestion in various parts of GIT, role of enzymes and secretions involved in the process of digestion and their function.

UNIT VI

05

Urinary System: Structure and functions of Nephron, formation of urine, renal mechanism for concentrating and diluting the urine, regulation of acid-base balance, knowledge on release of renin from kidney and its functions. Regulations of blood volume and extra cellular fluid volume. Disease related to kidney.

LO: To understand how urine is formed and various mechanisms involved in formation of urine and diseases related to the kidney.

TEXT BOOKS

1. Tortora, G.J and Anagnostoukas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. C.C.Chatterjee, Human Physiology.
3. Ross & Wilson, Anatomy & Physiology in health and illness.
4. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
5. Dr. Jayaveera K.N., Vrushabendra Swamy B.M., Human Anatomy Physiology and Health Education, S.Chand publ.

REFERENCES

1. A.C.Guyton, Text Book of Medical Physiology
2. Best & Taylor, The Living Body-A Text Book on Human Physiology




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GENERAL & DISPENSING PHARMACY

UNIT-I

6

Historical back ground and development of profession of Pharmacy & pharmaceutical industry in brief. Development of Indian Pharmacopoeia & other pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra Pharmacopoeia & Indian national formulary.

LO: To understand the development of pharmacy profession & various pharmacopoeias.

UNIT-II

10

Dispensing Pharmacy : Principles of dispensing, form of prescription, handling of prescription, source of errors for prescription, care required in dispensing procedures including labeling of dispensed products. Weights and Measures, introduction to Latin terms, Percentage calculations, allegation method, proof spirit calculations, displacement value and calculations of iso tonicity adjustment. General dispensing procedure- posology calculations of doses.

LO: To understand dispensing principles, procedures, calculations involved , doses.

UNIT-III

10

Principles involved and procedures adopted in dispensing of the following classes of preparations.

- (i) Mixtures
- (ii) Solutions – A study of the following solutions – Cresol with soap solution IP, Aqueous Iodine solution IP, Strong solution of Iodine IP, Weak Iodine Solution IP, strong solution of Ammonium acetate.
- (iii) Emulsions
- (iv) Powders
- (v) Lotions & liniments
- (vi) ointments

LO: To understand principles and procedures involved in the dispensing of various categories of products.

UNIT-IV

08

Dosage forms – Purpose, classification, definitions and general characteristics of the following dosage forms

Solids: Tablets and capsules.

Liquid orals: Elixirs, Syrups, Linctus, Suspensions and Emulsions.

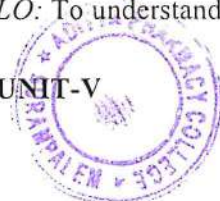
Liquids for external use: Lotions & liniments applications.

Semi solids: Ointments, Creams, Gels, Suppositories and Pessaries.

LO: To understand dosage forms and their general characteristics.

UNIT-V

08



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Incompatibilities: Physical, chemical and therapeutic incompatibilities – methods of overcoming and handling of incompatible prescriptions.

LO: To understand incompatibility and methods of overcoming incompatibility.

UNIT-VI

08

Extraction and Galenical products: Principle and methods of extraction - preparation of infusions, tinctures, dry, soft and liquid extracts.

LO: To understand extraction and Galenical products – Principles and procedures.

TEXT BOOKS

1. Cooper & Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
2. R.M Metha, Dispensing Pharmacy.
3. NK Jain and GD Guptha, Modern Dispensing Pharmacy, Pharma Med Press.
4. Sanmathi BS and Anshu Guptha, Dispensing Pharmacy – A Practical Manual, Pharma Med Press.
5. General Pharmacy by M.L.Schroff.
6. General Pharmacy by Cooper & Gunn.

REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. E.A. Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ.
3. Hoover, Dispensing of Medication.




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I Year - I Semester

L	T	P	C
4	1	0	3

PHARMACEUTICAL ORGANIC CHEMISTRY-I

UNIT-I

08

Structure and reactivity of organic molecules: Types of chemical bond and hybridization, Polarity of bonds, electronic effects: Electromeric effect, Inductive effect, Mesomeric effect and Hyperconjugation and their influence on the properties of organic molecules; charged species: carbocations and carbanions, their generation, stabilities, rearrangement in the case of carbocations; Free radicals: formation and stability

LO: Understanding the basic concepts influencing the reactivity of organic molecules, understanding the mechanisms wherever applicable, applications of the above in the interpretation of various properties of organic molecules.

UNIT-II

10

Alkanes and cycloalkanes: Nomenclature, general methods of preparation, free radical substitution, chain and conformational isomerism in the case of alkenes and their relative stabilities, Beyer's strain theory and Sachse-Mohr theory in the case of cycloalkanes and their limitations.

Alkenes: Nomenclature, general methods of preparation, characteristic electrophilic and free radical addition reactions, orientation of product formation as interpreted by Markonikov's rule and peroxide effect (Anti-Markonikov's rule), ozonolysis and allylic substitution.

Alkadienes: Nomenclature, stability of conjugated dienes, 1,2- and 1,4- reactions and their relative stabilities.

Alkynes: Nomenclature, general methods of preparation, characteristic reactions with emphasis on acidity of alkynes, formation of metal acetylides, stereospecific reduction of alkynes and addition of water involving keto-enol tautomerism

LO: Structures, equations involved in the preparations, mechanism of formation or the reaction, rearrangements if any, discussion on stabilities and applications of the characteristic reactions in synthesis.

UNIT-III

08

Alkylhalides: Nomenclature, general methods of preparation, significance of nucleophilic substitution of alkylhalides in organic synthesis, mechanisms and salient features of S_N1 and S_N2 reactions with examples including the proof in favor of these reactions, a comparison of S_N1 and S_N2 , elimination reactions ($E1$ and $E2$): mechanisms, salient features and orientation of product formation in terms of Saytzeff's rule and Hoffmann orientation.

LO: Structures, equations involving the methods of preparations and reactions, stabilities and applications of the reactions.




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UNIT-IV

08

Alcohols: Nomenclature, classification, methods of preparation, industrial synthesis of ethanol and methanol, reactions of alcohols involving the replacement of hydroxyl or replacement of the hydrogen of the hydroxyl, iodoform reaction and Lucas test.

Ethers: Nomenclature, Williamson synthesis, action of hydroiodic acid on ethers.

LO: Structures, general properties, equations involving the methods of preparation and reactions, mechanisms, reactivities.

UNIT-V

10

Stereochemistry: Isomerism and its comparison to stereoisomerism, stereoisomers, optical isomers (enantiomers), characteristics of enantiomers (chirality), racemic mixtures, methods of separation of racemic mixtures, optical activity, optical rotation, specific rotation, plane of symmetry and centre of symmetry, diastereomers, their properties and required characteristics with examples as given by Fischer projection formulae; mesoform and its characteristics; Configuration: Relative configuration (D and L), absolute configuration (R and S); Geometric isomerism: cis-trans isomerism and E and Z nomenclature.

LO: Stereochemical structures, importance of stereochemistry with respect to drugs as interpreted in terms of reactivity and the properties of chiral drugs.

UNIT-VI

06

Grignard reagent: Preparation, characteristic nucleophilic addition and substitution reactions, applications in organic synthesis and limitations.

LO: Structure, mechanism and usefulness in synthesis.

TEXT BOOKS

1. R.T. Morrison and R.N. Boyd, Organic chemistry, pentice hall of India private limited, New Delhi.
2. Arun Bahl & B. S. Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd.,
3. C. N. Pillai, Text book of Organic Chemistry, University Press.
4. Bhupinder Mehta, Manju Mehta, Organic Chemistry, PHI Learning.

REFERENCES

1. R.L Madan, *Organic Chemistry*.
2. Lloyd N. Ferguson, Text book of Organic Chemistry, 2nd edition,.
3. Raj K Bansal, A textbook of Organic Chemistry, 5th edition.




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I Year - I Semester

L	T	P	C
0	0	3	2

ENGLISH COMMUNICATION SKILLS LAB

Suggested Lab Manual:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading and writing including soft, i.e., life skills.

I: Listening and Speaking Skills:

To impart verbal and non-verbal communication skills through the following:

- (a). dialogues and body language
- (b). interviews and group discussions
- (c). Debate and Elocution
- (d). Phonetics.

II: Reading and Writing Skills:

To impart reading and writing skills through the following:

- a) Summarizing and abstracting.
- b) Case writing
- c) Office and business drafting like circular, Notice, Memo, enquiry letter, order letter, complaint letter and leave letter.
- d) Career skills like applying for a job, resume preparation, covering letter and e-mail writing etiquette.

TEXTBOOKS:-

- 1. Strengthen your communication skills, Part B by Maruthi Publications.
- 2. Spoken English in 3 volumes with 6 cassettes, OUP (CIEFL).
- 3. T. Balasubramanian, A textbook of English Phonetics for Indian students (Macmillan).

REFERENCE BOOKS:-

- 1. M.Ashraf Rizvi Effective Technical Communication (Tata McGraw Hill Companies)
- 2. Bhaskaran & Horsburgh Strengthen your English (Oxford University Press).
- 3. Andrea J Rutherford Basic Communication Skills for Technology (Pearson Education Asia).
- 4. Orient Longman English Skills for Technical students, WBSCTE with British Council.
- 5. P. Eliah A handbook of English for professionals. (Pharma book syndicate).
- 6. Judy Garton- Sprenger BBC, English stage 1 (B.B.C. English).
- 7. KK Ramchandran, Business communication (Macmillan).
- 8. SR Inthira and V Saraswathi, " Enrich your English – a)Communication skills, b)Academic Skills", (CIEFL and OUP).
- 9. Mohan Krishna & Banerji Meera. Developing communication skills (Macmillan).



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I Year - I Semester

L	T	P	C
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REMEDIAL BIOLOGY LAB

1. Study of Simple and Compound microscopes used in biology.
2. Section cutting, staining and mounting of sections.
3. Histological studies of the Leaf , Stem and Root with description of their stained sections.
4. Description and study of floral characters of the plants representing the families in theory.
5. Observation of permanent slides.




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I Year - I Semester

L	T	P	C
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GENERAL & DISPENSING PHARMACY LAB

1. Dispensing of prescriptions falling under the categories; Mixtures, solutions, emulsions, creams, ointments, powders, pastes, lotions, liniments, inhalations, paints. etc.
2. Identification of various types of incompatibilities in a prescription, correlation thereof and dispensing of such prescriptions.
3. Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.
4. Dispensing of prescriptions involving adjustment of tonicity.

A total 50 prescriptions are to be dispensed.




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I Year - I Semester

L	T	P	C
0	0	3	2

PHARMACEUTICAL ORGANIC CHEMISTRY - I LAB

Introduction to Equipment & Glassware

Recrystallization method, determinations of Melting point, Boiling Point and distillation

I. Preparation of organic compounds (each involving a specific organic reaction covered in theory)

1. N-Acetylation: Preparation of Acetanilide from Aniline
2. O-Acetylation: Preparation of Aspirin from salicylic acid
3. Nuclear Nitration: Preparation of m-Dinitrobenzene from nitrobenzene
4. Oxidation: Preparation of Benzoic acid from Benzyl chloride
5. Esterification: Preparation of n-Butyl acetate from n-Butyl alcohol
6. Etherification: Preparation of α -Naphthyl Methyl ether from α -Naphthol
7. Halogenation: Preparation of Iodoform from Iodination of acetone
8. Extensive Nuclear Substitution: Preparation of Tribromophenol
9. Bromination of Tribromo aniline from Phenol or Aniline

II. Systematic qualitative Analysis (Identification) of Mono functional Organic Compounds:

Avoid water-soluble compounds, and compounds containing more than one functional group; at least six individual compounds to be analyzed.

REFERENCES

1. Vogel's Text Book of Practical Organic Chemistry, 5th Edition, Pearson
2. R.K. Bansal, Laboratory Manual of Organic Chemistry.
3. O.P. Agarwal, Advanced Practical Organic Chemistry.
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry.




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I Year - II Semester

L	T	P	C
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HUMAN ANATOMY & PHYSIOLOGY – II

UNIT – I 08

Central Nervous System: Anatomy and physiology of different parts of brain, spinal cord and cranial nerves.

LO: Brain involvement in sensory and motor functions including pain perception, sleep wake cycle, cognitive skills, memory, behavior and governance.

UNIT – II 08

Neuron, axon conduction, Neurochemical transmission, reflex action, Electroencephalogram, specialized functions of the brain, and their Disorders.

LO: Chemical Mediators like Acetyl choline, Serotinine, Dopamine, Noradrenaline, Glutamic acid, Gaba involvement in transmission of impulse and disorders due to their changes.

UNIT – III 08

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

LO: Cholinergic system is essential for life process while adrenergic system is needed to meet emergency by flight or fight. ANS works through out life without rest unlike CNS.

UNIT – IV 08

Endocrine System: Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, testes, ovary and endocrine functions of hormones and their disorders.

LO: Growth, reproduction and metabolism depend on hormonal activity. Their imbalance leads to disorders and some of them cannot be rectified.

UNIT-V 08

Reproductive System: Male and female reproductive systems and the functions of their hormones. Physiology of menstruation, Spermatogenesis and Oogenesis.

LO: Concept of male & female hormones, Characters, sex cell maturity, reproductive period, copulation and pregnancy, parturition, concept of pregnancy, menopause and their care.

UNIT-VI 10

Sense organs: Basic anatomy and physiology of Eye, Ear, Nose, Tongue and Skin.

LO: Sensations are the combined activities of sensory organs and specified areas of the brain.



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TEXT BOOKS

1. Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. Ross & Wilson – Anatomy & Physiology in health and illness – Anne Waugh, Allison Grant.
3. T.S. Ranganathan, A Text book of Human Anatomy.
4. Human Anatomy and Physiology. C.C Chatterjee.
5. Dr. Jayaveera K.N., Vrushabendra Swamy B.M., Human Anatomy Physiology and Health Education, S.Chand publ.

REFERENCES

1. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
2. Subrhamanyam and Others, A textbook of Physiology
3. A.C.Guyton, Text Book of Medical PhysiologyKeele& Neil, Samson Wrights Applied Physiology
4. Best & Taylor, The Living Body-A Text Book on Human Physiology
5. M.N. Ghosh, Human Physiology Julia F. Gui, Learning Human Anatomy: A Laboratory Text
6. B.D. Chaurasia, Human Anatomy, Regional and Applied, Part-I,II and III, CBS Publishers and Distributors, New Delhi




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PHARMACEUTICAL INORGANIC CHEMISTRY

UNIT-I

08

1. Classification of inorganic pharmaceuticals based on their applications and therapeutic uses.
2. Sources of impurities, quality control and test for purity. Limit tests for chlorides, sulphates, iron, arsenic, lead and heavy metals and their pharmacopoeial standards.

LO: Pharmaceutical orientation to inorganic chemistry, definitions, principles, procedures, limits of detection, keeping the impurities in pharmaceutical substances to the minimal level.

UNIT-II

10

1. **Sodium, potassium and calcium replenishers:** sodium chloride, compound sodium chloride solution (Ringer solution), potassium chloride, ORS.
2. **Calcium replenishers:** Calcium chloride, calcium gluconate, dibasic calcium phosphate.
3. **Acid-base regulators:** sodium bicarbonate, sodium lactate, sodium citrate/potassium citrate, sodium acetate and ammonium chloride.
4. **Antacids:** Aluminium hydroxide gel, dried aluminium hydroxide gel, magnesium oxide, magnesium hydroxide mixture, magnesium trisilicate and calcium carbonate.
5. **Expectorants:** Ammonium chloride, potassium iodide.
6. **Emetics:** Potassium antimony tartrate and copper sulfate.
7. **Antidotes:** Sodium thiosulphate and sodium nitrite.

LO: Properties, classification, preparation, assay of ammonium chloride, sodium thiosulfate and sodium nitrite, uses.

UNIT-III

08

1. **Adsorbents:** Light kaolin, heavy kaolin and activated charcoal.
2. **Astringents:** Zinc oxide and Bismuth subcarbonate.
3. **Protectants:** Calamine, zinc oxide, zinc stearate, talc and titanium dioxide
4. **Silicone polymers:** Activated Dimethicone
5. **Anti-infectives:** Hydrogen peroxide solution, potassium permanganate, silver nitrate (Silver protein), iodine (Solutions of iodine, povidone-iodine) boric acid and yellow mercuric chloride.

LO: Properties, preparation wherever applicable, assay of hydrogen peroxide, potassium permanganate, boric acid, zinc oxide and uses.

UNIT-IV



08

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1. **Laxatives:** Magnesium sulphate and Sodium phosphate.
2. **Haematinics:** Ferrous sulphate, Ferrous fumarate, Ferrous gluconate, Ferric ammonium Citrate, Iron and Dextrose injection.
3. **Suspending agents:** Bentonite and Colloidal silica.
4. **Excipients:** Di and tricalcium phosphates, Magnesium stearate, talc and Calcium carbonate (precipitated chalk).
5. **Colorants:** Titanium oxide and Ferric oxide.

LO: Properties, preparations wherever applicable, uses.

UNIT-V

08

Dental products:

1. **Fluorides:** Sodium fluoride and Stannous fluoride.
2. **Oral antiseptics:** Hydrogen peroxide, Zinc peroxide and mouth washes.
3. **Dentifrices:** Dibasic calcium phosphate, Strontium chloride and Sodium metaphosphate.
4. **Cements and Fillers:** Zinc oxide.

LO: Properties, preparations wherever applicable, uses.

UNIT-VI

08

Miscellaneous medicinal agents of inorganic nature:

Cisplatin (Antineoplastic), lithium carbonate (Antipsychotic), Barium sulfate (diagnostic agent), Plaster of paris (surgical aid), Sodium Aurothiomalate (antirheumatic), Sodium antimonygluconate (internal parasiticide) and Potassium perchlorate (antithyroid).

LO: Structures, properties and uses.

TEXT BOOKS

1. A.H.Beckett and J.B.Stenlake, Practical pharmaceutical chemistry, Part-I. The Athtome press, University of London, London.
2. Advanced Inorganic Chemistry by Satya prakash, G.D.Tuli
3. Wal Ankita, Wal, Pranay, Rai, Awani Kumar, Inorganic Pharmaceutical Chemistry, New Age International Publishers.

REFERENCES

1. J.H Block, E.Roche, T.O Soine and C.O. Wilson, Inorganic Medical and pharmaceutical Chemistry Lea & Febiger Philadelphia PA.
2. P. Gundu Rao, Inorganic pharmaceutical chemistry; Vallabh Prakashan, Delhi.
3. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London.
4. G.R Chatwal, Pharmaceutical Chemistry Inorganic, Himalaya Publishers.
5. K Somasekhar Rao, C Venkata Suresh, Pharmaceutical Inorganic Chemistry, Pharma Med Press.




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I Year - II Semester

L	T	P	C
4	1	0	3

PHARMACEUTICAL ORGANIC CHEMISTRY-II

UNIT-I

10

Benzene: Kekule's structure, Aromaticity, Huckle's rule, resonance energy, characteristic electrophilic substitution reactions: Nitration, Halogenations, Sulfonation, Friedel-Craft's alkylation and acylation with limitations, orientation in mono substituted benzenes.

Polynuclear aromatic hydrocarbons: Nomenclature, methods of preparation of Naphthalene, Anthracene and Phenanthrene, their oxidation and reduction reactions, relative susceptibilities to oxidation as interpreted in terms of sacrifice of resonance energies, Electrophilic substitution reactions.

Arylhalides: Nomenclature, comparison of reactivity with respect to alkylhalides, mechanism of nucleophilic substitution (Benzyne concept).

LO: Understanding the properties of aromatic compounds, mechanisms of reactions and their usefulness in organic synthesis, electronic factors influencing orientation.

UNIT-II

08

Carbonyl compounds: Nomenclature, important methods of preparation, characteristic nucleophilic addition reactions (addition of bisulphate, Grignard reagent, hydrogen cyanide, hydrazine derivatives and alcohols); Aldol condensation, Cannizzaro reaction and Perkin reaction.

LO: General properties, relative reactivities towards nucleophilic addition, mechanisms and applications.

UNIT-III

08

Carboxylic acids: Nomenclature, important methods of preparation, characteristic reactions (acidity, relative acidities, reduction, H-V-Z reaction, conversion into acid chlorides, amides and esters); methods of preparation of important esters (Acetoacetic ester and Malonic ester) and their applications in organic synthesis.

LO: General properties, measurement of relative acidities, equations involving the reactions and mechanisms, applications in synthesis.

UNIT-IV

08

Phenols: Nomenclature, general methods of preparation, industrial synthesis of phenol by Dow process, characteristic reactions (acidity and its comparison to alcohols and carboxylic acids as interpreted by resonance, ether formation, ester formation, Kolbe reaction, Reimer-Tiemann Reaction, Bromination and nitration).

LO: Structures, equations, mechanisms, importance of these reactions in pharmaceutical organic synthesis.




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UNIT-V

08

Amines and Diazonium compounds: Nomenclature, methods of preparation, characteristic reactions (basicity and relative basicities, alkylation and exhaustive alkylation, nitration and orientation), separation of all three classes of amines by Hinsberg's method; formation of Diazonium compounds, characteristic reactions (replacement by hydrogen, Sandmeyer reaction, replacement by nitrile, and their applications in synthesis and coupling reactions).

LO: Properties, structures, equations, mechanisms, orientations and applications.

UNIT-VI

08

Name reactions: Beckmann rearrangement, Mannich reaction, Fries rearrangement, Michael addition, Schmidt reaction, Benzoin condensation.

LO: General reaction, structures and mechanism, applications in organic synthesis.

TEXT BOOKS

1. R.T. Morrison and R.N. Boyd, Organic chemistry, pentice hall of India private limited, New Delhi.
2. Arun Bahl & B. S. Bahl, Advanced Pharmaceutical Organic Chemistry, S. Chand & Company Ltd.
3. C. N. Pillai, Text book of Organic Chemistry, University Press.
4. Bhupinder Mehta, Manju Mehta, Organic Chemistry, PHI Learning

REFERENCES

1. R.L Madan, *Organic Chemistry*.
2. Lloyd N. Ferguson, Text book of Organic Chemistry, 2nd edition,.
3. Raj K Bansal, A textbook of Organic Chemistry, 5th edition.




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I Year - II Semester

L	T	P	C
4	1	0	3

PHYSICAL PHARMACY - I

UNIT – I 10

Intermolecular forces and states of matter: Binding forces between molecules, the states of matter, the gaseous state, the liquid state, solids and the crystalline state. Phase equilibria and the phase rule.

LO: To learn intermolecular forces and states of matter, Phase equilibria and Phase rule

UNIT – II 08

Thermodynamics: The first law of thermodynamics, The second law of thermodynamics. The third law of thermodynamics, Free energy functions and applications. Thermochemistry

LO: To understand laws of Thermodynamics and their Applications

UNIT – III 08

Physical properties of Drug Molecules: Dielectric constant induced polarization, Dipole moment, Refractive index and Molar refraction, Optical rotatory dispersion.

LO: To understand the physical properties of drug molecules and their significance.

UNIT – IV 12

Solutions of Non electrolytes: Concentration expressions, Ideal and Real solutions, Colligative properties, molecular weight determinations.

LO: To understand properties of Non electrolytes and their significance

Solutions of Electrolytes: Properties of solutions of electrolytes. The Arrhenius theory of electrolyte dissociation. The modern theory of strong electrolytes and other coefficients for expressing colligative properties.

LO: To know theories of electrolytes and their dissolution and colligative properties

UNIT - V 05

Buffers and buffered isotonic systems: The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions, methods of adjusting tonicity and pH (relevant numerical problems).

LO: To know about buffers, buffer isotonic solutions, Methods of adjusting isotonicity and their Significance.

UNIT - VI 07

Solubility and Distribution Phenomena: Solvent-solute interaction, solubility of gases in liquids, liquids in liquids, solids in liquids, distribution of solutes in immiscible solvents.

Introduction to phenomena of diffusion: Ficks first law and second law.

LO: To understand the solubility and distribution phenomenon and laws of diffusion.




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TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.
2. C.V.S.Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. C.V.S.Subramanyam, Physical Pharmacy, Vallabh Prakashan.
4. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.
5. Bentley's Text Book of Pharmaceutics by E.A. Rawlins.
6. Manavalan & Ramasamy, Physical Pharmaceutics, Vignesh Publishers

REFERENCES

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European.)
2. B.S Bahl, ArunBahl and G.D Tuli, Essentials of Physical Chemistry.
3. Martindale, the Extra Pharmacopoeia; Latest Edition the Royal Pharmaceutical Society
4. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
5. Robin J. Haiwan, Hand Book of Pharmacy and Health Care Edition, ThePharma Press, U.K.
6. S. J Carter, Cooper and Gunn's Tutorial pharmacy.




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I Year - II Semester

L	T	P	C
4	1	0	3

COMPUTER APPLICATIONS AND BIOSTATISTICS

UNIT-I

22

Overview of computer with general applications: components of computers, computer languages, usage of computers, introduction of operative system.

Introduction to MS-Office: MS- word: Basics, working with files, working with text, formatting paragraphs, styles, lists, tables, graphics, spelling and grammar, page formatting macros and table of contents.

MS-Excel: Basics, spreadsheets, data types, formulas, formatting charts and graphs.

MS-Power Point: Basics, views, slide controls, applied design, page setup, templates, background control, colour screens, traditions and animations, working with texts and working with graphics.

MS-Access: Data base concepts, screens layouts, creating tables, data sheet record, table relationships, shorting and filtering, query forms, form controls, sub forms, reports, importing, exporting and linking.

LO: The student should be familiar with overview of the computers and MS-office

UNIT-II

06

Information Technology Today: Internet and World Wide Web (www), structure and organization of www, browsers, information searching in www, search engines, pharmaceutical resources in www types of indexing tools and search strategies, Hyper Text Manuscripts Languages (HTML) and e-mail.

LO: Familiarity with internet, WWW, browsing, HTML & e-mails.

+UNIT-III

06

Database Management: Concepts and objectives of Database Management systems, advantages of database management systems and examples of DBMS packs (like DBASE III).

LO: Familiarity with Database management

UNIT-IV

08

Data collection and treatment: Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams.

Measures of central tendency and variations: Mean, median, mode, properties and applications, range, standard deviations and standard error of means, coefficient of variation, kurtosis, skewness and confidence (fiducial) limits for mean and proportions.

LO: Fundamentals of data / Sample collection and diagrammatic representation. Measures of central tendency and dispersion.




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UNIT-V

04

Correlation and Regression: Correlation and regression analysis, method of least squares and non-linear regression.

LO: Correlation and regression in pharmacy.

UNIT-VI

04

Statistical inference: t-test, chi square test and their applications in pharmacy.

LO: Application of t-test & Chi square test in testing the significance of difference or similarity.

TEXTBOOKS

1. Computer Fundamentals, Anita Goel, Pearson.
2. Information Technology Workshop, 3e, G Praveen Babu, M V Narayana BS Publications.
3. Khan & Khan, "*Fundamentals of Biostatistics*".
4. Pranab Kumar Banerjee, "*Introduction to Biostatistics*".

REFERENCE BOOK:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu
2. Biostatistics for medical, nursing and pharmacy students by A. Indrayan, L Satyanarayana.
3. Introduction to Information Technology, ITL Education Solutions Ltd., 2nd Ed, PEARSON
4. Comdex Information Technology, Vikas Gupta, dreamtech.



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I Year - II Semester

L	T	P	C
0	0	3	2

HUMAN ANATOMY & PHYSIOLOGY LAB

1. Study of compound microscope and precautions to be taken while handling it.
2. Microscopic study of the structure of cell and different tissues.
3. To understand and learn Blood withdrawal techniques.
4. Determination of bleeding time, clotting time, blood grouping and Estimation of Hemoglobin in blood.
5. Study of Haemocytometry.
6. Estimation of W.B.C count.
7. Estimation of R.B.C. count.
8. Estimation of D.L.C.
9. Study of human skeleton.
10. Study of different systems with the help of charts and models.
11. Recording of body temperature, pulse rate and blood pressure.
12. Determination of vital capacity, experiments on Spirometer.
13. Various devices used in family planning like Copper T, Lippe's loop, diaphragm, condom and oral pills.



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I Year - II Semester

L	T	P	C
0	0	3	2

PHYSICAL PHARMACY – I LAB

1. Determination of density of a liquid.
2. Determination of specific rotation of optically active substance by using polarimeter.
3. Determination of concentration of sugar solution by using Polarimeter.
4. Determination of refractive index of a liquid by using Refractometer.
5. Determination of Percent composition of a binary liquid mixture by using Refractometer.
6. Determination of Molecular weight of a given substance by using Landsberger method.
7. Determination of Molecular weight of a given substance by using Rast camphor method.
8. Calibration of pH Meter and determination of pH of a solution.
9. Estimation of pKa by Half Neutralization Method.
10. Determination of Upper Consolute Temperature by using Phenol water system.
11. Determination of heat of neutralization of strong acid by strong base.
12. Determination of effect of impurities on phase diagram of water – phenol system.
13. Preparation of Buffers.
14. Determination of Buffer capacity.
15. Determination of partition coefficient.
16. Effect of temperature on solubility of solid in liquid.
17. Effect of addition of salt / pH / cosolvent on the solubility.



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I Year - II Semester

L	T	P	C
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COMPUTER APPLICATIONS LAB

Identification of the peripherals of a computer.

To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

A practice on disassemble the components of a PC and assembling them to working condition.

Examples of Operating systems-Dos, Windows, Installation of MS windows on a PC.

Introduction to Memory and Storage Devices , I/O Port, Device Drivers, Assemblers, Compilers, Interpreters , Linkers, Loaders.

Internet & World Wide Web :Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC ,Bluetooth Technology, Wireless Technology, Modem, DSL, Dialup Connection.

Orientation & Connectivity Boot Camp and surfing the Web using Web Browsers: Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers.

Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google.

MS Office

Word Orientation: Word as word Processors.

Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option

Creating project : Abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

MS Excel

Excel Orientation: The mentor needs to tell the importance of MS Excel as a Spreadsheet tool, give the details of the tasks and features that would be covered in each.

Using Excel Accessing, overview of toolbars, saving excel files, Using help and resources

Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Performance Analysis - Features to be covered: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting




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Power Point

Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in PowerPoint.

Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

MS Access:

Students have to work on creating data bases, tables, storing and organizing data in the data base, querying, Creating Forms and Reports (take appropriate examples.)

TEXT BOOK:

- 1 Computer Fundamentals, Anita Goel, Pearson.
- 2 Information Technology Workshop, 3e, G Praveen Babu, M V Narayana BS Publications.
- 3 Introduction to Information Technology, ITL Education Solutions Ltd., 2nd & 3rd Eds., PEARSON.
- 4 Comdex Information Technology, Vikas Gupta, Dreamtech.

REFERENCE BOOK:

1. Williams, Using Information Technology: Practical Introduction, TMH.
2. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu.




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II Year - I Semester

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PHARMACEUTICAL UNIT OPERATIONS –I

UNIT-I

10

Fluid Flow: Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

LO: To understand fluid flow concepts – Reynold's number, viscosity, flow meters and valves – measurements of flow and pressure.

UNIT-II

08

Material handling systems:

- Liquid handling -different types of pumps.
- Gas handling -various types of fans, blowers and compressors.
- Solid handling -conveyors

LO: To understand material handling systems – liquid, gas and solid handling.

UNIT-III

08

Filtration and Centrifugation: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimenters.

LO: To understand theory and equipment of filtration and centrifugation.

UNIT-IV

08

Crystallization: Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

LO: To know the crystallization theory, crystallization equipment and their applications.

UNIT-V

08

Dehumidification and Humidity control

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.

LO: To know the theory of dehumidification and humidity control, measurement of humidity.

Refrigeration and Air Conditioning:



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Principles and applications of refrigeration and air conditioning.

LO: To understand the principles and applications of refrigeration and air conditioning.

UNIT-VI

08

Materials of Construction: General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.

Industrial hazards and safety precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, accident records etc.

LO: To understand the materials of construction, their properties and applications. To know the mechanical, chemical, fire and dust hazards and their prevention.

TEXT BOOKS

1. Prof. K. Samba Murthy, Pharmaceutical Engineering.
2. Badzer & Banchemo, Introduction to Chemical Engineering.
3. C.V.S. Subramanayam, Pharmaceutial Unit Operation, VallabhPrakashan
4. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy 6ed CBS publisher, Delhi.

REFERENCES

1. Perry's Handbook of Chemical Engineering.
2. Unit Operations by McCabe& Smith.
3. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences.
4. EA Rawlins, Bentley's Text Book of Pharmaceutics, 8th edition, ELBS
5. C.G. Brown, Unit Operations (Indian ed) Asia Publishing House, Bombay
6. Remington's Pharmaceutical Sciences



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II Year - I Semester

L	T	P	C
4	1	0	3

PHARMACEUTICAL BIOCHEMISTRY

UNIT – I

06

Introduction to Biochemistry: Outlines of the biochemistry organization of cell organelle, Molecular constituents of cell membrane, active and passive transport processes across the cell membranes.

LO: Introduction, essentials of biochemistry with respect to pharmacy, cell, structure and functions.

UNIT –II

08

Chemistry of carbohydrates, proteins and Lipids: definitions, classification with examples and structures, properties, reactions and biological significance of carbohydrates, proteins, lipids, nucleic acids, vitamins and minerals.

LO: Introduction, basic concepts, structures, properties, significance and uses.

UNIT – III

10

Carbohydrate Metabolism: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, Gluconeogenesis, Glycogenesis. Metabolic disorders of carbohydrate metabolism.

LO: Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT – IV

10

Lipid Metabolism: Oxidation of saturated (β - Oxidation), Ketogenesis and Ketolysis; Biosynthesis of Fatty acids, Lipids; Metabolism of cholesterol; Hormonal regulation of Lipid Metabolism. Defective metabolism of Lipids.

LO: Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT – V

08

Protein Metabolism: Protein turnover. Metabolism of Amino acids (Trans-amination, deamination, de-carboxylation). Urea cycle and its metabolic disorders. Outlines of the Metabolism and regulation of Protein synthesis.

LO: Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT – VI




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1. **Enzymes:** Classification, mode of action, factors affecting enzymes action, Coenzymes, enzyme kinetics.
 2. Brief outline of Energy rich compounds, Phosphate metabolism and Electron Transport system, Detoxification mechanisms and their biological significance.
- LO:** Introduction, properties, classes, biochemical role and mode of action.

TEXT BOOKS

1. Harper, Biochemistry
2. A.L.Lehninger, Principles of Biochemistry.
3. J.L.Jain, Fundamentals of Biochemistry.
4. Satyanarayana, Text Book of Biochemistry
5. Rama Rao, Text Book of Bio Chemistry.
6. Conn, Outlines of biochemistry

REFERENCES

1. L.Stryer, Text Book of Bio Chemistry.
2. E.E Conn & P.K. Stumpf, Outlines of Biochemistry by, John Wiley & sons, New York.
3. B.Harrow and A. Mazur, Text Book of Biochemistry, WB Saunders Co., Philadelphia.
4. Boyer Rodney, Modern experimental Bio Chemistry.
5. West, Edward Text Book of Biochemistry.
6. Conn, Outlines of Biochemistry.
7. Plummer, Practical Bio Chemistry.
8. Denniston, Topping & Caret; General, Organic, and Biochemistry, McGraw-Hill




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II Year - I Semester

L	T	P	C
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PHYSICAL PHARMACY - II

UNIT-I 10

Kinetics: Rates and orders of the reaction. Influence of temperature and other factors on reaction rates. Decomposition and stabilization of medicinal agents, kinetics in the solid state and accelerated stability studies (relevant numerical problems).

LO: To understand kinetic rates, order of reaction, decomposition pathways and methods of stabilization, stability testing methods, accelerated stability studies.

UNIT-II 08

Interfacial Phenomena: Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Surface active agents and systems of hydrophilic-lipophilic classification. Adsorption at solid interfaces. Electrical properties of interfaces.

LO: To understand theory of interfacial phenomenon, absorption, surfactants and theoretical properties of interfaces.

UNIT-III 08

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

LO: To learn micromeritic characteristics and their applications and significance.

UNIT-IV 08

Rheology: Newtonian system, non-Newtonian system, thixotropy, measurement and applications in formulations. Determination of viscosity and its applications.

LO: To understand rheology, types of flow, thixotropy, its applications and viscosity.

UNIT -V 08

Colloids: Introduction, types of colloidal systems, preparation and purification of colloids, solubilization, Stability of colloids, optical properties, kinetic properties, electrical properties and Donnan Membrane equilibrium.

LO: To know colloids – types – properties – stability considerations.

UNIT -VI 08

Coarse Dispersions: Suspensions, Emulsions.

Suspensions - interfacial properties of suspended particles, settling in suspensions. Formulation of suspensions.

Emulsions - theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological properties of emulsions & suspensions.

LO: To know suspension, emulsion theories, types and properties.




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TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5 Edition.
2. CVS Subhramanyam, Physical Pharmacy, Vallabhprakashan.
3. Bentley's text book of Pharmaceutics. E. A. Rawlins
4. B. S. Bahl, Arunbahl and G. D. Tuli. Essentials of Physical Chemistry.
5. Manavalan & Ramasamy, Physical Pharmaceutics, Vignesh Publishers

REFERENCE

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. M.E. Aulton, Pharmaceutics – The science of dosage form design, 2 edition
3. Deelip Rao Derle & Sai hanuman Sagar Boddu. Essentials of Physical Pharmacy
4. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.
5. Pharmacopoeia (IP, BP, USP and European)




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PHARMACEUTICAL MICROBIOLOGY

UNIT I

10

Introduction to Microbiology: Origin, scope and discovery of spontaneous generation theory, contributions of Antony Von Leuwenhock, Pasteur, Koch and Lister.

Diversity of Microorganisms: Prokaryotes versus Eukaryotes – Eukaryotic and Prokaryotic cell structure, three domains of life (Bacteria, Archea and Eukaryotics). Pharmaceutical significance of Protozoa, Algae, Fungi, Bacteria and Viruses. Characterization and identification of microorganisms.

LO: To understand diversity of microorganisms and their spontaneous generation and use and harmful nature.

UNIT II

10

Nutrition and Growth of Microbes: Nutritional requirements, types of nutrient media and growth conditions and nutritional types based on energy source.

Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determining bacterial numbers, mass and cell constituents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

Microorganisms and their Environment: *Effects and microbial adaptations to environmental conditions* – Temperature, oxygen desiccation, extreme cold ionic effect, electricity, osmotic pressure, radiant energy, hydrostatic pressure, mechanical impact, vibration.

LO: To understand that bacterial growth curve consist of rapid growth followed by stabilization and later decline due to exhaustion of nutrients and several parameters affects the above.

UNIT III

08

Control of Microorganisms: General Concepts, Inhibition of growth and killing, sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity. Chemotherapeutic agents, mode of action and applications. Drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.

LO: To understand that moist heat, dry heat, radiation, filtration, chemicals can be used for sterilization and disinfection to provide aseptic condition in the filling areas, operation theatres etc

UNIT IV

10



Bacterial Genetics: Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon). Mutagenesis, chemical and physical mutagens.

LO: To understand the concept of bacterial resistance to antibiotics and other conditions.

UNIT V

04

Epidemiology of Diseases: Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhea, tetanus, food poisoning and infection hepatitis.

LO: To understand that microbes are responsible for causing certain diseases.

UNIT VI

08

Microbiological Assays: Principles and methods involved in Assay of Antibiotics, Vitamins, Amino acids & Bio-Sensors in Analysis.

LO: To understand that Antibiotics/Vitamins can be standardized by microbial assays.

TEXT BOOKS

1. Pelczar and Reid, Text Book of Microbiology
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi.
3. N.K. Jain, Pharmaceutical Microbiology
4. Alcamo, Microbiology.

REFERENCES

1. Heritage. J, Introductory Microbiology.
2. Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
3. Hugo, W B Pharmaceutical Microbiology.
4. Tortora A. Gerard, Text Book of Microbiology.



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II Year - I Semester

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HEALTH EDUCATION & PATHOPHYSIOLOGY

UNIT-I

Concepts of health & disease:

05

Disease causing agents and prevention of disease.

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

First aid:

Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

LO: To understand that disorder is a physiological change while disease is caused by infecting organisms. Prevention is better than cure concept. First aid for emergency conditions before the patient is moved for medical treatment.

UNIT – II

Demography and family planning:

05

Demography cycle, family planning and various contraceptive methods. Medical termination of pregnancy.

LO: Problems of over population in providing basic amenities and measures to be adopted for control.

UNIT-III

Basic Principles of cell injury and adaptation:

04

- i. Causes, pathogenesis and morphology of cell injury.
- ii. Cellular adaptations, atrophy, hypertrophy.
- iii. Disturbances of growth of cells
- iv. General biology of tumors
- v. Differences between benign and malignant tumors
- vi. Classification of tumors
- vii. Etiology and pathogenesis of cancer
- viii. Patterns of spread of cancer.

LO: Different phases of cell growth and disorder to understand normal and tumor cells.



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UNIT-IV

Inflammation & Repair:

08

- A) i. Pathogenesis of acute inflammation
- ii. Chemical mediators in inflammation
- iii. Pathogenesis of chronic inflammation
- B) i. Wound healing mechanisms and
- ii. Factors affecting wound healing.
- C) Pain and its types.

LO: To understand that several substances are involved in producing inflammation and to understand different reasons for causing pain.

UNIT-V

Diseases of Immunity:

03

- i) Introduction to T and B cells
- ii) MHC proteins or transplantation antigens.
- iii) Immune Tolerance

A) Hypersensitivity

04

- i. Hypersensitivity type I, II, III, IV.
- ii. Biological significance of hypersensitivity.
- iii. Allergy due to food, chemicals and drugs

B) Auto-Immunity:

05

- i. Mechanism of autoimmunity.
- ii. Classification of autoimmune diseases in man
- iii. Transplantation and allograft reactions, mechanism of rejection of allograft.
- iv. Acquired Immuno Deficiency Syndrome (AIDS)

LO: To understand about allergy and body's resistance against diseases (Natural and adoptive immunity).

UNIT-VI

Pathophysiology of Cardiac disorders:

03

Shock, stroke, hypertension, Angina, Myocardial infarction, Congestive cardiac failure, Atherosclerosis.

Pathophysiology of Common Disorders:

10

Diabetes Mellitus, Abnormalities in Lipoproteinemia, glycogen infiltration and glycogen storage disease. Peptic ulcer, Alcoholic liver diseases, Acute and chronic renal failure, Asthma, Parkinsonism, Schizophrenia, Depression and Mania.

Infectious diseases:

03

Infective hepatitis, STD – Syphilis, Gonorrhea, HIV; Pneumonia, Typhoid, UTI, Tuberculosis.



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Leprosy, Malaria, Dysentery (Bacterial and amoebic).

LO: Abnormalities of cardiovascular system, metabolism, respiration, behavior and diseases caused by microorganisms and disorders caused by smoking and alcoholism.

TEXT BOOKS

1. Text book of Robbins Pathology basis of Disease – Robins, Cotran, Kumar.
2. Mary V. Buras, Pathophysiology: A self Instructional programme.
3. Mary Lou Mulvihill, Human Diseases: A Systemic approach.
4. General Pathology – Y M Bhende, S G Deodhare, SS Kelkar
5. Essentials of Pathophysiology for Pharmacy. Martin M. Zdanowicz.
Published by Pharma Med Press.

REFERENCE BOOKS

1. A.C Guyton, Textbook of medicinal physiology by W.B. Prism books Pvt. Ltd., Delhi.
2. Joseph Dipiro, Patho Physiology and applied therapeutics.
3. H.P. Rang, M.N. Dale, J.M. Ritter, Anatomy & Physiology
4. Dr. Jayaveera K.N., Vrushabendra Swamy B.M., Human Anatomy Physiology and Health Education, S.Chand publ.




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II Year - I Semester

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PHARMACEUTICAL BIOCHEMISTRY LAB

Experiments:

1. Identification of carbohydrates
2. Identification of amino acids.
3. Identification of lipids.
4. Estimation of glucose in urine.
5. Estimation of creatinine in urine.
6. Estimation of urea in blood.
7. Estimation of creatinine in blood.
8. Estimation of Serum protein.
9. Estimation of bile pigments in serum.
10. Estimation of alkaline phosphatase in serum
11. Effect of temperature on the activity of alpha-amylase.
12. Qualitative analysis of abnormal constituents of urine.
13. Estimation of glucose by Folin-Wu method.
14. Estimation of SGOT in Serum.
15. Estimation of SGPT in Serum.
16. Determination of sodium, calcium & potassium in serum.

TEXT BOOK

1. Ashish S Verma, et.al., Laboratory Manual for Biotechnology, S.Chand.




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II Year - I Semester

L	T	P	C
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PHYSICAL PHARMACY - II LAB

1. Determination of rate constant of hydrolysis of Hydrogen Peroxide.
2. Determination of rate constant of hydrolysis of Ethyl acetate.
3. Effect of temperature on rate of hydrolysis of Ethyl acetate (at least 3 temperatures).
4. Determination of shelf life of drug .
5. Determination of surface tension of a liquid by using stalagnometer.
6. Determination of HLB value of surfactants.
7. Determination of CMC of a surfactant.
8. Construction of Adsorption Isotherm.
9. Determination of bulk density, true density and porosity of a powder.
10. Determination of angle of repose of a powder and studying the effect of lubricants and glidants.
11. Determination of particle size by microscopic method and using Andreasen pipette method.
12. Determination of Viscosity of a liquid by using Ostwald Viscometer.
13. Preparation and purification of hydrophilic and hydrophobic colloids.
14. Determination of sedimentation volume and degree of flocculation of a suspension.
15. Determination of globule size of an emulsion.




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II Year - I Semester

L	T	P	C
0	0	3	2

PHARMACEUTICAL MICROBIOLOGY LAB

1. Study of apparatus used in experimental microbiology.
2. Sterilization techniques and their validations.
3. Preparation of various culture media.
4. Sterilization of glass ware and culture media.
5. Aseptic transfer of culture into different types of media.
6. Staining methods - Simple staining, Gram's staining, Acid fast and Negative staining.
7. Motility testing by hanging drop method.
8. Enumeration of bacteria by pour plate/spread plate technique.
9. Enumeration of bacteria by direct microscopic count.
10. Isolation of pure cultures by streak plate, spread plate, pour plate.
11. Evaluation of antiseptics and disinfectants, sterility of pharmaceutical products as per IP requirements.
12. Observation of colony characteristics.
13. Bio chemical reactions:
 - i) Indole test.
 - ii) Methyl red test.
 - iii) Voges Proskauer Test
 - iv) Starch hydrolysis test.
 - v) Fermentation of carbohydrates.
14. Morphology of molds, yeasts.
15. Preservation of microorganisms (slant and stab cultures)




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II Year - II Semester

L	T	P	C
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PHARMACEUTICAL UNIT OPERATIONS – II

UNIT-I

06

Heat Transfer:

Source of heat, heat transfer, methods of heat transfer, heating of fluids, film coefficients, design of heating equipments, radiant heat transmission, steam and electricity as heating media, properties of steam.

LO: To understand principles and theory of Heat flow / Conductions, Convection, Radiation.

UNIT-II

08

Evaporation: Basic concept of phase equilibria, factors affecting the evaporation, evaporators, film evaporators, single effect and multiple effect evaporators.

LO: To understand evaporation, Phase equilibrium, Theory of evaporation- Evaporators.

UNIT-III

08

Distillation: Raoult's law, phase diagrams, volatility, simple steam and flash distillations, principles of rectification, Azeotropic and extractive distillation.

LO: Theory of distillation types of rectifiers, their application.

UNIT-IV

10

Drying: Moisture content and mechanism of drying, rate of drying and time of drying calculations, classification and types of dryers, dryers used in pharmaceutical industries tray dryer, Fluidised dryer, spray dryer, vacuum oven and freeze-dryer.

LO: Drying, Moisture content, rate of evaporation, types of dryers construction working and Applications.

UNIT-V

10

Size Reduction: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including Ball mill, Hammer mill, Fluid energy mill etc.

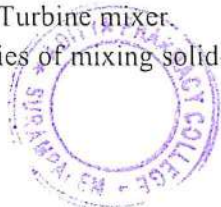
LO: To understand theory of size reduction, factors involved in size reduction, equipments- Construction working and applications-selection of size reduction equipment.

UNIT-VI

08

Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipment, Double cone, Twin-shell, Silverson mixer, Colloid mill, Sigma blade mixer, Planetary mixer, Propeller mixer and Turbine mixer.

LO: Theories of mixing solid-solid, solid-liquid & liquid-liquid mixing equipments.



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TEXT BOOKS

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th ed., CBS publisher, Delhi.
2. CVS Subhramanyam, Pharmaceutical Engineering.
3. K. Samba Murthy, Pharmaceutical Engineering
4. Mc Cabe & Smidth. Unit Operations.

REFERENCE BOOKS

1. W.I. Macebe and J. C. Smith Macro, Unit Operations To Chemical Engineering, Hill Int. Book Co., London.
2. L. Lachman, H. Lieberman & J. L Kaniz, The Theory And Practice Of Industrial Pharmacy, Lee & Febiger Philadelphia, USA
3. Badger & Banchoro, Introduction to Chemical Engineering.
4. Perry's Handbook of Chemical Engineering
5. M.E. Aulton, Pharmaceutics- The science of dosage form design, 2nd ed.
6. E.A. Rawlin's, Bentley's Text Book of Pharmaceutics, 8th ed ELBS




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PHARMACEUTICAL ANALYSIS –I

UNIT-I

08

A General introduction to Pharmaceutical analysis and general aspects of Standardization of Pharmaceutical chemicals and Formulated products mentioned in Indian pharmacopoeia. Importance of proper sampling and general books for pharmaceutical standards like pharmacopoeias, National formularies.

Computation of analytical results, Significant numbers, rejection of doubtful values with reference to Volumetric and Gravimetric analysis, sources of errors and Calibration of analytical equipment used in volumetric and Gravimetric analysis.

LO: To understand the concept of standardization by gravimetric and volumetric methods.

UNIT-II

10

Acid-Base titrations: Theoretical basis of neutralization reactions including electrolytic dissociation, application of law of mass action, relative strength of acids and bases, hydrolysis of salts and buffer solutions, theory of neutralization indicators and factors involved in the selection of indicators for different types of acid-base titrations. Procedures involved in different types of titrations using strong acid, weak base, strong base, weak base and back titration with blank determination. Assay of Boric acid Sodium bicarbonate, Borax, calcium hydroxide, zinc oxide, calcium carbonate, Acetyl salicylic acid, Formaldehyde, NaOH in presence of sodium carbonate.

Non-aqueous titrations: Principles, Advantages and pharmaceutical applications, solvents reagents and indicators used in Non aqueous titrimetry, other methods of detecting end points. Examples of titrations of alkali metal and alkaline earth metal salts of organic acids, primary, secondary and tertiary amines, halogen acid salts of bases, titration of acidic substances. Assay of thiamine hydrochloride.

LO: To understand the concept of standardization by aqueous and non-aqueous titrations.

UNIT-III

08

Oxidation-reduction titrations: theoretical considerations including standard potentials, calculation of redox potentials, redox indicators, principle and procedure involved in different types of redox titrations using potassium permanganate, iodine. Titrations of released iodine and back titration of excess iodine, potassium iodate, ammonium ceric sulphate and titanous chloride. Assay of ferrous sulphate, Hydrogen peroxide, Sodium nitrate, Estimation of ascorbic acid with 2,6-dichlorophenol indophenols, Assay of mercuric chloride, Assay of sodium metabisulphite, Assay of copper sulphate

LO: To understand the concept of standardization by oxidation – reduction methods.

UNIT-IV



10
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Precipitation titrations: principles and procedures involved in Argentimetry, use of Silver nitrate and Ammonium thiocyanate. Indicators used in precipitation titrations including adsorption indicators, Mohr's and Volhard's methods with examples. Assay of Potassium chloride, Ammonium thiocyanate, Assay of Mercuric oxide.

Complexometric titrations: Basic principles of Complexometric analysis including theories of complex ions, chelating agents, properties of metal complexes with particular reference to EDTA. Basic principles of complexometric analysis including theories of complex formation. Werner's coordination number and structure of complex ions, Chelating agents, properties of metal complexes with particular reference to EDTA, various examples of titrations of metal ions using Disodium acetate, indicators and end point detection using indicators and by physical methods, masking and demasking agents, pharmaceutical applications of complexometry with particular reference to I.P. Assay of Calcium gluconate injection/tablets, Calcium lactate and Assay of Aluminium sulphate

LO: To understand that standardization can be done for some compounds by Precipitation titrations.

UNIT-V

08

A detailed study of gravimetric analysis including principles involved, critical factors and typical methods involving precipitation, coagulation, digestion, filtration and incineration procedures with suitable examples. Advantages and disadvantages, sources of errors and their elimination in gravimetric analysis. Determination of sulphate as barium sulphate, Estimation of magnesium as magnesium pyrophosphate, Determination of thiamine as silico tungstate.

LO: To understand that standardization can be done for some compounds by gravimetric method.

UNIT-VI

06

Principles and procedures involved and application of nitrite titrations, titrations using 2, 6-dichlorophenol-indophenol. Aquametry including use of Karl-fisher reagent and moisture balances.

Gas analysis: principles of gas analysis use of hempel's gas burette and pipette, nitrometer, haldome's and orset's gas analysis apparatus and their operations. Examples of gas analytical methods of pharmaceutical significance.

LO: To understand that moisture in drugs can be determined by Karl-Fisher titration.

TEXT BOOKS:

1. Indian pharmacopoeia
2. Practical Pharmaceutical Chemistry by A.H. Becket and Stenlake
3. Quantitative Inorganic Analysis by A.I. Vogel.
4. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press, Delhi.
5. Pharmaceutical Analysis, Volume -I by PC Kamboj.

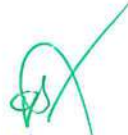



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REFERENCES

1. A.H. Beckett & J.B Stanlake Vol.I&II., Practical Pharmaceutical Chemistry, Athlone Press of the Univ of London
2. Y.Anjaneyulu, K.Chandrasekhar, Valli Manickam, A Textbook of Analytical Chemistry.
3. U N Dash, Pharmaceutical Analysis Biotech Pharma Publication
4. Fundamentals of Analytical Chemistry by Skoog, Donald M West.
5. A textbook of Pharmaceutical Analysis by Kenneth A Connors.




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PHARMACOGNOSY – I

UNIT- I

Definition, History, Scope and development of Pharmacognosy. General introduction to alternative systems of medicine like Ayurveda, Siddha, Unani and Homeopathy. **02**

Brief introduction to natural sources of drugs with examples: Plant Source, Animal Source, Mineral Source, Marine Source and microorganisms. **04**

LO: To make the students understand that drugs are obtained from different sources and crude drugs are used in the indigenous systems of medicine.

UNIT-II

06

Classification of Crude Drugs: Alphabetical, Morphological, Pharmacological, Chemical, Taxonomical and Chemo taxonomical methods of classification with suitable examples.

LO: To make the students understand that crude drugs can be classified based on several criteria.

UNIT-III

08

Cultivation, collection, processing, drying and storage of medicinal plants:

- Factors influencing cultivation of medicinal plants.
- Plant hormones and their applications.
- Definitions and examples for polyploidy, mutation and hybridization with reference to medicinal plants.

Good Agriculture Practices: Strategies of obtaining improved cultivation of medicinal plants.

LO: To understand improved agricultural conditions provide high yield and the methods be standardized to get consistent yields.

UNIT-IV

08

Adulteration & Evaluation of crude drugs:

Adulteration of crude drugs: Different methods of adulteration of crude drugs and general methods for detection of adulterants like Organoleptic, Microscopic, Physical, Chemical and Biological methods of evaluation.

LO: To provide enough knowledge to identify adulterants from genuine products and to provide quality products.

UNIT-V

08

Systematic Pharmacognostic study of the following carbohydrates and derived products:

Acacia, Tragacanth, Agar, Starch, Guar gum, Pectin, Ispaghula and Honey.

LO: To provide quality products of the above as excipients.



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UNIT-VI

14

Systematic Pharmacognostic study of the following Lipids: Castor oil, Cod liver oil, Shark liver oil, Linseed oil, Cocoa butter, Kokum butter, Bees wax, Wool fat, Hydnocarpus oil, Spermaceti, Lard and Olive oil.

Study of Tannins & Tannin containing drugs: Gambier, Black catechu, Myrobalan & Arjuna.

Study of Resins & Resin containing drugs: Benzoin, Asafoetida, Balsam of Tolu, Podophyllum.

LO: To maintain quality in fixed oils & understand that Tannins and Resins and their combination products are produced by different plants.

TEXT BOOKS

1. Trease and Evans, Pharmacognosy.
2. Tyler, Brady & Robert, Pharmacognosy.
3. T.E.Wallis, Textbook of Pharmacognosy.
4. Kokate C.K, Purohit AP & Gokhale Pharmacognosy.
5. G.S.Kumar, K.N.Jayaveera, A Text Book of Pharmacognosy and Phytochemistry.

REFERENCES

1. Atal C.K & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.
3. Heinrich, Fundamentals of Pharmacognosy and Phytotherapy.
4. R.N Chopra, S.L Nair and I.C Chopra, Glossary of Indian Medicinal Plants, CSIR, New Delhi
5. A A Farooqi and B S Sree Ramu, Cultivation of Medicinal and Aromatic Crops. University Press
6. Quadry, Pharmacognosy.




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MEDICINAL CHEMISTRY-I

UNIT-I

09

Heterocyclic compounds:

1. Five and six membered ring systems with heteroatoms: Furan, Pyrrole, Thiophene, Pyridine, Imidazole, Pyrazole, Oxazole, Isoxazole, Thiazole and Pyrimidine.
2. Fused ring systems with heteroatoms: Quinolines, Isoquinolines, Acridine, Benzimidazole and Phenothiazine.

LO: Nomenclature (numbering), one or two methods of preparation, important reactions, mechanisms and examples of drugs having the above ring systems.

UNIT-II

06

1. **Drug activity and physico-chemical properties:** Solubility, partition coefficient, hydrogen bonding, chelation, surface activity, bioisosterism, optical and geometrical isomerism, prodrugs and soft drugs.
2. **Mechanism of drug action:** receptor theories, enzyme stimulation and enzyme inhibition.
3. **Drug metabolism:** Phase I and Phase II reactions, factors affecting drug metabolism.

LO: Concepts involving receptors, drug-receptor interaction forces, mechanisms, equations, structures, advantages.

UNIT-III

10

Drugs acting on CNS:

1. **Hypnotics and anxiolytics:** Phenobarbital, Diazepam and Alprazolam.
2. **Antipsychotics:** Chlorpromazine and Haloperidol.
3. **Antiepileptics:** Phenytoin, Carbamazepine, Valproate sodium.
4. **Antidepressants:** Imipramine, Amitriptyline, Isocarboxazide, Iproniazide.
5. **General anaesthetics:** Ketamine, Halothane and Thiopental sodium.

LO: Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT-IV

09

1. **Adrenergic drugs:** Amphetamine, Salbutamol, Ephedrine, Phenylephrine and Dopamine.
2. **Adrenergic blockers:** Prazosine, Tolazoline, Propranolol, Atenolol
3. **Cholinergic drugs:** Carbachol, Bethanichol.
4. **Anticholinergics:** Propantheline, Dicyclomine.
5. **Neuromuscular blockers:** Succinyl choline.



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LO: Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT-V

08

1. **Analgesics and Non-steroidal anti-inflammatory agents (NSAIDs):** Paracetamol, Aspirin, Ibuprofen, Indomethacin, Diclofenac.
2. **Narcotic analgesics:** Meperidine, Methadone.
3. **Local anaesthetics:** Benzocaine, Procaine, Lignocaine and Dibucaine

LO: Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class, an understanding of morphinans, its agonists and antagonists.

UNIT-VI

08

1. **Oral antihyperglycemic agents:** Tolbutamide, Gliclazide, Glipizide, Glibenclamide, Metformin and Pioglitazone.
2. **Thyroid drugs:** Methimazole, Propylthiouracil
3. **H1-receptor antagonists:** Diphenhydramine, Chlorpheniramine, Chlorcyclizine, Cetrizine.
4. **H2-receptor antagonists:** Ranitidine
5. **Proton pump inhibitors:** Omeprazole, Rabeprazole, Lansaprazole.

LO: Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.


TEXT BOOKS

1. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcott, Raven, Philadelphia, 2004.
2. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, Ed: I. Oxford University Press, Delhi.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
2. Lippincott Williams and Wilkins, Remington: The Science and Practice of Pharmacy; 20th Edition.
3. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
4. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford




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Text Books

1. Thomas L. Lemke, David A. Williams, Foye's Principals of Medicinal Chemistry, 7th Ed, Lippincott.
2. John H. Block, IM Beale, Wilson & Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Ed, Lippincott, Raven Philadelphia, 2004.




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PHARMACOLOGY – I

UNIT – I

06

General Pharmacology: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, Structural activity and relationship (SAR), factors modifying drug action, tolerance and dependence; Pharmacogenetics; Enzyme Induction & Inhibition; Absorption, distribution, metabolism and excretion of drugs; Principles of drug discovery and development of new drugs.

L.O: Knowledge imparting basic concepts of Pharmacology, mechanism of action of drugs, SAR, Pharmacokinetics and drug discovery.

UNIT – II

10

Pharmacology of Autonomic Nervous System:

Neurohumoral transmission in peripheral nervous system (Autonomic and Somatic)
Parasympathomimetics & parasympatholytics, sympathomimetics & sympatholytics
Ganglionic-stimulants and blocking agents, skeletal muscle relaxants.

L.O: To understand the basics of physiology and neurotransmitters and their roles. To gain knowledge on the drugs acting on ANS and muscle relaxants.

UNIT – III

08

Drugs acting on Central Nervous System:

Neurohumoral transmission in the C.N.S, General anesthetics, Alcohols and Disulfiram, Sedatives, hypnotics, & anti-anxiety agents.

L.O: To understand the role of neurotransmitters in the CNS and pharmacology of various classes of drugs acting on CNS.

UNIT – IV

08

Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs, Narcotic analgesics & antagonists, Pharmacology of Local Anaesthetics

L.O: To have knowledge on the pathophysiology on Analgesia, pyretics, inflammation, gout and drugs used in their treatment.

UNIT – V

06

Antipsychotics & Lithium, Antidepressants, Pharmacology of Anti-epileptic drugs, Pharmacological management of Parkinsonism & other movement disorders, C.N.S. stimulants, Drug Addiction & Drug Abuse.

L.O: To impart knowledge on pathophysiology of various disease conditions of the above topics and pharmacology of drugs.



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UNIT – VI

06

Drugs Acting on the Gastrointestinal Tract

Antacids, Antisecretory & Anti-ulcer Drugs, Laxatives & antidiarrhoeal drugs, Appetite Stimulants & Suppressants, Emetics & anti-emetics, Carminatives, Demulcents, Protectives, Adsorbents, Astringents, digestants, enzymes & mucolytics.

L.O: To impart knowledge on pathophysiology and conditions relating to peptic ulcers and emesis and to understand the pharmacology of drugs used in GIT disorders.

TEXT BOOKS

1. Sathoskar, Pharmacology and Pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
2. Tripathi, Text book of Pharmacology.
3. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone.
4. F.S.K. Barar, Text book of Pharmacology, S.Chand.

REFERENCE BOOKS

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
2. Bertram. G. Katzung, Basic and Clinical Pharmacology, 9th Edn.
3. J. Crossland, Lewis's Pharmacology, Church living stone.
4. Ruth Woodrow, Essentials of Pharmacology for Health Occupations.



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II Year - II Semester

L	T	P	C
0	0	3	2

PHARMACEUTICAL UNIT OPERATIONS – LAB

1. Measurement of flow of fluids and their pressure, determination of Reynolds's number and calculation of frictional losses.
2. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration including filter aids.
3. Experiments to demonstrate applications of centrifugation.
4. Determination of Humidity-use of Dry Bulb and Wet Bulb thermometers and Psychometric charts.
5. Determination of radiation constant of painted and unpainted glass, metal cylinder (Iron, Brass).
6. Determination of overall Heat Transfer Coefficient.
7. Determination of rate of evaporation.
8. Experiments based on steam. Extractive and Azeotropic distillations.
9. Determination of rate of drying, free moisture content and bound moisture content.
10. Experiments to illustrate the influence of various parameters on the time of drying.
11. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction.
12. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.




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II Year - II Semester

L	T	P	C
0	0	3	2

PHARMACEUTICAL ANALYSIS –I LAB

Acid-base titrations

1. Standardization of HCl, H₂SO₄ & NaOH
2. Assay of following (any 6)
 - a. Assay of Boric acid
 - b. Assay of Sodium bicarbonate
 - c. Assay of Borax
 - d. Assay of Calcium hydroxide
 - e. Assay of Zinc oxide
 - f. Assay of Calcium carbonate
 - g. Assay of Acetyl salicylic acid
 - h. Assay of Formaldehyde
 - i. Assay of NaOH in presence of Sodium carbonate.

Redox titrations:

3. Standardization of Iodine & KMnO₄
4. Assay of following (any 5)
 - a. Assay of Ferrous sulphate
 - b. Assay of Hydrogen peroxide
 - c. Assay of Sodium nitrate
 - d. Estimation of Ascorbic acid with 2,6-dichlorophenol indophenols
 - e. Assay of Mercuric chloride
 - f. Assay of Sodium metabisulphite
 - g. Assay of Copper sulphate

Precipitation titrations

5. Standardization of Silver nitrate
6. Assay of Potassium chloride or Ammonium thiocyanate or Mercuric oxide.




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Complexation titrations

7. Standardization of EDTA
8. Assay of Calcium Gluconate injection/tablets
9. Assay of Aluminium sulphate

Non-aqueous titrations

10. Assay of Thiamine hydrochloride
11. Any other assay involving Perchloric acid

Gravimetry

12. Determination of Sulphate as Barium sulphate or Magnesium as Magnesium pyrophosphate.

Limit tests

13. Limit test for Chlorides
14. Limit test for Sulphates
15. Limit test for Iron
16. Limit test for Arsenic.



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II Year - II Semester

L	T	P	C
0	0	3	2

PHARMACOGNOSY LAB – I

1. Collection of natural herbs and preparation of herbarium / laminated photos for five drugs.
2. Quantitative microscopy:
 - a. Ratio values: Stomatal number and Stomatal Index.
 - b. Determination of dimensions of starch grains and fiber lengths using eye piece micrometer and Camera lucida methods.
3. Determination of proximate values:
 - i. Moisture content
 - ii. Ash value
 - iii. Extractive values.
 - iv. Swelling Factor.
4. Macroscopy, Microscopy and Chemical tests of any five carbohydrate drugs mentioned in theory.
5. Macroscopy and Chemical tests of any five lipid drugs mentioned in theory.
6. Macroscopy and Chemical tests of any two Tannin drugs mentioned in theory.
7. Macroscopy and Chemical tests of any two Resin drugs mentioned in theory.
8. Cultivation of medicinal plants: Maintenance of one plant in medicinal garden.

TEXTBOOKS:

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.
2. Harborne, Phytochemical methods: A guide to modern technology of plant analysis.



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PHARMACOGNOSY – II

Definition, general tests and detailed Pharmacognostic study of the following drugs.

UNIT I

10

Glycoside containing drugs:

- | | | |
|----|--------------------------|--|
| a. | Saponin Glycosides | : Glycyrrhiza, Ginseng, Dioscorea, Sarasaparilla & Senega. |
| b. | Cardio active Glycosides | : Digitalis, Squill, Strophanthus & Thevetia. |
| c. | Anthraquinone Glycosides | : Aloe, Senna, Rhubarb & Cascara. |
| d. | Bitter Glycosides | : Psoralea, Gentian & Chirata. |

LO: To understand that Glycosides are isolated from plant sources and have varied action based on aglycone part.

UNIT II

10

Alkaloid containing drugs:

- | | | |
|----|-----------------------------------|--|
| a. | Pyridine – Piperidine derivatives | : Tobacco & Lobelia. |
| b. | Tropane | : Belladonna, Hyoscyamus, Datura, Coca & Aswagandha. |
| c. | Quinoline & Isoquinoline | : Cinchona, Ipecac, Opium. |
| d. | Indole | : Ergot, Rauwolfia, Vinca, Nux-vomica |
| e. | Imidazole | : Pilocarpus |
| f. | Steroid | : Kurchi |
| a. | Alkaloidal amine | : Ephedra & Colchicum. |
| b. | Glycoalkaloid | : Solanum |
| c. | Purine | : Coffee, Tea. |

LO: To understand that Alkaloids of different structures are synthesized by different plants and possess varied activities based on structure.

UNIT - III

07

Systematic Pharmacognostic study of the following Volatile oil containing drugs: Mentha, Coriander, Cinnamon, Lemon Oil, Nutmeg, Eucalyptus, Ginger, Cardamom, Tulsi, Lemon Grass, Caraway, Cumin, Dill, Clove, Fennel and Black Pepper.

LO: To maintain quality in volatile oils.




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UNIT- IV

06

Biological source, preparations, identification tests and uses of the following enzymes:

Diastase, Papain, Pepsin, Trypsin, Pancreatin.

LO: To understand that different enzymes of useful nature are produced by plants

UNIT-V

10

Biogenesis of Phytopharmaceuticals:

General techniques of biosynthetic studies and basic metabolic pathways.

Brief introduction to biogenesis of secondary metabolites of Pharmaceutical importance.

Biosynthesis of Atropine, Morphine, Isoprenoid compounds and Cardiac glycosides.

LO: To understand that compounds of varied chemical nature are produced by Plants (chemo diversity).

UNIT – VI

07

Study of plant Fibers like Cotton, Cotton Wood Pulp, Jute, Silk, Hemp and Flax used in surgical dressing and related products.

The applications of natural dyes like Turmeric, Henna, Saffron, Cochineal and Marigold in Pharmacy.

LO: Plants exhibit a lot of diversity in producing Fibers useful for fabrics as well as Dyes to colour them.

TEXT BOOKS

1. Trease and Evans, Pharmacognosy.
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

REFERENCES

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




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MEDICINAL CHEMISTRY-II

UNIT – I

06

1. **Introduction to principles of chemotherapy**, chemotherapeutic index, drug resistance.
2. **Sulphonamides**: Sulfisoxazole, Sulphamethazole and Sulphathiazole.
3. **Antitubercular agents**: PASA, isoniazid, Ethambutol
4. **Antileprotic agents**: Dapsone

LO: Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT – II

08

1. **Antimalarials**: Chloroquine, primaquine and pyrimethamine
2. **Anthelmintics**: Diethyl carbamazine citrate, mebendazole, tinidazole,
3. **Antiamoebic agents**: Metronidazole and diloxanide furoate.
4. **Antifungal agents**: Clotrimazole, fluconazole and tolnaftate.

LO: Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT – III

10

1. **Antiviral agents**: Acyclovir, zidovudine, idoxuridine and amantadine.
2. **Cytostatic agents**: Chlorambucil, cyclophosphamide, carmustine, 5-fluoro uracil and mercaptopurine

LO: Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT – IV

12

Antibiotics:

1. **Penicillins**: Ampicillin, Amoxycillin
2. **Cephalosporins**: Structures of important cephalosporins (not synthesis)
3. **Tetracyclins**: Oxytetracycline, doxycycline
4. **Aminoglycosides**: Streptomycin and neomycin (structures).
5. **Miscellaneous**: Chloramphenicol, rifampicin (only structure)

LO: Chemistry, structures of currently used drugs, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.



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UNIT – V

07

Water soluble vitamins: Structures of B1, B2, B6, B12, Nicotinic acid, Nicotinamide, Folic acid and Ascorbic acid.

LO: Chemistry, structural features, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses, biological role.

UNIT – VI

07

Fat soluble vitamins: Physiological role, uses and Structures of vitamin A, Retinoic acid, Vitamin D, Ergosterol, Vitamin E, Vitamin K

LO: Chemistry including reactions, structural features, interconversions, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses, biological role.

TEXT BOOKS

1. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
2. Sri Ram, Medicinal Chemistry.
3. Rama Rao Nadendla, Medicinal Chemistry.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003.
2. Lippincott Williams and Wilkins: Remington: The Science and Practice of Pharmacy.
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, M.G.Mandel and F.I.Way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford 1991.
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.
8. Kadam, Textbook of Medicinal Chemistry Vol. 1 & 2.
9. O.P.Agarwal, Text book of natural products. Vol. 1 & 2



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TEXT BOOKS

1. Thomas L. Lemke, David A. Williams, Foye's Principles of Medicinal Chemistry, 7th Ed, Lippincott.
2. John H. Block, JM Beale, Wilson & Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Ed, Lippincott, Raven, Philadelphia, 2004.



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PHARMACEUTICAL TECHNOLOGY – I

UNIT – I

10

Preformulation: Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, organoleptic additives, hydrolysis, oxidation reduction, recemization, polymerization, etc., and their effect on formulation, stability and bioavailability. Study of Prodrugs. Stability testing of finished products as per ICH guidelines.

L.O: To understand preformulation parameters and their significance, methods, stability testing protocols, ICH guidelines.

UNIT – II

12

Liquid dosage forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubulizers, colors, flavours and other manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

L.O: To understand liquid dosage formulations, additives, manufacturing, evaluation, packaging procedures, official preparations.

UNIT – III

10

Semisolid dosage forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging.

Suppositories: Ideal requirements of bases, Different types of bases, manufacturing procedure, packing and evaluation.

L.O: To understand semisolid and suppositories preparations, their formulations, methods of preparation, evaluation and packaging.

UNIT – IV

06

Pharmaceutical aerosols: Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications.

Ophthalmic Preparations: Requirements, formulation, methods of preparation, containers, evaluation.

L.O: To understand aerosols, ophthalmic preparations, their formulation, types, preparations, packaging and evaluation methods.



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UNIT – V

06

Cosmeticology and Cosmetic Preparations - I: Fundamentals of cosmetic science, structures and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin like powders and compacts, skin creams (Cold cream and Vanishing cream), sun screen preparations & cosmetics for Hair like Shampoos, hair colorants, hair removers.

L.O: To understand cosmetics science, functions of skin and hair, cosmetic properties and their formulations, preparations and evaluation methods.

UNIT – VI

06

Cosmeticology and Cosmetic Preparations – II: Formulation, preparation & packaging of dentrifices like tooth powders, pastes, gels etc., and manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.

L.O: To understand formulation, preparations and packaging of various cosmetics preparations.


TEXT BOOKS

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of Industrial Pharmacy, Lea & Febieger, Philadelphia Latest Edn.
2. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.
3. BM Mithal and RN Saha, A handbook of Cosmetics, Vallabh Prakashan, New Delhi.
4. M.Vimala Devi, Textbook of Cosmetics, CBS Publishers.
5. Balsam S.M and Sagarin Edward, Cosmetics: Science and Technology, 2nd Ed. 3 Vol set.

REFERENCES

1. Shobha Rani, Text of Industrial Pharmacy, Hiremath Orient Longman.
2. Sagarian & MS Balsam, Cosmetics Sciences & Technology Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. E.A.Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publications.
5. HC Ansel Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York 1998.
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IV Ed, Marcel Dekker, USA, 2005.
8. Poucher's, Perfumes, cosmetics and soaps, 10th Edition by Hilda Butler.




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ENVIRONMENTAL SCIENCES

UNIT – I

10

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance– Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

LO: To know environment, Natural resource, Conservation of national resources

UNIT – II

10

Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem:

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

LO: To understand various Ecosystems Characteristic features, structural functions of each

UNIT-III

10

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

LO: To understand biodiversity-basic principles-Conservation of Biodiversity



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UNIT –IV

10

Environmental Pollution : Definition, Cause, effects and control measures of :

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

LO: To know about environmental pollution, types of pollution-Causes-Measures to prevent and solid waste management-techniques/Methods.

UNIT – V

05

Social Issues and the Environment: Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Waste land reclamation, Consumerism and waste products. Environment Protection Act -Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

LO: To know about social issues in environment, ethics, Acts related to environmental protection and conservation.

UNIT –VI

05

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. -Environment and human health. -Human Rights. -Value Education. HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health.

LO: Different aspects of human population and environment and their importance.


Text Books :

1. An Introduction to Environmental Studies by B. Sudhakara Reddy, T. Sivaji Rao, U. Tataji & K. Purushottam Reddy, Maruti Publications.

Reference:

1. Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada
3. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.




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III Year - I Semester

L	T	P	C
4	1	0	3

PHARMACEUTICAL MANAGEMENT

UNIT – I

08

Features of Business Organisations & New Economic Environment:

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing business environment in post-liberalisation scenario.

L.O: To understand business organization – types – functions.

UNIT – II

10

Manufacturing Management: Goals of Production management and organisation – Production, Planning and Control – Plant location - Principles and types of Plant layout-Methods of production (Job, Batch and Mass Production), New product development.

L.O: To understand production management and organization – Planning and control – Layout – Product development.

UNIT – III

10

Work Study - Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: \bar{X} chart, R chart, c chart, p chart, (simple problems), Acceptance sampling, Deming's contribution to quality.

L.O: To understand principles of work study – Methods – Control charts – Principles – Contribution – Quality concepts.

UNIT – IV

08

Organisation of Distribution and Marketing: Functions of Marketing, Marketing mix, Marketing strategies based on Product life cycle., Channels of distribution – Factors influencing channels of distribution, sales organization and sales promotion.

L.O: To understand concepts in organization – Distribution – Marketing – Functions – Strategies – Factors – Sales – Sales promotions.

UNIT - V

08

Pharma Industry: Growth of Pharma industry in India – current status and its role in building national economy and national health – Structure of Pharma industry in India – PSUs in Pharma industry –Progress in the manufacture of basic drugs, synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import trade.

L.O: To understand Pharma industry – Structure – Manufacturing of drugs and Pharmaceuticals – Exports and imports.




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UNIT – VI

06

Insurance and Pharma: Various types of insurance including marine and health insurance. Pharmaceutical associations and societies, statutory councils governing the profession. General principles of medical detailing.

L.O: To understand insurance – types – health insurance – associations and societies governing pharmacy profession.

TEXT BOOK

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Manohar A. Potdar, Pharmaceutical Plant Administration.
3. G.Vidya Sagar, Pharmaceutical Industrial Management.
4. C.V.S. Subramanyam, Pharmaceutical Production and Management

REFERENCES

1. Subbarao Chaganti, Pharmaceutical Marketing in India – Concepts and Strategy Cases, BS Publications.
2. O.P.Khanna, Industrial Management, Dhanpatrai, New Delhi.
3. Raja B Smarta, Strategic Pharmaceutical Marketing.




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III Year - I Semester

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PHARMACOGNOSY – II LAB

1. Study of Microscopy, Macroscopy and Powder characters of any four to five **Glycoside** containing crude drugs.
2. Study of Microscopy, Macroscopy and powder characters of any four to five **Alkaloid** containing crude drugs.
3. Study of Microscopy, Macroscopy and powder characters of any four to five **Volatile oils** containing crude drugs.
4. Identification of powdered crude drug mixtures based on microscopical characters (Two powder mixtures, 2 experiments)
5. Identification of powdered crude drug mixtures based on microscopical characters (Three powder mixtures, 2 experiments)
6. Identification tests for the enzymes Papain and Casein.
7. Identification of the fibers - cotton, wool, silk by morphological characters and chemical tests .

TEXT BOOKS

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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III Year - I Semester

L	T	P	C
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PHARMACEUTICAL TECHNOLOGY – I LAB

A total of at least 50 preparations are to be prepared belonging to various categories.

Preparation, evaluation and packaging of Syrups (6*), Elixir (4*), Oral Suspensions (4*), Suspensions for external use (4*), Emulsions (6*), Ointments (4*), Creams (2*), Gels (2*), Eye ointments (2*).


Formulation of various types of cosmetics - Shampoos (4*), Cleansing creams (2*), Tooth powders (2*), Tooth paste (2*), Nail Polish (1*), Manicure preparations (1*), Lipsticks (1*), Face powder (1*), Prickly heat powder (1*) and Baby Powder (1*).

*** indicates number of experiments**

TEXT BOOK

1. Swarnlata Saraf and shailendra Saraf, Cosmetics: A Practical Manual, 3rd Ed.




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MEDICINAL CHEMISTRY LAB

I. Synthesis of any 8 medicinal compounds and their analogues listed below.

- Barbituric acid from Diethyl Malonate.
- Phenytoin from Benzoin or Benzyl.
- Paracetamol from *para*- nitro phenol or *para*- aminophenol.
- 1,4- di hydro pyridine from ethyl aceto acetate.
- Quinazolinone from anthranilic acid via benzoxazinone.
- Sulfanilamide from acetanilide
- Isoniazid from γ -picoline.
- Antipyrine from ethyl aceto acetate.
- Benzocaine from *para*- nitro benzoic acid.
- Amphetamine from Phenyl acetone.
- Acetyl Glycine from glycine.
- 2,3 – Diphenyl quinoxaline from benzil.
- Chlorobutanol from acetone and chloroform.

II. Qualitative estimation of some functional groups.

- Halogens (Strepheno's method).
- Hydroxyl groups (Acetylation method)
- Methoxyl groups (Zeissel's method)
- Carboxyl groups (Silver salt method).

REFERENCES

- A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition.
- R.K. Bansal, Laboratory Manual of Organic Chemistry.
- F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition.



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III Year - II Semester

L	T	P	C
4	1	0	4

PHARMACEUTICAL TECHNOLOGY – II

UNIT – I

06

Capsules: Advantages and disadvantages of capsule dosage forms, materials for production of hard and soft gelatin capsules, sizes of capsules, capsule filling, soft processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

LO: To understand Capsule formulation, types, manufacturing and evaluation – Quality Control – Stability testing-storage.

UNIT - II

10

Microencapsulation: Types of microencapsulation and importance of microencapsulation in pharmacy, micron capsulation by coacervation phase separator, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques, evaluation of microcapsules.

LO: To understand microencapsulation – Applications, Methods of preparation. evaluation – Applications of Microcapsules.

UNIT - III

10

Tablets: Formulation of different types of tablets, granulation technology on large-scale by various techniques, types of tablet compression machinery and the equipments employed evaluation of tablets.

LO: To understand tablet formulations, additives- manufacturing methods-equipment-Evaluation of quality & control.


UNIT - IV

08

Coating of Tablets: Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes, evaluation of coated tablets.

LO: To understand types of tablet coating – coating solutions- Equipment-Process- evaluation of Coating tablets.




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Parenteral Products

- a. Preformulation factors, routes of administration, water for injection, treatment, apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- b. Formulation details, container and closures and selection.
- c. Prefilling treatment, washing and sterilization of containers and closures, preparation of solution and suspensions, filling and closing of ampules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
- d. Aseptic techniques, sources of contamination and method of prevention. Design of aseptic area, laminar flow benches, services and maintenance.

LO : To understand Formulations, Preformulations, additives, Manufacturing methods, containers, Packaging, evaluation of Parenterals – quality control , Types of sterile powders, aseptic processing facilities

Packaging of Pharmaceutical products:

Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencing choice of containers, package testing, legal and other official requirements for containers, packing testing.

Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packing material, stability aspects of packaging.

LO : To understand Packaging components- types, specifications and evaluation methods of packaging materials and containers- legal and official requirements

TEXT BOOKS

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn
2. HC Ansel introduction to Pharmaceutical Dosage forms
3. Pharmaceutical Dosage forms Tablet by Lieberman, Lachman
4. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.




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REFERENCES

1. Sagarian & MS Balsam, Cosmetics Sciences & Technology, Vol. 1, 2 & 3
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.A. Rawlkins Bentley's Text Book of Pharmaceutics, Elbs publ
4. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2nd ed, Marcel Dekker, Inc., New York 1998.
5. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed, marcel dekker, usa, 2005.
6. Yiew chien, novel drug delivery systems, 2nd ed, marcel dekker 2003.
7. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
8. Good Manufacturing Practices – Schedule M. Read With The Drugs And Cosmetic Rules 1945
9. M.E. Aulton, Pharmaceutics- The science of Dosage form Design 2nd ed.




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III Year - II Semester

L	T	P	C
4	1	0	4

PHARMACEUTICAL BIOTECHNOLOGY

UNIT – I

10

Fermentation Technology: Isolation, Selection, Screening of Industrial important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment.

LO: To understand principles of fermentation technology- types of bioreactor – optimization of fermentation process – principles of effluent treatment

UNIT – II

10

Specific Fermentations: Selection of organism, fermentation & purification of various antibiotics, vitamins, aminoacids, organic acids, solvents like penicillin, streptomycin, tetracyclin, erythromycin, riboflavin, cyanocobalamin, glutamic acid, lysin, citric acid, lactic acid, alcohol, acetone etc.

LO: To understand Fermentations of various types of industrial and medicinal compounds.

UNIT – III

08

Microbial Transformations: Types, Methods of bioconversions & Application in Pharma Industry, Steroidal transformation.

Recombinant DNA Technology: Introduction to R-DNA technology and genetic engineering, steps involved, isolation of enzymes, vectors, recombination and cloning of genes.

Production of biotechnology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB (Hepatitis B).

LO: To understand types, methods and applications of bioconversion – principles and production technology of recombinant DNA technology with examples.




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UNIT – IV

08

Immunology & Immunological Preparations: Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antibody reactions, hypersensitivity and its applications.

Active & passive immunizations, vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.

LO : To understand principles of Immunology, Antigen- Antibody reactions – applications, active and passive immunizations – study of various vaccines and sera.

UNIT – V

08

Enzyme Technology: Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes.

Study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

LO: To understand techniques, applications and production enzymes of medicinal importance

UNIT – VI

06

Introduction, role, collection, process & storage of blood products, plasma substitutes like Whole human blood, Human normal immunoglobulins, dextran. Sutures & ligatures like catgut etc.

Definition & applications of bioinformatics, proteomics and genomics.

LO: To understand Blood products – collection processing, storage and uses of various blood products.

TEXT BOOKS

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2nd Ed, Publ-Panima publication
co-operation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press
3. B.P. Nagori & Roshan Issari, Foundations in Pharmaceutical Biotechnology
4. Sambamurthy. K, Text Book of Pharmaceutical Biotechnology.
5. S. S. Kori, Pharmaceutical biotechnology.




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REFERENCES

1. Prescott and Dunne, "Industrial Microbiology" MC Caraw Hill Bool Company
2. Pepler "Microbial Technology" Vol. 1 & 2.
3. K. Kielslich "Biotechnology" Vol 6, Verlegchemic, Switzerland.
4. PF Standury & A. Whitaker, "Principles of fermentation Technology" Pergamon Press.
5. OP Ward "Fermentation Technology, Principles, Processes products" Open University press, Milton Keynes, UK.
6. A. M. Campbell, Monoclonal antibody technology.
7. A. Wiseman, Handbook of enzyme biotechnology.
8. J. D. Watson, Recombinant DNA technology.
9. Smith and Hood, Molecular biology and biotechnology.
10. E.A. Rawlins, Bentley's, A text book of pharmaceutics, 8th Ed, 1982 Bailler Tindall & Co.
11. Alexander N. Glazer & Hiroshi Nikaido, Microbial biotechnology, W. H. Freeman Co.
12. Ahwood.T.K, Introduction to Bioinformatics.
13. Cassida, Industrial microbiology.
14. H.K. Das, Textbook of Biochemistry.




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III Year - II Semester

L	T	P	C
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PHARMACOLOGY – II

UNIT – I

08

Pharmacology of Cardiovascular System – Drugs used in congestive heart failure & Cardiotonics.

Drugs used in cardiac arrhythmias, Antihypertensives, Drugs used in the treatment of Angina pectoris,

Drugs used in the therapy of shock.

LO: To acquire knowledge on CVS and its regulatory mechanisms, pathophysiology related to CVS diseases and disorders and Pharmacology of drugs used in the Cardio vascular diseases.

UNIT – II

06

Drugs acting on blood forming organs: Anti-coagulants, Anti-platelets, Thrombolytics & hematinics.

Drugs acting on urinary system: Fluid and electrolyte balance, Diuretics & Antidiuretics.

LO: Grasping knowledge on treatment of blood disorders, kidney disorders.

UNIT – III

08

Drugs acting on Endocrine system

Pancreatic hormone and Antidiabetic drugs, Thyroid & Antithyroid drugs, Gonadal hormones & Inhibitors, Adrenocorticosteroids & Adrenocortical antagonists, Hypothalamic & Pituitary Hormones.

LO: Grasping knowledge on Physiological role of Endocrine glands and its pathological conditions and the Pharmacology of drugs used.


UNIT – IV

06

Autacoids: Histamine, Serotonin (5-HT) & their antagonists, Prostaglandins & leukotrienes, Pentagastrin, cholecystokinin, angiotensin, vasoactive peptides.

LO: To acquire knowledge on Autocoids, synthesis, metabolism and their Pharmacology.




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UNIT – V

06

Drugs Acting on the Respiratory System

Anti-asthmatic drugs including bronchodilators, Anti-tussives & expectorants, Respiratory stimulants.

LO: Impart knowledge on respiratory diseases and the Pharmacology of drugs.

UNIT – VI

16

Chemotherapeutic agents and their applications: General principles of chemotherapy,

Sulphonamides and co-trimoxazole, Antibiotics: Penicillins, cephalosporins, betalactams,

Chemotherapeutic agents and their applications: Tetracyclines aminoglycosides, chloramphenicol, erythromycin, quinolones and miscellaneous antibiotics.

Chemotherapy of tuberculosis & leprosy.

Chemotherapy of fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.

Chemotherapy of malignancy and immunosuppressive Agents.

LO: To gain knowledge on Chemotherapeutics and various classes of drugs used for infection and diseases.

TEXT BOOKS

1. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
2. Tripathi, Textbook of Pharmacology, JAYPEE.
3. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone.
4. F.S.K. Barar, Text book of Pharmacology, S.Chand.
5. F.S.K Barar, Essentials of Pharamcotherapeutics.

REFERENCES

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann: The Pharmacological Basis of Therapeutics, Mc Graw hill, Health Professions Dvn.
2. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn, Mc Graw hill.
3. J. Crossland, Lewis 's Pharmacology, Church living stone.
4. Leilani Grajeda, Understanding Pharmacology: A Physiological Approach




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MEDICINAL CHEMISTRY-III

UNIT I

08

A general introduction to advances in medicinal chemistry with emphasis on the principles of combinatorial chemistry, high throughput screening and QSAR studies.

LO: General concepts, principles, procedures, advantages, equations and methodologies.

UNIT II

08

1. Types of receptors, interaction forces.
2. Preliminary aspects of molecular modeling studies: docking, pharmacophore modeling

LO: General concepts, principles, procedures, advantages and methodologies.

UNIT III

10

1. **Steroidal anti-inflammatory agents:** Classification, structures, SAR, uses and toxicity
2. **Bile acids:** Classification, structures and functions
3. **Estrogens and progesterone:** Structures, functions, interconversion of estrogens, uses of natural and synthetic estrogens, synthesis of progesterone from diosgenin.

LO: Acquaintance with steroidal structures, features, properties, uses, mode of action.

UNIT IV

08

1. **Antiarrhythmics:** Classification, mode of action, SAR of different classes uses and synthesis of procainamide.
2. **Cardiac glycosides:** Classification, structures and structural features, mode of action SAR and therapeutic uses.

LO: Introduction to cardiovascular diseases, uses, mode of action.




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UNIT V

08

1. **Antihypertensives:** Classification, mode of action, SAR, currently used drugs and synthesis of methyldopa, clonidine, Losartan.
2. **Antianginals and coronary vasodilators:** classification, mode of action, SAR of different classes, uses and synthesis of isosorbide dinitrate.

LO: Introduction to cardiovascular diseases, uses, mode of action.

UNIT VI

08

1. **Diuretics:** Definition, classification, mode of action, SAR of different classes, uses and synthesis of acetazolamide, ethacrynic acid and hydrochlorthiazide.
2. **Antihyperlipidemics (Hypocholesteremic drugs)** - Definition, classification, mode of action, SAR of different classes, uses and synthesis of Clofibrate.

LO: Introduction, structures, methodology of synthesis, advantages.

TEXT BOOKS

1. Thomas L. Lenke, David A. Williams, Foye's Principles of Medicinal Chemistry, 7th Ed, Lippincott. John H. Block 12th Lippincott
2. John H. Block, JM Beale, Wilson & Giswold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Ed, Lippincott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
2. Lippincott Williams and Wilkins: Remington: The Science and Practice of Pharmacy.
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.



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III Year - II Semester

L	T	P	C
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REGULATORY AFFAIRS, IPR & PATENTS

UNIT-I

10

Preformulations and Formulation Development – Regulatory requirements in Preformulations and Formulation Development of Solid, Liquid and Semisolid dosage.

LO: To understand preformulations – protocols – regulatory – requirements – Formulation Development of Solid, Liquid and Semisolid dosage.

UNIT-II

10

Manufacturing- Regulatory requirements related to manufacturing- manufacturing formula, Records, Validations involved-GMP

Validations: Types- Validation of Process and Equipment – Raw materials, Excipients and solvents.

LO: To understand regulatory requirements related to manufacturing, validation – types, Validation of process, equipment, raw materials, excipients.

UNIT-III

10

Regulatory requirements of packaging materials- Evaluation of Packaging materials.

Stability – Regulation for Stability testing of API, Solid and liquid dosage form as per ICH guidelines.

LO: To understand regulatory requirements of packaging materials, evaluation of packaging materials, stability testing as per ICH.

UNIT – IV

07

Clinical Trials: Phase –I, II, III & IV studies – Regulations involved

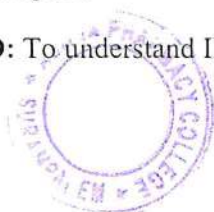
LO: To understand regulatory requirements of Clinical Trials, Phase –I, II, III & IV studies.

UNIT- V

06

A Study of Intellectual Property Rights : Definitions – Guidelines – National and international – Examples.

LO: To understand IPR with examples




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Patents: patenting laws and Regulations – Procedures for obtaining and writing a patent – Examples.

LO: To understand patents, patent laws, procedures with examples.

TEXT BOOKS

1. How to Practice GMPs By P.P.Sharma, Vandhana Publications, Agra.
2. Quality Assurance and Quality Management in Pharmaceutical Industry, Anjaneyulu Y.
3. Good Manufacturing Practices and Inspection, W.H.O, Vol – II.
4. I.P.R: Hand book for pharma students and researchers, Bansal.

References :

1. Quality Assurance guide by organization of Pharmaceutical Procedures of India
2. Drug formulation manual by D.P.S.Kohli and D.H.Shah. Eastern Publishers, New Delhi.
3. Pharmaceutical Process Validation by FRA.R.Berry and Robert.A.Nash.
5. Pharmaceutical Preformulations by J.J.Wells.
6. Applied Production and Operations management by Evans, Anderson, Sweeny and Williams.
7. Basic principles of Clinical Research and methodology by Guptha.
8. Biopharmaceutics and Clinical Pharmacokinetics – An Introduction ; 4th Edition, Revised and Expanded by Robert E. Notary, Marcel Dekker incm, New york and Basel, 1987.




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III Year - II Semester

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PHARMACEUTICAL TECHNOLOGY – II LAB

At least 25 Pharmaceutical preparations related to the topics are to be prepared

1. Experiments to illustrate preparation, stabilization, physical, chemical and biological evaluation of pharmaceutical products like capsules (2*), tablets (8*), Parenterals – Ampoules (4*), Large Volume Parenterals (4*), Microcapsules (2*).
2. Quality control test for Tablets (2*) and Capsules (2*) as per IP 2014.
3. Quality control test for Glasses as per IP 2014.

* indicates number of experiments




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III Year - II Semester

L	T	P	C
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PHARMACOLOGY LAB

1. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
2. To study the effect of drugs on rat ileum.
3. To study the effects of drugs on isolated normal and hypodynamic frog heart.
4. To determine the dose-response curve of acetylcholine using rectus abdominus muscle of frog.
5. To determine the potentiating effect of neostigmine on the action of acetylcholine on Rectus abdominus muscle of frog.
6. To find the antagonistic effect of pancuronium against the action of acetylcholine on Rectus abdominus muscle of frog.
7. To record the CRC of 5-HT on rat fundus preparation.
8. To record the CRC of histamine on guinea pig ileum preparation.
9. Experiments pertaining to analgesia. (*Only demonstration*).
10. Experiments pertaining to anti-convulsant activity. (*Only demonstration*).
11. Experiments pertaining to anti-inflammatory activity (*Only demonstration*).
12. To determine the hypoglycemic activity of drugs (second generation antidiabetic drugs) on rabbits / albino rats. (*Only demonstration*).




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III Year - II Semester

L	T	P	C
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PHARMACEUTICAL BIOTECHNOLOGY LAB

1. Isolation of antibiotic producing microorganism from soil.
2. Enzyme immobilization by Ca-alginate method.
3. Determination of minimum inhibitory concentration of the given antibiotic. Antibiotic assay by cup plate method.
4. Collection, Processing, Storage and fractionation of blood.
5. Standardization of Cultures.
6. Microbiological assay of Antibiotics / Vitamins.
7. Production of alcohol by fermentation techniques.
8. Comparison of efficacy of immobilized cells.
9. Sterility testing of Pharmaceutical products.
10. Isolation of mutants by gradient plate technique.
11. Preparation of bacterial vaccine.
12. Preparation of blood products / Human normal immunoglobulin injection.
13. Extraction of DNA (*demonstration only*)
14. Separation techniques: Various types of Gel Electrophoresis, Centrifugation.

TEXT BOOK

1. Ashish S Verma, et.al., Laboratory Manual for Biotechnology, S.Chand.




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IV Year - I Semester

L	T	P	C
4	1	0	4

PHARMACEUTICAL ANALYSIS – II

UNIT – I

10

Visible, UV & IR Spectrophotometry: Principle, Electron Transition, Beer-Lamberts Law & Deviations, Chromophore concept, Instrumentation – Construction of Single Beam and Double Beam Spectrophotometers, Woodward-fieser rules for calculating absorption maximum and Applications.

LO: To understand principles, instrumentations and working of UV and its Spectrophotometers – applications with examples.

UNIT – II

08

Nuclear Magnetic Resonance spectroscopy:-

Basic Principle, Instrumentation, Chemical Shift, Shielding & Deshielding effects, factor influencing Chemical shift and Applications.

Electron Spin Resonance Spectroscopy: Basic Principle, Instrumentation, Hyperfine splitting, g- value and Applications.

Mass Spectrometry: Basic Principle, Instrumentation and Applications.

LO: To understand principles, instrumentations, applications with examples of NMR, ESR, Mass spectrometry.

UNIT – III

10

Basic Principles and applications of differential thermal analysis (DTA) and differential scanning calorimetry (DSC).

Basic Principles and applications of Atomic absorption spectroscopy, XRD, Emission spectroscopy and Raman spectroscopy.

Optical rotatory dispersion (ORD) and Circular dichroism: General Principle and Applications.

Radio Immuno Assay & Enzyme Linked Immuno Sorbent Assay.

LO: To understand basic principles and applications of DTA, DSC, XRD, Atomic absorption, Emission, Raman, ORD and Radio Immuno Assay.



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08

Chromatography: Column chromatography, Paper chromatography, TLC, Ion exchange chromatography, Gel chromatography.

LO: To understand principles and procedures of various types of chromatography with examples.

UNIT – V

08

GLC, HPLC, HPTLC

LO: To understand principles, instrumentations and applications of GLC, HPLC, HPTLC .

UNIT – VI

06

LCMS and Electrophoresis: Scope, Different types Electrophoresis and applications.

LO: To understand principles, instrumentations and applications of LCMS and Electrophoresis.

TEXT BOOKS

1. R.M. Silverstein and G.C. Bassler. Spectrometric Identification of Organic Compounds.
2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol.I & II CBS Publ.
3. AI Vogel, Quantitative Chemical Analysis.
4. Hobart. H. Willard and others, Instrumental methods of analysis, CBS publ and Distributors New Delhi.
5. Robert D. Brown, Introduction to Instrumental Analysis.
6. Skoog, Principles of Instrumental Analysis.
7. B.K.Sharma, Instrumental and Chemical Analysis, Goel Publ House , Hyderabad.
8. Elementary organic spectroscopy (Principles and applications) by YR Sharma.
9. Basic concepts of Analytical Chemistry by SM Khopkar.
10. Pharmaceutical Analysis – II by PC Kamboj.
11. Pharmaceutical Analysis – III by PC Kamboj
12. Qualitative organic Analysis (Spectrochemical technique) by William Kemp.

REFERENCES

1. Settle, Handbook of Instrumental Techniques for Analytical Chemistry.
2. Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. P.D. Sethi, Quantitative analysis of Drugs and Pharmaceuticals.
4. K. A. Connors, A Textbook of pharmaceutical analysis, Wiley Interscienc, NY.



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5. A.M. Knevel & F.E. Digengl, Jenkin's quantitative pharmaceutical chemistry, Mc Graw Hill Book Co., NY.
6. Pharmacopoeia (IP, BP, USP, PhI, Eu. PhI).
7. Modern methods of Pharmaceutical Analysis, 2nd edition, 2nd volume set, by Roger E Schirmer.
8. Liquid Chromatography – Mass spectrometry by Wilfried MA Niessen.



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IV Year - I Semester

L	T	P	C
4	1	0	4

BIOPHARMACEUTICS AND PHARMACOKINETICS

UNIT – I

10

Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting

Biopharmaceutics: Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis) factors influencing absorption – physiochemical, physiological and pharmaceutical.

L.O: To understand Biopharmaceutics, Pharmacokinetics and their applications –absorption mechanisms, factors, their application with examples.

UNIT – II

06

Drug distribution in the body, Factors influencing distribution.

Plasma protein binding, binding sites, factors influencing protein binding

L.O: To understand drug distribution, protein binding – factors.

UNIT – III

12

Pharmacokinetics

Significance of plasma drug concentration measurement.

Compartment model: Definition and scope.

Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner Nelson and Loo-riegelman method.

Volume of distribution and distribution coefficient.

L.O: To understand the significance of plasma drug concentrations, compartment models - kinetics, parameters.

UNIT – IV

08
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Comparative kinetics: One compartment and two compartment models. Determination of Pharmacokinetic parameters from plasma and urine data after drug administration by oral parenteral and other routes.

Curve fitting (Method of Residuals) Regression procedures.

Clearance concept, Mechanism of Renal clearance, clearance ratio, determination of renal clearance.

Non-linear pharmacokinetics with special reference to one compartment model after I.V. Drug administration, Michaelis - Menten Equation, detection of non-linearity (Saturation mechanism).

L.O: To understand pharmacokinetic models, Linear and Non-Linear kinetics, mechanisms and method of assessments.

UNIT – V

06

Clinical pharmacokinetics

Definition and scope

Dosage adjustment in patients with and without renal and hepatic failure.

Pharmacokinetic drug interactions and its significance in combination therapy.

L.O: To understand clinical pharmacokinetics and their significance, drug interactions – Adjustment of dose.

UNIT – VI

08

Bioavailability and Bioequivalence.

Measures of bioavailability, C-max, T-max and Area Under the Curve (AUC)

Design of single dose bioequivalence study and relevant statistics.

Overview of regulatory requirements for conduction of bio-equivalence studies.

Bio availability and bio equivalence including evaluation testing protocols.

- a. *In vitro* dissolution studies for solid dosage forms interpretation of dissolution data *in vitro* - *in vivo* correlations.
- b. Bioavailability testing protocol and procedures.
- c. *In vivo* methods of evaluation – statistical treatment (t-test, ANOVA - one way & two way).

L.O: To understand bioavailability, bioequivalence, concepts, assessments, design, regulation, *in vitro* dissolution methods, *In vitro* – *in vivo* correlation.



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TEXT BOOKS

1. Venkateshulu, Fundamentals of Biopharmaceutics and Pharmacokinetics, Pharma Book Syndicate.
2. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate.
3. DM Brahmankar and SB Jaiswal, Biopharmaceutics and Pharmacokinetics- A Treatise, Vallabh Prakasham, Delhi,
4. P.L. Madan, Biopharmaceutics and Pharmacokinetics, Jaypee Bros.

REFERENCES

1. Remington's pharmaceutical sciences, Mac Pub. Co., Easton Pennsylvania.
2. Modern pharmaceutics by Banker Marcel Dekker Inc., NY
3. L. Lachman, H.A.Lieberman, J.L. Kanig, The Theory and Practice of Industrial Pharmacy, Varghese publ house, Mumbai.
4. AR. Gennerio Remington: The Science and Practice of Pharmacy, Vol 1 &2 Lippincott Williams & Wilkins, Philadelphia, 2004.
5. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, arceldedekerinc., NY
6. L. Shargel and ABC Yu, Textbook of Applied Biopharmaceutics & Pharmacokinetics, 4thedn, Appleton – century – crofts, Connecticut, 2004.




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IV Year - I Semester

L	T	P	C
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CHEMISTRY OF NATURAL PRODUCTS

UNIT-I

08

Carbohydrates: Classification and general properties. Knowledge of structure including stereochemistry of glucose. General treatment of pharmaceutically important carbohydrates- maltose, lactose, starch, cellulose and dextrin.

LO: Introduction, basic understanding, structures, features, stabilities and uses.

UNIT-II

08

Amino acids and proteins: Classification and general reactions of amino acids and their relationship to proteins and polypeptides. Methods of preparation of amino acids, classification and general reactions of proteins, degradation of proteins-hydrolysis and end group analysis- protein hormones, oxytocin.

LO: Introduction, basic understanding, structures, features and uses.

UNIT-III

08

1. Purines and Xanthine derivatives: Structure and synthesis of uric acid, Theobromine, theophylline, and caffeine. General aspects of nucleoproteins and nucleic acids,
2. Lipids: Fixed oils and Fats. Fatty acids: chemistry and analysis of oils and fats.

LO: Introduction, basic understanding, structures, methodologies, significance and uses.

UNIT-IV

08

Terpenes: Occurrence, general methods of isolation and classification, chemistry of citral, limonene, α - terpineol, carvone, camphor and menthol.

LO: Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.



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UNIT-V

10

Alkaloids: Classification, general methods of isolation, general methods of structural determination, chemical tests for alkaloids, Chemistry and uses of ephedrine, nicotine, papaverine and atropine.

LO: Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.

UNIT-VI

08

1. Vitamins: Classification, chemistry, physiological role and uses of thiamine, riboflavin and ascorbic acid. Skeletal structures of vitamins official in I.P.
2. Steroids: Nomenclature and skeletal structures of ergosterol, stigmasterol, cholesterol diosgenin, hecogenin. Chemical tests for steroids.

LO: Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.

TEXT BOOKS

1. O.P. Agarwal, Natural products by. Vol.1 & 2, Goel publications – Meerut.
2. JB Harborne, Phyto Chemical methods.
3. I L Finar, Organic chemistry, Vol. 1 & 2, the English language book society, London, New Delhi.

REFERENCES

1. RT Morrison and R.N BOYD, Organic chemistry, Allyn and Bacon, inc., boston
2. Me – Wolf, ed., Burger's medicinal chemistry, J. Wiley & sons, NY.
3. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
4. RM. Acheson, an introduction to the chemistry of heterocyclic compounds, Interscience NY.
5. Duquesne & others, Practical Pharmacognosy, CBS Publ.




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IV Year - I Semester

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HOSPITAL & COMMUNITY PHARMACY

UNIT-I

12

Hospital Pharmacy: Organization and structure, organization of a hospital and hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy and therapeutic committee, Budget preparation and implementation hospital formulary, organization of drug store, purchase and inventory control, patient counseling, role of pharmacist in community health care and education.

LO: To understand Hospital Pharmacy – organisation structure - Budget preparation and implementation hospital formulary, organization of drug store, purchase and inventory control, patient counseling, role of pharmacist in community health care and education.

UNIT-II

05

The pharmacy procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory

Patient - dispensing of ancillary and controlled substances, Drug Information Center.

LO: To understand The pharmacy procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory

Patient - dispensing of ancillary and controlled substances, Drug Information Center.

UNIT-III

05

Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

LO: To understand Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases




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UNIT-IV

07

Introduction to community Pharmacy

- Community pharmacy Practice — definition
- The role of the community pharmacy and its relationship to other local health care providers and services to nursing homes and clinics
- Professional responsibilities of community pharmacist (FIP & WHO Model)
- Prescribed medication order - interpretation and legal requirements

LO: To understand Community pharmacy – role and relationship, professional responsibilities and prescribed medication order

UNIT-V

05

Communication skills - communication with prescribers and patients

Over-the-counter (OTC) sales

- Rational use of common OTC medications (Vitamins and tonics, iron preparations, analgesics, NSAIDs, cough mixtures, anti-diarrhoeal preparations)

LO: To understand communication with prescribers and patients, Rational use of common OTC medications

UNIT-VI

16

1. Primary health care in community pharmacy

Family planning, First aid, Participation in primary health programs, Smoking cessation, Screening programs, Nutrition, Responding to common ailments

2. Community pharmacy management

Financial, materials, staff, infrastructure requirements, drug information resources, in community pharmacies, computer applications in community pharmacy, Education and training

3. Home Medicines Review (HMR) program: introduction and guidelines

LO : To understand Family planning, First aid, Participation in primary health programs, Smoking cessation, Screening programs, Nutrition, Responding to common ailments and Community pharmacy management and Home Medicines Review (HMR).




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Text Books

1. Hospital Pharmacy - Hassan WE. Lee and Febiger publication.
2. Textbook of Hospital Pharmacy - Aliwood MC and Blackwell. Reference books (Latest editions)
3. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
4. Remington Pharmaceutical Sciences,
5. Relevant review articles from recent medical and pharmaceutical literature.
6. Cooper & Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
7. Gupta AK, Health Education and Community Pharmacy, CBS, Publ. and Distributors New Delhi.
8. JS Quadry, Hospital Pharmacy.
9. K.Sampath, Hospital & Clinical Pharmacy, Vikas Publications.
10. Lorria & William, Essential dosage calculations.

REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. William Hassan, Hospital Pharmacy.
3. R.M Metha, Dispensing Pharmacy.
4. E.A. Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ.
5. Hoover, Dispensing of Medication.
6. NK Jain, Health Education and Community Pharmacy by, CBS, Publ. and Distributors New Delhi.




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IV Year - I Semester

L	T	P	C
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PHARMACEUTICAL JURISPRUDENCE

UNIT-I

12

Introduction

- a. Pharmaceutical Legislations - A brief review
- b. Drugs & Pharmaceutical Industry - A brief review
- c. Pharmaceutical Education - A brief review.
- d. Pharmaceutical ethics & policy

LO: To understand Pharmaceutical Legislations, Drugs & Pharmaceutical Industry, Pharmaceutical Education and Pharmaceutical ethics & policy.

UNIT-II

08

Pharmacy Act 1948 and Drugs (Price control) order.

LO: To understand rules prescribed order, Pharmacy act, Drugs (Price control) order.

UNIT-III

08

Drugs and Cosmetics Act 1940 and Rules 1945

LO: To understand rules, schedules of Drugs and Cosmetics Act in detail.

UNIT-IV

06

Medicinal & Toilet Preparations (Excise Duties) Act 1955

Narcotic Drugs & Psychotropic Substances Act 1985 & A.P. N. D. P.S Rules 1986

LO: To understand and procedures under medicinal and toilet preparations act and Narcotic Drugs & Psychotropic Substances Act.




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UNIT-V

06

Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

LO: To understand the rules and procedures under drugs and magic remedies.

UNIT-VI

10

A study of the salient features of the following.

- a. Prevention of Cruelty to animals Act 1960.
- b. The Poisons Act.
- c. The Medical Termination of Pregnancy Act.
- d. AP State Shops & Establishments Act 1988 & Rules 1990.
- e. Factories Act 1948.
- f. WTO, GATT and the Indian Patents Act, 1970.
- g. Pharmaceutical Policy 2002.

LO: To understand the salient features of the above.

TEXT BOOKS

1. B.M.Mithal, Text book of Forensic Pharmacy, Vallabh Prakashan Publishers.
2. N.K.Jain, A text book of Forensic Pharmacy. Vallabh Prakashan Publishers.
3. Dr.S.P.Agarwal, Rajesh Khanna, Pharmaceutical Jurisprudence and Ethics (Forensic Pharmacy), Birla Publications.
4. Prof. Suresh Kumar J.N, Text book of Forensic Pharmacy by. Frontline publications
5. C.K.Kokate & S.B.Gokhale, Textbook of Forensic Pharmacy

REFERENCE BOOK

1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
2. AIR – reported judgments of Supreme Court of India and other High Courts
3. Pharmaceutical policy of India
4. Notification from NPPA
5. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
6. K.Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy)

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IV Year - I Semester

L	T	P	C
0	0	3	2

PHARMACEUTICAL ANALYSIS – II LAB

Experiments

1. Interpretation of IR Spectra.
2. Determination of λ - max and construction of calibration curve of a drug.
3. Determination of concentration of glycerine by Abbe's refractometer.
4. Assay by UV- spectrophotometry (Atleast 4 drugs).
5. Assay by Colorimetric method (Atleast 2 drugs).
6. Ascending paper chromatography.
7. Radial paper chromatography.
10. Two dimension chromatography
11. Thin layer chromatography (Atleast 3 drugs).
12. Column chromatography (*Demonstration Only*).
13. Paper electrophoresis of amino acids.
14. Gel electrophoresis (*Demonstration Only*).
15. HPLC (*Demonstration Only*).




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IV Year - I Semester

L	T	P	C
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BIOPHARMACEUTICS AND PHARMACOKINETICS LAB

1. Experiments designed for the estimation of various pharmacokinetic parameters with given Data (6 exercises).
2. Analysis of biological specimens for drug content and estimation of the pharmacokinetic parameters (at least 2 drugs).
3. *In vitro* evaluation of different dosage forms for drug release (4 experiments – tablets, capsules, suspensions and semi solids).
4. Statistical treatment of pharmaceutical data (ANOVA).

TEXT BOOK

1. B. Suresh, J.Raju and M.Vijay Kumar, Experimental Approaches to Biopharmaceutics and Pharmacokinetics.




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IV Year - I Semester

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CHEMISTRY OF NATURAL PRODUCTS LAB

1. Preparation of different alkaloids testing reagents like Dragondroff, Mayer, Wagner's, etc., and testing some alkaloids and plant extracts using these reagents.
2. Identification of alkaloids by specific colour tests.
3. Test for steroids, steroidal glycosides and cardiac glycosides. Liberman-Burchard test, Salkowski reaction, Kedde reaction etc.
4. Tests for flavanoids and their glycosides. Shinoda test (Mg/Hcl test), FeCl₃ test.
5. TLC and examination of alkaloids, steroids, steroidal glycosides and cardiac glycosides.
6. Identification of natural products.
7. Extraction of caffeine from tea leaves.
8. Extraction of lactose from milk.
9. Extraction of nicotine from tobacco.
10. Extraction of piperine from black pepper.
11. Extraction of lycopene from tomatoes.
12. Extraction of β -carotene from carrots.
13. Volatile oil production by steam distillation (*demonstration only*).

TEXT BOOKS

1. Indian Pharmacopoeia-1996.
2. Weagners, Phytochemical methods of Drug Analysis.
3. C.K.Kokate, Practical Pharmacognosy.




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IV Year - II Semester

L	T	P	C
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BIOASSAYS & TOXICOLOGY

UNIT – I 08

Basic principles of Bioassays, merits and demerits, methods of bioassays and cross over designs.

Test for pyrogens and test for undue toxicity.

L.O: To gain knowledge on bioassays and its applications, its importance and need in the present context.

UNIT – II 08

Bioassays of Digitalis, posterior pituitary extract, Insulin and Tetanus anti toxin.

L.O: Principles and procedures involved in bioassays and their limitations

UNIT – III 06

History, scope of toxicology, principles of toxicology, mechanisms and risk assessment, biotransformation of xenobiotics and toxicokinetics.

L.O: To grasp knowledge on scope, principles , mechanisms and risk assessment.

UNIT – IV 08

Acute toxicity, subacute toxicity and chronic toxicity, Determination of LD₅₀.

Chemical Carcinogens: Definitions, mechanisms of action of chemical carcinogens, test systems for carcinogenicity assessment, chemical carcinogenesis in humans.

L.O: To get an overview on acute, sub-acute and chronic toxicity studies, carcinogenicity and chemical carcinogenesis in humans .

UNIT – V 10

Target Organ Toxicity:

- Toxic responses of the blood.
- Toxic responses of the liver.
- Toxic responses of the kidney.
- Toxic responses of heart and vascular system.

General Principles of Poisoning: Signs, symptoms, treatment of acute and chronic poisoning due to heavy metals, snake venom.



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L.O: To acquire knowledge on toxic responses of target organs, poisoning and its treatment strategies.

UNIT – VI

10

Toxic Agents:

- Toxic effects of pesticides.
- Toxic effects of metals.
- Toxic effects of solvents and vapors.
- Toxic effects of plants.

L.O: To learn about intoxication produced by various toxicants.

Text Books:

1. Casarett&Doull's Toxicology The Basic Science of Poisons, Seventh edition. Editor- Curtis D. Klaassen, Ph.D.
2. Niesink R.J.M. de Vries J and Hollingers M.A. Toxicology, Principal and Applications, CRC Press1996.
3. Harrisons Principles of Internal Medicine. Medical Toxicology (Ellen Horns).
4. Toxicology – Principles and Applications, Raymond J.M.Niesink, John de.Vries, Mannfred A. Hollinger.
5. Basis of Toxicology Testing Edited by Douald J Ecobichon.
6. Ellenhorn"s Medical toxicology 2nd Edition Williams and Wilkins, Baltimore, 1997.
7. Goldfrank's Toxicological Emergencies , ninth edition.




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IV Year - II Semester

L	T	P	C
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CLINICAL PHARMACY, THERAPEUTICS AND PHARMACOVIGILANCE

CLINICAL PHARMACY (20H)

UNIT – I

10

Concept and definition of Clinical Pharmacy, functions of Clinical Pharmacist, Medication history review, medication errors, essential drug concept, Rational drug use, irrational use of Antibiotics, injectables and NSAID'S. Patient Counseling, Medication Adherence, Drug Compliance and Drug Interactions.

L.O:- To understand several concepts of essential drug list, Rational drug therapy, medication errors and patient drug compliance.

UNIT – II

10

Concept of Pharmacoeconomics, Pharmacoepidemiology, Pharmacovigilance, Therapeutic Drug Monitoring, Medication use in Neonates, Pediatrics, Geriatrics, Pregnancy & lactation, and Total Parental Nutrition.

L.O:- To understand the concept of Pharmacoeconomics, Pharmacoepidemiology, Pharmacovigilance, Therapeutic drug monitoring and Total Parental Nutrition.

THERAPEUTICS (15H)

UNIT – III

09

Drug therapy in treatment of diseases like Tuberculosis, HIV, Malaria, Typhoid and Filaria.

Drug therapy in the treatment of Skin disorders like Eczema, Impetigo, Psoriasis, Seborrheic dermatitis, Acne vulgaris and Glaucoma (open angle and closed angle).

L.O:- To understand the drug therapy of above diseases.

UNIT – IV

06

Drug therapy in the treatment of Thyroid and parathyroid disorders, Menstrual cycle disorders, Menopause, Erectile dysfunction, Osteoporosis and Diabetes mellitus.

L.O:- To understand the drug therapy of above Endocrine disorders.



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PHARMACOVIGILANCE (15H)

UNIT – V

05

Introduction to Pharmacovigilance. History of Pharmacovigilance in India, its importance, scope, outcomes and various methods in Pharmacovigilance.

L.O:- To understand the concept of Pharmacovigilance.

UNIT – VI

10

Introduction to Adverse Drug Reactions, their classification, mechanism and susceptibility. Study of various adverse events reporting forms, quality assurance in Pharmacovigilance, Pharmacogenetics in Pharmacovigilance, Ethical consideration in Pharmacovigilance and various banned drugs.

L.O:- To understand the importance of Pharmacovigilance role in Clinical practice as described above.

TEXTBOOKS

1. Clinical Pharmacy and Therapeutics: Roger Walker and Clive Edwords.
2. Clinical Pharmacy & Therapeutics, 4th edition by Eric T. Herfindal, Dick R. Gourley and Linda Lloyd hart.
3. A text book of Clinical Pharmacy Practice – Essential Concepts and skills by G. Parthasarathi, Karin Nyfort-Hansen, Malip C. Nahata.
4. Clinical Pharmacy by Dr. H. P. Tipnis, Dr. Amrita Bajaj; Career Publications.
5. Fundamentals of Clinical Pharmacy Practice by D. Sudheer Kumar, J. Krishnaveni, P. Manjula.
6. Contemporary perspectives on Clinical Pharmacotherapeutics: Kamlesh. Kohli.
7. A textbook of Pharmacovigilance – Concept & Practice by Guruprasad Mohantha.




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REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. Pharmacotherapy – A Pathophysiologic Approach by Joseph T. Dipiro, Robert L. Talbert, Gary C. Yee, Gary R. Matzke, Barbara G. Wells, L. Michael Posey – 7th Edition – Mc Graw Hill Medical Publications.
3. Basic Principles of Clinical Research and Methodology by Sk Gupta, Institute of Clinical Research (India), Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
4. Essentials of Pharmacotherapeutics by F.S.K.Barar, 7th Revised Ed.. S.Chand.



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IV Year - II Semester

L	T	P	C
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CONTROLLED RELEASE AND NOVEL DRUG DELIVERY SYSTEMS

UNIT – I

10

Controlled and sustained release: Factors to be considered – Principles involved in their design – regulatory considerations.

L.O: To understand Controlled and sustained release: Factors to be considered – Principles involved in their design – regulatory considerations.

UNIT – II

10

Oral Control Drug Delivery Systems: Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems and altered density systems.

L.O: To understand fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems and altered density systems.

UNIT – III

06

Transdermal Drug Delivery Systems: Fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

L.O: To understand fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

UNIT – IV

06

Mucoadhesive Delivery Systems: Mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of mucoadhesive-based systems.

L.O: To understand mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of mucoadhesive-based systems.

UNIT – V

12

Targeted Drug Delivery Systems: Fundamentals and applications, formulation and evaluation of Liposomes, Resealed Erythrocytes and Nano particles.

L.O: To understand fundamentals and applications, formulation and evaluation of Liposomes, Resealed Erythrocytes and Nano particles.




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UNIT – VI

06

Study of polymers for controlled release – Classification, study of biodegradable polymers & hydrogels – their applications.

L.O: To understand classification, study of biodegradable polymers & hydrogels – their applications.

TEXT BOOKS

1. N.K. Jain, Control Drug Delivery Systems.
2. Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of Industrial Pharmacy by Lea & Febieger, Philadelphia Latest Edn.
4. Shobhan Rani Hiremath Text Book of Industrial Pharmacy.

REFERENCES

1. Leon Shargel Isadore Kanfer, Generic Drug Product Development, Solid Oral Dosage Forms, Marcel Dekker.
2. Sagarin & MS Balsam, Cosmetics Sciences & Technology. Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
4. E.A Rawlkins, Bentley's Text Book of Pharmaceutics, ELBS publ
5. HC Ansel, Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth Ed, Marcel Dekker, USA, 2005.
8. Yiew Chien, novel drug delivery systems, 2nded, marcel dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M, Read with The Drugs And Cosmetic Rules 1945.
11. M.E. Aulton, Pharmaceutics - The Science of Dosage form Design 2nded.
12. Aukunuru Jithan, Oral Drug Delivery Technology.



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IV Year - II Semester

L	T	P	C
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QUALITY ASSURANCE, GMP & GLP

UNIT – I

06

Concept of Quality assurance, philosophy of GMP, CGMP and GLP.

L.O: To understand Concept of Quality assurance, philosophy of GMP, CGMP and GLP.

UNIT – II

08

Organization and personnel, responsibilities, training hygiene - Premises: Location, design, plan layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination.

L.O: To understand organization and personnel, responsibilities, training hygiene - Premises: Location, design, plan layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination.

UNIT – III

08

Equipments: Selection, purchase specifications, maintenance, clean in place, sterilize in place - Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials.

L.O: To understand selection, purchase specifications, maintenance, clean in place, sterilize in place - Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials.

UNIT – IV

10

Manufacture and controls on dosage forms, manufacturing documents master formula, batch formula records, standard operating procedures, quality audits of manufacturing processes and facilities - In process quality control on various dosage forms: sterile, biological products and non-sterile, standard operating procedures for various operations like cleaning, filling, drying, compression, coating. Packaging and labeling controls.



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L.O: To understand manufacture and controls on dosage forms, manufacturing documents master formula, batch formula records, standard operating procedures, quality audits of manufacturing processes and facilities - In process quality control on various dosage forms: sterile, biological products and non-sterile, standard operating procedures for various operations. Packaging and labeling controls.

UNIT – V

10

Quality Control Laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage, quality control documents, retention samples, records, audits of quality control facilities - Finished products release: quality review, quality audits, and batch release document.

L.O: To understand responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage, quality control documents, retention samples, records, audits of quality control facilities - Finished products release: quality review, quality audits, and batch release document.

UNIT – VI

08

Distribution and Distribution records: Handling of returned goods, recovered materials and reprocessing. Complaints and recalls, evaluation of complaints, recall procedures, related records and documents.

L.O: To understand handling of returned goods, recovered materials and reprocessing. Complaints and recalls, evaluation of complaints, recall procedures, related records and documents.

TEXT BOOKS

1. The International Pharmacopoeia Vol. 1,2,3,4, 3rd edition General methods of analysis quality specifications for Pharmaceutical substances, Excipients, dosage forms.
2. Quality Assurance of Pharmaceuticals: A compendium of guidelines and related material Vol. 1 and Vol. 2., WHO, (1999).
3. GMP-Mehra.
4. Pharmaceutical Process validation by Berry and Nash

REFERENCE BOOKS

1. Basic tests for Pharmaceutical substances - WHO (1988 & 1991)
2. How to practice GMP's – P.P.Sharma
3. The Drugs and Cosmetic Act 1940- Vijay Malik.
4. Q.A Mannual by D.H.Shah.
5. SOP Guidelines by D.H.Shah.
6. Quality Assurance Guide by OPPI.




PRINCIPAL
Aditya Pharmacy College
SURAMPALAM-533 437

IV Year - II Semester

L	T	P	C
0	0	3	2

BIOASSAYS & TOXICOLOGY LAB

To find the potency of test sample using a suitable isolated tissue

1. Matching point BIO assay
2. Two-point BIO assay
3. Three point BIO assay
4. 4 point bioassay
5. To calculate the PA_2 value of Atropine using Acetyl Choline as an agonist on rat Ileum
6. To find the acute toxicity of the given test drug (Digoxin, Nicotine, Aspirin, Paracetamol).
7. Determination of toxic responses of liver against chemically (Paracetamol & CCl_4) induced intoxication by estimating SGPT, SGOT and serum bilirubin levels..
8. Test for Pyrogen
9. Test for undue toxicity




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IV Year - II Semester

L	T	P	C
0	0	0	2

SEMINAR ON SELECTED TOPIC



A handwritten signature in green ink, consisting of a stylized 'A' and 'X'.


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IV Year - II Semester

PROJECT WORK

L	T	P	C
0	0	0	10




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IV Year - II Semester

L	T	P	C
0	0	0	2

COMPREHENSIVE VIVA



[Signature]

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**ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS**

B.PHARMACY

For

B.PHARMACY FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2013-14)



PRINCIPAL
Aditya Pharmacy College
SURAMPALEM-533 437

**JAWAHARLAL NEHRU TECHNOLOGICAL
UNIVERSITY KAKINADA
KAKINADA – 533003, ANDHRA PRADESH, INDIA.**



PRINCIPAL
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SURAMPALEM-533 437

Academic Regulations (R13) for B. Pharm. (Regular)

Applicable for the students of B. Pharm. (Regular) from the Academic Year 2013-14 onwards

1. Award of B. Pharm. Degree:

A student will be declared eligible for the award of the B.Pharm Degree if he fulfils the following academic regulations:

- 1.1 Pursued a course of study for not less than four academic years and not more than eight academic years.
- 1.2 Register for all the 180 credits and secure all the 180 credits.

2. Distribution and Weightage of Marks:

- i. The performance of a student in each semester shall be evaluated subject – wise with a maximum of 100 marks for theory and 75 marks for practical subject. The project work shall be evaluated for 200 marks.
- ii. For theory subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
- iii. For theory subjects, during the semester there shall be 2 tests. The weightage of Internal marks for 30 consists of Descriptive – 15, Assignment - 05 (Theory, Design, Analysis, Simulation, Algorithms, Drawing, etc. as the case may be) Objective -10 (Conducted at College level with 20 Multiple choice question with a weightage of ½ Mark each). The objective examination is for 20 minutes duration. The subjective examination is for 90 minutes duration conducted for 15 marks. Each subjective type test question paper shall contain **3 questions** and all questions need to be answered. The Objective examination conducted for 10 marks and subjective examination conducted for 15 marks are to be added to the assignment marks of 5 for finalizing internal marks for 30. The best of the two tests will be taken for internal marks. As the syllabus is framed for 6 units, the 1st mid examination (both Objective and Subjective) is conducted in 1-3 units and second test in 4-6 units of each subject in a semester.
- iv. The end semester examination is conducted covering the topics of all Units for 70 marks. Part – A contains a mandatory question (Brainstorming / Thought provoking / case study) for 22 marks. Part – B



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has 6 questions (One from each Unit). The student has to answer 3 out of 6 questions in Part – B and carries a weightage of 16 marks each.

- v. For practical subjects there shall be continuous evaluation during the semester for 25 internal marks and 50 end examination marks. Of the 25 marks for internal, 15 marks shall be awarded as follows: day to day work 10 and Record-5, and 10 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner.
- vi. For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (20 marks for day – to – day work, and 10 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester and the better of the two shall be considered for the award of marks for internal tests.
- vii. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.
- viii. Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.
- ix. Laboratory marks and the internal marks awarded by the College are not final. The marks are subject to scrutiny and scaling by the University wherever felt desirable. The internal and laboratory marks awarded by the College will be referred to a Committee. The Committee shall arrive at a scaling factor and the marks will be scaled as per the scaling factor.



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SURAMPALEM 533 437

The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved in the respective departments as per the University norms and shall be produced to the Committees of the University as and when they ask for.

- x. There shall be a Comprehensive Viva-Voce in IV year II semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of (i) Head of the Department (ii) two Senior Faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he / she studied during the B.Pharm course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-voce.

3. **Attendance Requirements:**

- a. A student is eligible to write the University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.
- b. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee
- c. Shortage of Attendance below 65% in aggregate shall not be condoned.
- d. A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.
- e. Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.
- f. A stipulated fee shall be payable towards condonation of shortage of attendance.
- g. A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester and (ii) credits.
- h. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

4. **Minimum Academic Requirements:**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 3.




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SURAMPALEM 575 497

- i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or practical subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the internal evaluation and end examination taken together.
- ii. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.
- iii. A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to II year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.
- iv. A student shall be promoted from III year to IV year only if he fulfills the academic requirements of 40% of the credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.
- v. A student shall register and put up minimum attendance in all 180 credits and earn all the 180 credits. Marks obtained in all the 180 credits shall be considered for the calculation of percentage of marks.

5. **Course pattern:**

- 5.1 The entire course of study is for four academic years, all years on semester pattern.
- 5.2 A student, eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
- 5.3 When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the same semester / year in which he has been detained. However, the academic regulations under which he was first admitted, shall continue to be applicable to him.

6. **Award of Class:**

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Pharmacy Degree he shall be placed in one of the following four classes:



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SURAMPALEM-533 437

Class Awarded	% of marks to be secured
First Class with Distinction	70% and above
First Class	Below 70 but not less than 60%
Second Class	Below 60% but not less than 50%
Pass Class	Below 50% but not less than 40%
From the aggregate marks secured from 180 Credits.	

(The marks in internal evaluation and end examination shall be shown separately in the marks memorandum)

7. Minimum Instruction Days:

The minimum instruction for each semester shall be 90 clear instruction days.

8. WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

9. TRANSITORY REGULATIONS

9.1 Discontinued or detained candidates are eligible for readmission as and when next offered.

9.2 After the revision of the regulations, the students of the previous batches will be given two chances for passing in their failed subjects, one supplementary and the other regular. If the students cannot clear the subjects in the given two chances, they shall be given equivalent subjects as per the revised regulations which they have to pass in order to obtain the required number of credits.

9.3 In case of transferred students from other Universities, the credits shall be transferred to JNTUK as per the academic regulations and course structure of the JNTUK.

10. General:

10.1 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".



Principal
Aditya Pharmacy College
Srikalahasti-515 412

- 10.2 The academic regulation should be read as a whole for the purpose of any interpretation.
- 10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- 10.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.
- 10.5 The students seeking transfer to colleges affiliated to JNTUK from various other Universities/Institutions have to pass the failed subjects which are equivalent to the subjects of JNTUK, and also pass the subjects of JNTUK on their own without the right to sessional marks which the candidates have not studied at the earlier Institution.

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SURAMPALAM-533 437

Academic Regulations (R13) for B. Pharm. (Lateral Entry Scheme)

Applicable for the students admitted into II year B. Pharm. (LES) from the Academic Year 2014-15 and onwards

1. The Students have to acquire 138 credits from II to IV year of B.Pharm program (regular) for the award of the degree.
2. Students, who fail to fulfil the requirement for the award of the degree in 6 Consecutive academic years from the year of admission, shall forfeit their seat.
3. The same attendance regulations are to be adopted as that of B.Pharm (Regular).
4. **Promotion Rule:**
A student shall be promoted from III year to IV year only if he fulfils the academic requirements of 40% of the credits up to III year I semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.
5. **Award of Class:**
After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B.Pharm Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured	From the aggregate marks secured from 138 Credits from II year to IV year.
First Class with Distinction	70% and above	
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Pass Class	Below 50% but not less than 40%	




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MALPRACTICES RULES

Disciplinary Action for / Improper Conduct in Examinations

	Nature of Malpractices / Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the



PHARMACY COLL
 SURAMPALAM 593 43

		examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that



	examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.




9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person (s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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PRINCIPAL
 Aditya Pharmacy College
 SURAMPALEM 533 437



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, Andhra Pradesh (India)






For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- ➡ Ragging within or outside any educational institution is prohibited.
- ➡ Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing & Humiliation	 6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	 1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	 2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	 5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	 10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY



Aditya Pharmacy College
SURAMPALAM-533 437



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA-533003, Andhra Pradesh (India)

For Constituent Colleges and Affiliated Colleges of JNTUK

Ragging

ABSOLUTELY NOT TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded.
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.



Jawaharlal Nehru Technological University Kakinada

For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE No. : 1800 - 425 - 1288

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PRINCIPAL
Aditya Pharmacy College
Kakinada - 533003

COURSE STRUCTURE

I Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	English	3 + 1	--	3
2	Remedial Mathematics/ Remedial Biology	3/2 + 1	--	3/2
3	Human Anatomy & Physiology – I	3 + 1	--	3
4	Dispensing Pharmacy & Ethics	3 + 1	--	3
5	Pharmaceutical Organic Chemistry-I	3 + 1	--	3
6	English Communications Skills Lab	--	3	2
7	Remedial Biology Lab	--	2	0/1
8	Dispensing Pharmacy Lab	--	3	2
9	Pharmaceutical Organic Chemistry-I Lab	--	3	2
Total Credits				21

I Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Human Anatomy & Physiology – II	3 + 1	--	3
2	Pharm. Inorganic Chemistry	3 + 1	--	3
3	Pharm. Organic Chemistry – II	3 + 1	--	3
4	Physical Pharmacy – I	3 + 1	--	3
5	Computer Applications & Biostatistics	3 + 1	--	3
6	Human Anatomy & Physiology Lab	--	3	2
7	Physical Pharmacy – I Lab	--	3	2
8	Computer Applications Lab	--	3	2
Total Credits				21

II Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Pharmaceutical Unit Operations - I	3 + 1	--	3
2	Pharmacognosy - I	3 + 1	--	3
3	Physical Pharmacy - II	3 + 1	--	3
4	Pharmaceutical Microbiology	3 + 1	--	3
5	Environmental Science	3 + 1	--	3
6	Pharmacognosy – I Lab	--	3	2
7	Physical Pharmacy – II Lab	--	3	2
8	Pharmaceutical Microbiology Lab	--	3	2
Total Credits				21



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II Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Pharmaceutical Unit Operations –II	3 +1	--	3
2	Pharmaceutical Analysis - I	3 +1	--	3
3	Pharmacognosy -II	3 +1	--	3
4	Medicinal chemistry - I	3 +1	--	3
5	Health Education & Pathophysiology	3 +1	--	3
6	Pharmaceutical Unit Operations Lab	--	3	2
7	Pharmaceutical Analysis – I Lab	--	3	2
8	Pharmacognosy –II Lab	--	3	2
Total Credits				21


III Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Pharmaceutical Biochemistry	3 +1	-	3
2	Medicinal Chemistry - II	3 +1	-	3
3	Pharmaceutical Technology - I	3 +1	-	3
4	Pharmacology -I	3 +1	-	3
5	Pharmaceutical Management	3 +1	-	3
6	Pharmaceutical Biochemistry Lab	-	3	2
7	Pharmaceutical Technology-I Lab	-	3	2
8	Medicinal Chemistry Lab	-	3	2
Total Credits				21

III Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Pharmaceutical Technology -II	3 +1	-	4
2	Pharm. Biotechnology	3 +1	-	4
3	Pharmacology - II	3 +1	-	4
4	Medicinal Chemistry - III	3 +1	-	4
5	Regulatory Affairs, IPR & Patents	3 +1	-	2
6	Pharmaceutical Technology –II Lab	-	3	2
7	Pharmacology Lab	-	3	2
8	Pharm. Biotechnology Lab	-	3	2
Total Credits				24




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IV Year – I SEMESTER

S. No.	Subject	T	P	Credits
1	Pharmaceutical Analysis -II	3 +1	-	4
2	Bio assays & Toxicology	3 +1	-	4
3	Chemistry of Natural Products	3 +1	-	4
4	Hospital & Community Pharmacy	3 +1	-	4
5	Pharmaceutical Jurisprudence	3 +1	-	3
6	Pharmaceutical Analysis – II Lab	-	3	2
7	Bio assays& Toxicology Lab	-	3	2
8	Chemistry of Natural Products	-	3	2
9	Project Commencement	-	-	-
Total Credits				25

IV Year – II SEMESTER

S. No.	Subject	T	P	Credits
1	Biopharmaceutics & Pharmacokinetics	3 +1	-	4
2	Clinical Pharmacy, Therapeutics & Pharmacovigilance	3 + 1	-	3
3	Controlled release & Novel Drug Delivery Systems	3 +1	-	4
4	Quality Assurance, GMP, GLP	3 +1	3	3
5	Biopharmaceutics & Pharmacokinetics Lab	-	3	2
6	Project Work	-	-	4
7	Project Seminar	-	-	4
8	Comprehensive Viva	-	-	2
Total Credits				26



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SYLLABUS

I Year – I SEMESTER

T	P	C
3+1	0	3

ENGLISH

DETAILED TEXT-I : Recommended Topics :

1. THE KNOWLEDGE SOCIETY- APJ KALAM (RAVINDRA PUBLISHERS)

OBJECTIVE : To make the learners rediscover India as a land of Knowledge.

OUTCOME : The learners will achieve a higher quality of life, strength and sovereignty of a developed nation.

2. MAN'S PERIL (RAVINDRA PUBLISHERS)

OBJECTIVE : To inform the learner that all men are in peril.

OUTCOME : The learner will understand that all men can come together and avert the peril.

3. IN LONDON : M.K. GANDHI (RAVINDRA PUBLISHERS)

OBJECTIVE : To apprise the learner how Gandhi spent a period of three years in London as a student.

OUTCOME : The learner will understand how Gandhi grew in introspection and maturity.

4. PRINCIPLES OF GOOD WRITING: L.A. HILL (RAVINDRA PUBLISHERS)

OBJECTIVE: To inform the learners how to write clearly and logically.

OUTCOME: The learner will be able to think clearly and logically and write clearly and logically.

Text Book : 'Sure Outcomes' by Orient Black Swan Pvt. Ltd Publishers

NON-DETAILED TEXT:


(From Modern Trailblazers of Orient Blackswan)

(Common single Text book for two semesters)

(Semester I (1 to 4 lessons)/ Semester II (5 to 8 lessons))

1. G.D. Naidu




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OBJECTIVE: To inspire the learners by G.D. Naidu's example of inventions and contributions.

OUTCOME: The learner will be in a position to emulate G.D.Naidu and take to practical applications.

2. G.R. Gopinath

OBJECTIVE: To inspire the learners by his example of inventions.

OUTCOME: Like G.R.Gopinath, the learners will be able to achieve much at a low cost and help the common man.

3. Sudhamurthy

OBJECTIVE: To inspire the learners by the unique interests and contributions of Sudha Murthy.

OUTCOME: The learner will take interest in multiple fields of knowledge and make life worthwhile through social service.

4. Vijay Bhatkar

OBJECTIVE: To inspire the learner by his work and studies in different fields of engineering and science.

OUTCOME: The learner will emulate him and produce memorable things.

Text Book : 'Trail Blazers' by Orient Black Swan Pvt. Ltd. Publishers




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SURAMPALAM-593 497

I Year – I SEMESTER

T	P	C
3/2+1	0	3/2

Remedial Mathematics –I/ Remedial Biology – I**Remedial Mathematics –I (50 Hrs)****(For Biology stream students)****UNIT I****Algebra:**

Arithmetic Progression-Geometric Progression- Permutations & combinations - Binomial theorem partial fractions - Matrices - Determinants - Application of determinants to solve simultaneous equations (Cramer's Rule).

10

UNIT II

Trigonometry: Trigonometric ratios and the relations between them Sin (A+B), Cos (A+B), Tan (A+B) formulae only. Trigonometric ratios of multiple angles-Heights and distances (simple 000 problems there on).

10

UNIT III

Co-ordinate Geometry: Distances between points-Area of a triangle, Co-ordinates of a point dividing a given segment in a given ratio - locus - equation to a straight line in different forms-Angle between straight lines-point of intersection.

10

UNIT IV

Differential Calculus: Continuity and limit: Differentiation, derivability and derivative, R.H. derivatives and L.H. derivatives, Differentiation, General theorems of derivation.

05

UNIT V

Integral Calculus: Integration as on inverse process of differentiation, definite integrals, integration by substitution, integration by parts, integration of algebraic function of E^x evolution of area in simple cases.

10



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UNIT VI

Differential equations: Formation of a differential equation, order and degree, solution of first order differential equations, Laplace transformation.

05

TEXT BOOKS

1. Intermediate first Year mathematics
2. Intermediate Second year mathematics, printed and published by Telugu Academy, Himayatnagar, Hyderabad
3. Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor, New Delhi.
4. Higher Engineering Mathematics by Grewal.



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I Year – II SEMESTER

T	P	C
3+1	0	3

COMPUTER APPLICATIONS AND BIOSTATISTICS

Unit-I

Overview of computer with general applications: components of computers, computer languages, usage of computers, introduction of operative system.

Introduction to MS-Office: MS- word: Basics, working with files, working with text, formatting paragraphs, styles, lists, tables, graphics, spelling and grammar, page formatting macros and table of contents.

MS-Excel: Basics, spreadsheets, data types, formulas, formatting charts and graphs.

MS-Power Point: Basics, views, slide controls, applied design, page setup, templates, background control, colour screens, traditions and animations, working with texts and working with graphics.

MS-Access: Data base concepts, screens layouts, creating tables, data sheet record, table relationships, shorting and filtering, query forms, form controls, sub forms, reports, importing, exporting and linking.

LO : The student should be familiar with overview of the computers and MS-office

Unit-II

Information Technology Today: Internet and World Wide Web (www), structure and organization of www, browsers, information searching in www, search engines, pharmaceutical resources in www types of indexing tools and search strategies, Hyper Text Manuscripts Languages (HTML) and e-mail.

LO : Familiarity with internet, WWW, browsing, HTML & e-mails.

Unit-III

Database Management: Concepts and objectives of Database Management systems, advantages of database management systems and examples of DBMS packs (like DBASE III).

LO : Familiarity with Database management

Unit-IV

Data collection and treatment: Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data



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UNIT - VI

Buffers and buffered isotonic systems: The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions, methods of adjusting tonicity and pH (relevant numerical problems).

10

LO : To know about buffers ,buffer isotonic solutions, Methods of adjusting isotonicity and their significance.

TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.
2. C.V.S.Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.
4. S. J Carter, Cooper and Gunn's Tutorial pharmacy.

REFERENCES

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European.)
2. Derle Deeliprao, Essentials of Physical Pharmacy
3. B.S Bahl, ArunBahl and G.D Tuli, Essentials of Physical Chemistry.
4. Pharmacopoeia (I.P, B.P, U.S.P and European)
5. Martindale, the Extra Pharmacopoeia; Latest Edition the Royal Pharmaceutical Society
6. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
7. Robin J. Haiwan, Hand Book of Pharmacy and Health Care Edition, ThePharma Press, U.K.
8. Bentley's Text Book of Pharmaceutics by E.A. Rawlins



Remedial Biology – I (40Hrs)
(For Maths stream students)

UNIT I

Classification of plant kingdom: Methods of classification of plants.

05

Plant cell: It's detailed structure, mitosis, meiosis different types of plant tissues and their functions.

05

UNIT II

Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed.

05

Modifications of root, stem and leaf.

05

UNIT III

General survey of animal kingdom: Non-chordates (Protozoa, Porifera, Cnidaria, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca, Echinodermata).

05

UNIT IV

Chordates: Phylum Hemichordata

Phylum Chordata (Classes: Pisces, Amphibians, Reptiles, Aves, Mammals)

05

UNIT V

Structure and life history of parasites: Amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris.

05

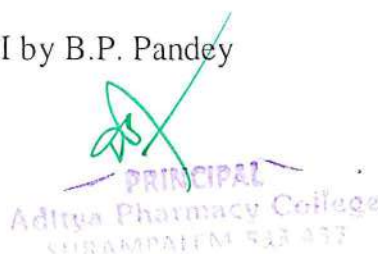
UNIT VI

General structure and life history of insects: Cockroach, Mosquito, Housefly, Itch mite and Silkworm. Relationship of insects with medicinal crops diseases.

05

TEXT BOOKS

1. Intermediate First Year and Second Year Botany / Zoology Text Books printed and published by Telugu Academy, Himayatnagar, Hyderabad.
2. A.C. Dutta, Text Book of Botany
3. Botnay for Degree students Vol I & II by B.P. Pandey



I Year – I SEMESTER

T	P	C
3+1	0	3

HUMAN ANATOMY & PHYSIOLOGY - I**UNIT-I**

Scope of anatomy and physiology: Structure of cell, its components and their function. **Elementary tissues of the human body:** Epithelial, connective, muscular and nervous tissues, their sub- types and properties.

08

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

04

Skeletal system: Structure, composition and functions of skeleton. Classification of joints, types of movements at joints, disorders of joints.

04

LO: To understand different tissues are involved in the formation of organs and perform different functions. For example skeletal muscle produce by way of its contraction and relaxation produce movement of the skeletal, nerves are involved in the transmission of electrical impulses, bones form body frame, muscles produce contraction and help in movement, circulation, digestion and excretion. Epithelial tissues protect and secretes juices.

UNIT-II**Haemopoietic system:**

Composition and functions of blood, Genesis and regulation of red blood cells production, blood groups, transfusion of blood. Leukocytes, properties of white blood cells, reticulo endothelial system, blood coagulation and its mechanism, formation and circulation of lymph. Disorders of blood.

Formed elements of blood :

WBC, RBC and Platelets, Heamopoiesis and blood hormones, Blood groups and their significance, Coagulating factors, Pathways of coagulation and Mechanism of coagulation, Disorders of blood and its components disorders of coagulation.

08

LO : Blood is involved in oxygen and carbon dioxide transport, maintenance of B.P, defense immunity and excretion.



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UNIT III

Cardiovascular system:

Basic anatomy, structure and functions of the heart and blood vessels. Excitatory and conductive system of the heart, action potential in cardiac cycle, nervous regulation of heart. Systemic coronary and hepatic blood circulation, cardiac output, blood pressure in different blood vessels, blood pressure regulations and measurements. ECG of heart. Brief outline of cardiovascular disorders like hypertension, hypotension, atherosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

08

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

03

LO: Heart and blood vessels maintain BP, transport gases, nutrients and waste products. Their function is essential to sustain life.

UNIT IV

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

07

LO : To know about external and internal respiration exchanging of gases, need for oxygen for metabolism of nutrients and generation of energy and is essential for life process.

UNIT V

Digestive System: Anatomy, structure and functions of different parts of gastrointestinal tract, motility of alimentary canal and its regulation. Gastrointestinal secretions, their compositions, function and regulations. Digestion of food in mouth, stomach and small intestine and its absorption.

LO : To understand digestion in various parts of GIT, enzymes and secretions involved – their functions.

UNIT VI

Urinary System: Structure and functions of Nephron, formation of urine, renal mechanism for concentrating and diluting the urine, regulation of acid-base balance, knowledge on release of renin from kidney and its functions. Regulations of blood volume and extracellular fluid volume. Disease related to kidney.

05

LO : To understand how urine is formed and various mechanisms involved in formation of urine.



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TEXT BOOKS

1. Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. C.C.Chatterjee, Human Physiology.
3. Ross & Wilson, Anatomy-Physiology in health and illness.
4. Donald.C Rizzo, Fundamental of Anatomy and Physiology.

REFERENCES

1. A.C.Guyton, Text Book of Medical Physiology.
2. Best & Taylor, The Living Body-A Text Book on Human Physiology.




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I Year – I SEMESTER

T	P	C
3+1	0	3

DISPENSING PHARMACY & ETHICS**UNIT-I**

Dispensing Pharmacy: Principles of dispensing, form of prescription, handling of prescription, source of errors for prescription, care required in dispensing procedures including labelling of dispensed products. Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, proof spirit calculations, displacement value and calculations of isotonicity adjustment. General dispensing procedure- posology calculations of doses.

LO : To understand dispensing principles, procedures, calculations involved, doses.

UNIT-II

Principles involved and procedures adopted in dispensing of the following classes of preparations.

- (i) Mixtures
- (ii) Solutions – A study of the following solutions – Cresol with soap solution IP, Aqueous Iodine solution IP, Strong solution of Iodine IP, weak iodine solution IP, strong solution of Ammonium acetate.
- (ii) emulsions (iv) powders (v) lotions & liniments (vi) ointments

LO : To understand principles and procedures involved in the dispensing of various categories of products.

Unit-III

Dosage forms – Purpose, classification, definitions and general characteristics of the following dosage forms

Solids : Tablet and capsules.

Liquid orals : Elixirs, Syrups, Linctus, Suspensions and Emulsions.

Liquids for external use : Lotions & liniments applications.

Semi solids : Ointments, Creams, Gels, Suppositories and Pessaries.

LO : To understand dosage forms and their general characteristics.

UNIT-IV

Incompatibilities: Physical, chemical and therapeutic incompatibilities – methods of overcoming and handling of incompatible prescriptions.



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LO : To understand incompatibility and methods of overcoming incompatibility.

UNIT-V

Extraction and galenical products: Principle and methods of extraction - preparation of infusions, tinctures, dry, soft and liquid extracts.

LO : To understand extraction and galenical products – Principles and procedures.

UNIT-VI

Pharmacy Ethics as prescribed by PCI.

LO: To understand Ethics related to Pharmacy profession as prescribed by PCI.

TEXT BOOKS

1. Cooper & Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
2. R.M Metha, Dispensing Pharmacy.
3. NK Jain and GD Guptha, Modern Dispensing Pharmacy, Pharma Med Press.
4. Sanmathi BS and Anshu Guptha, Dispensing Pharmacy – A Practical Manual, Pharma Med Press.

REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. E.A. Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ.
3. Hoover, Dispensing of Medication.



I Year – I SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL ORGANIC CHEMISTRY-I

UNIT-I

Structure and reactivity of organic molecules: Polarity of bonds, electronic effects: electromeric effect, inductive effect, mesomeric effect and Hyperconjugation and their influence on the properties of organic molecules; charged species: carbocations and carbanions, their generation, stabilities, rearrangement in the case of carbocations; Free radicals: formation and stability.

LO : Understanding the basic concepts influencing the reactivity of organic molecules, understanding the mechanisms wherever applicable, applications of the above in the interpretation of various properties of organic molecules.

UNIT-II

Alkanes and cycloalkanes: Nomenclature, general methods of preparation, chain and conformational isomerism in the case of alkenes and their relative stabilities, Bayer's strain theory and Sachse-Mohr theory in the case of cycloalkanes and their limitations.

Alkenes: Nomenclature, general methods of preparation, characteristic electrophilic and free radical addition reactions, orientation of product formation as interpreted by Markonikov's rule and peroxide effect (Anti-Markonikov's rule), ozonolysis and allylic substitution.

Alkadienes: Nomenclature, stability of conjugated dienes, 1,2- and 1,4-reactions and their relative stabilities.

Alkynes: Nomenclature, general methods of preparation, characteristic reactions with emphasis on acidity of one alkynes, formation of metal acetylides, stereospecific reduction of alkynes and addition of water involving keto-enol tautomerism

LO : Structures, equations involved in the preparations, mechanism of formation or the reaction, rearrangements if any, discussion on stabilities and applications of the characteristic reactions in synthesis.

UNIT-III

Alkylhalides: Nomenclature, general methods of preparation, significance of nucleophilic substitution of alkylhalides in organic synthesis, mechanisms and salient features of S_N1 and S_N2 reactions with examples including the proof in favor of these reactions, a comparison of S_N1 and S_N2 , elimination



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reactions (E1 and E2): mechanisms, salient features and orientation of product formation in terms of Saytzeff's rule and Hoffmann orientation.

LO : Structures, equations involving the methods of preparations and reactions, stabilities and applications of the reactions.

UNIT-IV

Alcohols: Nomenclature, classification, methods of preparation, industrial synthesis of ethanol and methanol, reactions of alcohols involving the replacement of hydroxyl or replacement of the hydrogen of the hydroxyl, iodoform reaction and Lucas test.

Ethers: Nomenclature, Williamson's synthesis, action of hydroiodic acid on ethers.

LO : Structures, general properties, equations involving the methods of preparation and reactions, mechanisms, reactivities.

UNIT-V

Stereochemistry: Isomerism and its comparison to stereoisomerism, stereoisomers, optical isomers (enantiomers), characteristics of enantiomers (chirality), racemic mixtures, methods of separation of racemic mixtures, optical activity, optical rotation, specific rotation, plane of symmetry and centre of symmetry, diastereomers, their properties and required characteristics with examples as given by Fischer projection formulae; mesoform and its characteristics; Configuration: relative configuration (D and L), absolute configuration (R and S); Geometric isomerism: cis-trans isomerism and E and Z nomenclature.

LO : Stereochemical structures, importance of stereochemistry with respect to drugs as interpreted in terms of reactivity and the properties of chiral drugs.

UNIT-VI

Grignard reagent: Preparation, characteristic nucleophilic addition and substitution reactions, applications in organic synthesis and limitations.

LO : Structure, mechanism and usefulness in synthesis.

TEXT BOOKS

1. T.R. Morrison and R.N. Boyd, Organic chemistry, pentice hall of India private limited, New Delhi.
2. Arun Bahl & Bahl, Advanced Pharmaceutical Organic Chemistry.

REFERENCES

1. R.L Madan, Organic Chemistry.
2. Lloyd N. Ferguson, Text book of Organic Chemistry, 2nd edition.
3. Raj K Bansal, A textbook of Organic Chemistry, 5th edition.




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I Year – I SEMESTER

T	P	C
0	3	2

ENGLISH COMMUNICATIONS SKILLS LAB

Suggested Lab Manuals:

OBJECTIVE: To impart to the learner the skills of grammar as well as communication through listening, speaking, reading, and writing including soft, that is life skills.

ADVANCED COMMUNICATION SKILLS

UNIT 6	Body language
UNIT 7	Dialogues
UNIT 8	Interviews and Telephonic Interviews
UNIT 9	Group Discussions
UNIT 10	Presentation Skills
UNIT 11	Debates

Text Book:

‘Strengthen your Communication Skills’ Part-B by Maruthi Publications

Reference Books:

1. INFOTECH English (Maruthi Publications)
2. Personality Development and Soft Skills (Oxford University Press, New Delhi)




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I Year – I SEMESTER

T	P	C
0	2	0/1

REMEDIAL BIOLOGY LAB

1. Study of Simple and compound microscopes used in biology.
2. Section cutting, staining and mounting of sections.
3. Histological studies of the leaf, stem and root with description of their stained sections.
4. Description and study of floral characters of the plants representing the families in theory.
5. Observation of permanent slides.




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I Year – I SEMESTER

T	P	C
0	3	2

DISPENSING PHARMACY LAB

1. Dispensing of prescriptions falling under the categories; Mixtures, solutions, emulsions, creams, ointments, powders, pastes, lotions, liniments, inhalations, paints. etc.
2. Identification of various types of incompatibilities in a prescription, correlation thereof and dispensing of such prescriptions.
3. Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.
4. Dispensing of prescriptions involving adjustment of tonicity.

A total 50 prescriptions are to be dispensed.

I Year – I SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL ORGANIC CHEMISTRY LAB

Introduction to Equipment & Glassware

Recrystallization method, determinations of Melting point, Boiling Point and distillation

I. Preparation of organic compounds (each involving a specific organic reaction covered in theory)

1. N-Acetylation : Preparation of Acetanilide from Aniline
2. O-Acetylation : Preparation of Aspirin from salicylic acid
3. Nuclear Nitration : Preparation of μ -Dinitrobenzene from nitrobenzene
4. Oxidation : Preparation of Benzoic acid from Benzyl chloride
5. Esterification : Preparation of n-Butyl acetate from n-Butyl alcohol
6. Etherification : Preparation of α -Naphthyl methyl ether from α -Naphthol
7. Halogenation : Preparation of Iodoform from iodation of acetone
8. Extensive Nuclear Substitution : Preparation of Tribromophenol
9. Bromination of Tribromoaniline from Phenol or Aniline

II. Systematic qualitative Analysis (Identification) of Monofunctional Organic Compounds:

Avoid water-soluble compounds, and compounds containing more than one functional group; at least six individual compounds to be analyzed.

REFERENCES

1. Vogel's Text Book of Practical Organic Chemistry, 5th Edition.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry.
3. O.P. Agarwal, Advanced Practical Organic Chemistry.
4. F.G.Mann & B.C. Saunders, Practical Organic Chemistry.



I Year – II SEMESTER

T	P	C
3+1	0	3

HUMAN ANATOMY & PHYSIOLOGY – II (50 Hrs)

UNIT –I

08

Central Nervous System: Anatomy and physiology of different parts of brain, spinal cord and cranial nerves.

LO : Brain involvement in sensory and motor functions including pain perception, sleep wake cycle, cognitive skills, memory, behavior and governance.

UNIT – II

Neuron, axon conduction, Neurochemical transmission, reflex action, electroencephalogram, specialized functions of the brain, and their functions.

08

LO : Chemical Mediators like Acetyl choline, Serotinine, Dopamine, Noradrenaline, glutamic acid, gaba involvement in transmission of impulse and disorders due to their changes.

UNIT - III

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

08

LO : Cholinergic system is Essential for life process while adrenergic system is needed to meet emergency by flight or fight. ANS works without rest through life without rest unlike CNS.

UNIT - IV

Endocrine System: Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, testes, ovary and endocrine functions of hormones and functions.

08

LO : Growth, reproduction and metabolism depend on hormonal activity. Their imbalance leads to disorders and some of them cannot be rectified.



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UNIT-V

Reproductive System: Male and female reproductive systems and the functions of their hormones. Physiology of menstruation, Spermatogenesis and Oogenesis. 08

LO : Concept of male & female hormones, Characters, sex cell maturity, reproductive period, copulation and pregnancy, parturition, concept of pregnancy, menopause and their care.

UNIT-VI

Sense organs: basic anatomy and physiology of Eye, Ear, Nose, Tongue and skin. 10

LO : Sensations are the combined activities of sensory organs and specified areas of the brain.

TEXT BOOKS

1. Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y
2. Ross & Wilson – Anatomy & Physiology in health and illness – Anne Waugh, Allison Grant.
3. T.S. Ranganathan, A Text book of Human Anatomy.
4. Human Anatomy and Physiology. C.C Chatterjee.

REFERENCES

1. Donald.C Rizzo, Fundamental of Anatomy and Physiology.
2. Subrhamanyam and Others, A textbook of Physiology.
3. A.C.Guyton, Text Book of Medical PhysiologyKeele& Neil, Samson Wrights Applied Physiology.
4. Best & Taylor, The Living Body-A Text Book on Human Physiology.
5. M.N. Ghosh, Human Physiology Julia F. Gui, Learning Human Anatomy: A Laboratory Text.
6. B.D. Chaurasia, Human Anatomy, Regional and Applied, Part-I,II and III, CBS Publishers and Distributors, New Delhi.



I Year – II SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL INORGANIC CHEMISTRY

UNIT-I

1. Classification of inorganic pharmaceuticals based on their applications and therapeutic uses.
2. Sources of impurities, quality control and test for purity. Limit tests for chlorides, sulphates, iron, arsenic, lead and heavy metals and their pharmacopoeial standards.

LO : Pharmaceutical orientation to inorganic chemistry, definitions, principles, procedures, limits of detection, keeping the impurities in pharmaceutical substances to the minimal level.

UNIT-II

1. **Sodium, potassium and calcium replenishers:** sodium chloride, compound sodium chloride solution (Ringer solution), potassium chloride, ORS.
2. **Calcium replenishers:** Calcium chloride, calcium gluconate, dibasic calcium phosphate.
3. **Acid-base regulators:** sodium bicarbonate, sodium lactate, sodium citrate/potassium citrate, sodium acetate and ammonium chloride.
4. **Antacids:** Aluminium hydroxide gel, dried aluminium hydroxide gel, magnesium oxide, magnesium hydroxide mixture, magnesium trisilicate and calcium carbonate.
5. **Expectorants:** Ammonium chloride, potassium iodide.
6. **Emetics:** Potassium antimony tartrate and copper sulfate.
7. **Antidotes:** Sodium thiosulphate and sodium nitrite.

LO : Properties, classification, preparation, assay of ammonium chloride, sodium thiosulfate and sodium nitrite, uses.

UNIT-III

1. **Adsorbents:** Light kaolin, heavy kaolin and activated charcoal.
2. **Astringents:** Zinc oxide and Bismuth subcarbonate.
3. **Protectants:** Calamine, zinc oxide, zinc stearate, talc and titanium dioxide.
4. **Silicone polymers:** Activated Dimethicone.



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5. **Anti-infectives:** Hydrogen peroxide solution, potassium permanganate, silver nitrate (Silver protein), iodine (Solutions of iodine, povidone-iodine) boric acid and yellow mercuric chloride.

LO: Properties, preparation wherever applicable, assay of hydrogen peroxide, potassium permanganate, boric acid, zinc oxide and uses.

UNIT-IV:

1. **Laxatives:** Magnesium sulphate and sodium phosphate.
2. **Haematinics:** Ferrous sulphate, Ferrous fumarate, Ferrous gluconate, Ferric ammonium citrate, Iron and dextrose injection.
3. **Suspending agents:** Bentonite and colloidal silica.
4. **Excipients:** Di and tricalcium phosphates, magnesium stearate, talc and calcium carbonate (precipitated chalk).
5. **Colorants:** Titanium oxide and ferric oxide.

LO : Properties, preparations wherever applicable, uses.

UNIT-V

Dental products:

1. **Fluorides:** Sodium fluoride and stannous fluoride.
2. **Oral antiseptics:** Hydrogen peroxide, Zinc peroxide and mouth washes.
3. **Dentifrices:** Dibasic calcium phosphate, strontium chloride and sodium metaphosphate.
4. **Cements and Fillers:** Zinc oxide.

LO : Properties, preparations wherever applicable, uses.

UNIT-VI

Miscellaneous medicinal agents of inorganic nature:

Cisplatin (Antineoplastic), lithium carbonate (Antipsychotic), barium sulfate (diagnostic agent), plaster of paris (surgical aid), sodium aurothiomalate (antirheumatic), sodium antimonygluconate (internal parasiticide) and potassium perchlorate (antithyroid).

LO : Structures, properties and uses.

TEXT BOOKS

1. A.H.Beckett and J.B.Stenlake, Practical pharmaceutical chemistry, Part-I. The Athlone press, University of London, London.
2. Advanced Inorganic Chemistry by Satya prakash, G.D.Tuli



3. Wal Ankita, Wal, Pranay, Rai, Awani Kumar, Inorganic Pharmaceutical Chemistry, New Age International Publishers.

REFERENCES

1. J.H Block, E.Roche, T.O Soine and C.O. Wilson, Inorganic Medical and pharmaceutical Chemistry Lea & Febiger, Philadelphia PA.
2. P. Gundu Rao, Inorganic pharmaceutical chemistry; Vallabh Prakashan, Delhi.
3. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London.
4. G.R Chatwal, Pharmaceutical Chemistry Inorganic, Himalaya Publishers.
5. K Somasekhar Rao, C Venkata Suresh, Pharmaceutical Inorganic Chemistry, Pharma Med Press.




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I Year – II SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL ORGANIC CHEMISTRY-II

UNIT-I

Benzene: Kekule's structure, aromaticity, Huckle's rule, resonance energy, characteristic electrophilic substitution reactions: nitration, halogenations, sulfonation, Friedel-Craft's alkylation and acylation with limitations, orientation in monosubstituted benzenes.

Polynuclear aromatic hydrocarbons: Nomenclature, methods of preparation of naphthalene, anthracene and phenanthrene, their oxidation and reduction reactions, relative susceptibilities to oxidation as interpreted in terms of sacrifice of resonance energies, electrophilic substitution reactions.

Arylhalides: Nomenclature, comparison of reactivity with respect to alkylhalides, mechanism of nucleophilic substitution (Benzyne concept).

LO : Understanding the properties of aromatic compounds, mechanisms of reactions and their usefulness in organic synthesis, electronic factors influencing orientation.

UNIT-II

Carbonyl compounds: Nomenclature, important methods of preparation, characteristic nucleophilic addition reactions (addition of bisulphate, Grignard reagent, hydrogen cyanide, hydrazine derivatives and alcohols); Aldol condensation, Cannizzaro reaction and Perkin reaction.

LO : General properties, relative reactivities towards nucleophilic addition, mechanisms and applications.

UNIT-III

Carboxylic acids: Nomenclature, important methods of preparation, characteristic reactions (acidity, relative acidities, reduction, H-V-Z reaction, conversion into acid chlorides, amides and esters); methods of preparation of important esters (acetoacetic ester and malonic ester) and their applications in organic synthesis.

LO : General properties, measurement of relative acidities, equations involving the reactions and mechanisms, applications in synthesis.

UNIT-IV

Phenols: Nomenclature, general methods of preparation, industrial synthesis of phenol by Dow process, characteristic reactions (acidity and its



comparison to alcohols and carboxylic acids as interpreted by resonance, ether formation, ester formation, Kolbe reaction, Reimer-Tiemann Reaction, bromination and nitration).

LO : Structures, equations, mechanisms, importance of these reactions in pharmaceutical organic synthesis.

UNIT-V

Amines and Diazonium compounds: Nomenclature, methods of preparation, characteristic reactions (basicity and relative basicities, alkylation and exhaustive alkylation, nitration and orientation), separation of all three classes of amines by Hinsberg's method; formation of Diazonium compounds, characteristic reactions (replacement by hydrogen, Sandmeyer reaction, replacement by nitrile, and their applications in synthesis and coupling reactions).

LO : Properties, structures, equations, mechanisms, orientations and applications.

UNIT-VI

Name reactions: Beckmann rearrangement, Mannich reaction, Fries rearrangement, Michael addition, Schmidt reaction, Benzoin condensation.

LO : General reaction, structures and mechanism, applications in organic synthesis.

TEXT BOOKS

1. T.R.Morrison and R.N.Boyd, Organic chemistry, pentice hall of India private limited, New Delhi.
2. Arun Bahl & Bahl, Advanced Pharmaceutical Organic Chemistry.

REFERENCES

1. R.L Madan, Organic Chemistry.
2. Lloyd N. Ferguson, Text book of Organic Chemistry, 2nd edition,.
3. Raj K Bansal, A textbook of Organic Chemistry, 5th edition.




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I Year – II SEMESTER

T	P	C
3+1	0	3

PHYSICAL PHARMACY – I (50 Hrs)

UNIT I

Intermolecular forces and states of matter: Binding forces between molecules, the states of matter, the gaseous state, the liquid state, solids and the crystalline state. Phase equilibria and the phase rule. 10

LO : To learn intermolecular forces and states of matter, Phase equilibria and Phase rule

UNIT - II

Thermodynamics: The first law of thermodynamics. Thermochemistry. The second law of thermodynamics. The third law of thermodynamics, Free energy functions and applications. 10

LO : To understand laws of Thermodynamics and their Applications

UNIT - III

Physical properties of Drug Molecules: Dielectric constant induced polarization, dipole moment, refractive index and molar refraction, optical rotatory dispersion.

LO : To understand the physical properties of drug molecules and their significance. 06

UNIT - IV

Solutions of Non electrolytes: Concentration expressions, ideal and real solutions, colligative properties, molecular weight determinations.

06

LO : To understand properties of Non electrolytes and their significance

UNIT - V

Solutions of Electrolytes: Properties of solutions of electrolytes. The Arrhenius theory of electrolyte dissociation. The modern theory of strong electrolytes and other coefficients for expressing colligative properties.

08

LO : To know theories of electrolytes and their dissolution and colligative properties



UNIT - VI

Buffers and buffered isotonic systems: The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions, methods of adjusting tonicity and pH (relevant numerical problems).

10

LO : To know about buffers ,buffer isotonic solutions, Methods of adjusting isotonicity and their significance.

TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.
2. C.V.S.Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.
4. S. J Carter, Cooper and Gunn's Tutorial pharmacy.

REFERENCES

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European.)
2. Derle Deeliprao, Essentials of Physical Pharmacy
3. B.S Bahl, ArunBahl and G.D Tuli, Essentials of Physical Chemistry.
4. Pharmacopoeia (I.P, B.P, U.S.P and European)
5. Martindale, the Extra Pharmacopoeia; Latest Edition the Royal Pharmaceutical Society
6. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
7. Robin J. Haiwan, Hand Book of Pharmacy and Health Care Edition, ThePharma Press, U.K.
8. Bentley's Text Book of Pharmaceutics by E.A. Rawlins




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I Year – II SEMESTER

T	P	C
3+1	0	3

COMPUTER APPLICATIONS AND BIOSTATISTICS**Unit-I**

Overview of computer with general applications: components of computers, computer languages, usage of computers, introduction of operative system.

Introduction to MS-Office: MS- word: Basics, working with files, working with text, formatting paragraphs, styles, lists, tables, graphics, spelling and grammar, page formatting macros and table of contents.

MS-Excel: Basics, spreadsheets, data types, formulas, formatting charts and graphs.

MS-Power Point: Basics, views, slide controls, applied design, page setup, templates, background control, colour screens, traditions and animations, working with texts and working with graphics.

MS-Access: Data base concepts, screens layouts, creating tables, data sheet record, table relationships, shorting and filtering, query forms, form controls, sub forms, reports, importing, exporting and linking.

LO : The student should be familiar with overview of the computers and MS-office

Unit-II

Information Technology Today: Internet and World Wide Web (www), structure and organization of www, browsers, information searching in www, search engines, pharmaceutical resources in www types of indexing tools and search strategies, Hyper Text Manuscripts Languages (HTML) and e-mail.

LO : Familiarity with internet, WWW, browsing, HTML & e-mails.

Unit-III

Database Management: Concepts and objectives of Database Management systems, advantages of database management systems and examples of DBMS packs (like DBASE III).

LO : Familiarity with Database management

Unit-IV

Data collection and treatment: Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data



organization, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams.

Measures of central tendency and variations: Mean, median, mode, properties and applications, range, standard deviations and standard error of means, coefficient of variation, kurtosis, skewness and confidence (fiducial) limits for mean and proportions.

LO : Fundamentals of data / Sample collection and diagrammatic presentation. Measures of central tendency and dispersion.

Unit-V

Regression: Correlation and regression analysis, method of least squares and non-linear regression.

Statistical Quality control: Statistical Quality control charts like mean and range charts, p-chart, np-chart and c-chart. Applications of Statistical Quality control in pharmaceutical sciences.

LO : Correlation and regression quality control charts in pharmacy.

Unit-VI

Statistical inference: t-test, chi square test and their applications in pharmacy.

Elements of ANOVA: One-way and two-way with examples.

LO: Application of t-test, Chi square test and approve in the testing the significance of difference or similarity.

TEXTBOOKS

1. Computer Fundamentals, Anita Goel, Pearson.
2. Information Technology Workshop, 3e, G Praveen Babu, M V Narayana BS Publications.
3. Khan & Khan, "Fundamentals of Biostatistics".
4. Pranab Kumar Banerjee, "Introduction to Biostatistics".

REFERENCE BOOK:

1. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu
2. Biostatistics for medical, nursing and pharmacy students by A.Indrayan, L Satyanarayana.
3. Introduction to Information Technology, ITL Education Solutions Ltd., 2nd Ed, PEARSON
4. Comdex Information Technology, Vikas Gupta, dreamtech.



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I Year – II SEMESTER

T	P	C
0	3	2

HUMAN ANATOMY PHYSIOLOGY LAB

1. Study of compound microscope and precautions to be taken while handling it.
2. Microscopic study of structure of cell and different tissues.
3. To understand and learn Blood withdrawal techniques.
4. Determination of bleeding time, clotting time, blood grouping and Estimation of Hemoglobin in blood.
5. Study of Haemocytometry.
6. Estimation of W.B.C count.
7. Estimation of R.B.C. count.
8. Estimation of D.L.C.
9. Study of human skeleton.
10. Study of different systems with the help of charts and models.
11. Recording of body temperature, pulse rate and blood pressure.
12. Determination of vital capacity, experiments on spirometry.
13. Various devices used in family planning like Copper T, Lippe's loop, diaphragm, condom and oral pills.



I Year – II SEMESTER

T	P	C
0	3	2

PHYSICAL PHARMACY – I LAB

1. Percent composition – Capillary Flow method.
2. Percent composition – Polarimeter & Refractometer.
3. Molecular weight – Landsberger method.
4. Molecular weight – Rast camphor method.
5. Calibration of pH Meter.
6. pH Estimation – pH meter.
7. pH Estimation – Colourimetric method.
8. pH Estimation by Half Neutralization Method.
9. Refractive index of liquids.
10. Phenol water system – Upper Consolute Temperature.
11. Lower consolute temperature – Tea and Water.
12. Heat of neutralization.
13. Phase diagram -Phenol – Water, Effect of Impurities.
14. Ternary phase diagram.
15. Preparation of Buffers and Buffer capacity determination.




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I Year – II SEMESTER

T	P	C
0	3	2

COMPUTER APPLICATIONS LAB**Identification of the peripherals of a computer.**

To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

A practice on disassemble the components of a PC and assembling them to working condition.

Examples of Operating systems-Dos, Windows, Installation of MS windows on a PC.

Introduction to Memory and Storage Devices , I/O Port, Device Drivers, Assemblers, Compilers, Interpreters , Linkers, Loaders.

Internet & World Wide Web : Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC ,Bluetooth Technology, Wireless Technology, Modem, DSL, Dialup Connection.

Orientation & Connectivity Boot Camp and surfing the Web using Web Browsers: Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers.

Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google.

MS Office

Word Orientation: Word as word Processors.

Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option

Creating project : Abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check , Track Changes,



Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

MS Excel

Excel Orientation: The mentor needs to tell the importance of MS Excel as a Spreadsheet tool, give the details of the tasks and features that would be covered in each.

Using Excel Accessing, overview of toolbars, saving excel files, Using help and resources.

Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text.

Performance Analysis - Features to be covered: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.

Power Point

Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this week includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting –Images, Clip Art, Tables and Charts in PowerPoint.

Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topic covered during this week includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

MS Access:

Students have to work on creating data bases, tables, storing and organizing data in the data base, querying, Creating Forms and Reports (take appropriate examples.)

TEXT BOOK:

- 1 Computer Fundamentals, Anita Goel, Pearson.
- 2 Information Technology Workshop, 3e, G Praveen Babu, M V Narayana BS Publications.




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- 3 Introduction to Information Technology, ITL Education Solutions Ltd., 2nd & 3rd Eds., PEARSON
- 4 Comdex Information Technology, Vikas Gupta, dreamtech.

REFERENCE BOOK:

1. Williams, Using Information Technology: Practical Introduction, TMH.
2. Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu.




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II Year – I SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL UNIT OPERATIONS –I (50 Hrs)

UNIT-I

08

Fluid Flow: Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

LO: To understand fluid flow concepts – Reynold's number, viscosity, flow meters and valves – measurements of flow and pressure.

UNIT-II

Material handling systems:

10

- Liquid handling -different types of pumps.
- Gas handling -various types of fans, blowers and compressors.
- Solid handling -conveyors

LO : To understand material handling systems – liquid, gas and solid handling.

UNIT-III

10

Filtration and Centrifugation: Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimenters.

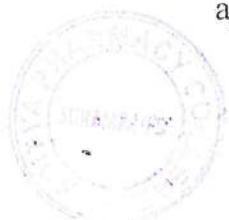
LO : To understand theory and equipment of filtration and centrifugation.

UNIT-IV

10

Crystallization: Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

LO : To know the crystallization theory, crystallization equipment and their applications.




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UNIT-V**Dehumidification and Humidity control**

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.

03

LO : To know the theory of dehumidification and humidity control, measurement of humidity.

Refrigeration and Air Conditioning:

Principles and applications of refrigeration and air conditioning.

02

LO : To understand the principles and applications of refrigeration and air conditioning.

UNIT-VI

Materials of Construction: General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.

04

Industrial hazards and safety precautions: Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, accident records etc.

03

LO : To understand the materials of construction, their properties and applications. To know the mechanical, chemical, fire and dust hazards and their prevention.

TEXT BOOKS

1. Prof. K. Samba Murthy, Pharmaceutical Engineering.
2. Badzer & Banchemo, Introduction to Chemical Engineering.
3. C.V.S. Subramanayam, Pharmaceutial Unit Operation, VallabhPrakashan
4. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy 6ed CBS publisher, Delhi.

REFERENCES

1. Perry's Handbook of Chemical Engineering.
2. Unit Operations by McCabe& Smith.
3. McCabe& Smith, Elements of Chemical Engineering.
4. Lippincott Williams and Wilkins : Remington Pharmaceutical Sciences.
5. EA Rawlins, Bentley's Text Book of Pharmaceutics, 8edition, ELBS
6. C.G. Brown, Unit Operations (Indian ed)Asia Publishing House, Bombay
7. Remington's Pharmaceutical Sciences



II Year – I SEMESTER

T	P	C
3+1	0	3

PHARMACOGNOSY – I(50 Hrs)

UNIT- I

Definition, history, scope and development of Pharmacognosy. General introduction to alternative systems of medicine like Ayurveda, Siddha, Unani and Homeopathy. 02

Brief introduction to natural sources of drugs with examples: Plant Source, Animal Source, Mineral Source, Marine Source and microorganisms. 04

LO : To make the students understand that drugs are obtained from different sources and crude drugs, are used in the indigenous systems of medicine.

UNIT-II

Classification of Crude Drugs: Alphabetical, morphological, pharmacological, chemical, taxonomical and chemotaxonomical methods of classification with suitable examples. 06

LO : To make the students understand that crude drugs can be classified based on several criteria.

UNIT-III

Cultivation, collection, processing, drying and storage of medicinal plants: 08

- Factors influencing cultivation of medicinal plants.
- Plant hormones and their applications.
- Definitions and examples for polyploidy, mutation and hybridization with reference to medicinal plants.

Good Agriculture Practices: Strategies of obtaining improved cultivation of medicinal plants.

LO : To understand improve agricultural conditions provide high yield and the methods be standardized to get consistent yields.

UNIT-IV

Adulteration & Evaluation of crude drugs: 06

Adulteration of crude drugs: Different methods of adulteration of crude drugs and general methods for detection of adulterants. For example

i) Organoleptic ii) Microscopic iii) Physical iv) Chemical and Biological methods of evaluation.




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LO : To provide enough knowledge to identify adulterants from genuine products and to provide quality products.

UNIT-V

06

Systematic pharmacognostic study of the following carbohydrates and derived products: Acacia, tragacanth, agar, starch, guar gum, pectin, isabgol and honey.

LO : To provide quality products of the above as excipients.

UNIT-VI

Systematic Pharmacognostic study of the following Lipids: Castor oil, cod liver oil, shark liver oil, linseed oil, cocoa butter, kokum butter, bees wax, wool fat, hydrocarpus oil, spremaceti, lard and olive oil.

08

Systematic Pharmacognostic study of the following volatile oils: Mentha, coriander, cinnamon, lemon oil, nutmeg, eucalyptus, ginger, cardamom, tulsi, lemon grass, caraway, cumin, dill, clove, fennel and black pepper.

06

LO : To maintain quality in fixed and volatile oils.

TEXT BOOKS

1. Kokate C.K, Purohit AP & Gokhale Pharmacognosy S.B (Nirali)
2. Trease and Evans Pharmacognosy, Latest Edition.
3. Tyler, Brady & Robert, Pharmacognosy.
4. T.E.Wallis, Textbook of Pharmacognosy, Pub by CBS Publishers and distributors, New Delhi.

REFERENCES

1. Atal C.R & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Ayurvedic Pharmacopoeia of India, Pub by Govt. of India.
3. A.A. Farooqi & B.S. Sree Ramu, Cultivation of Medicinal and Aromatic Crops, University Press.
4. CSIR Publications, Wealth of India.
5. Handa and Kapoor, Text Book of Pharmacognosy.
6. Gokhale, Pharmacognosy.
7. Heinrich, Fundamentals of Pharmacognosy and Phytotherapy.
8. Taylor and Evans, Text Book of Pharmacognosy.
9. Iyengar, Pharmacognosy of Powdered Crude Drugs.
10. R.N Chopra, S.L Nair and I.C Chopra, Glossary of Indian Medicinal Plants, CSIR, New Delhi.



II Year – I SEMESTER

T	P	C
3+1	0	3

PHYSICAL PHARMACY -II(50 Hrs)

UNIT-I

08

Solubility and Distribution Phenomena : Solvent-solute interaction, solubility of gases in liquids, liquids in liquids, solids in liquids, distribution of solutes in immiscible solvents.

Introduction to phenomena of diffusion : Ficks first law and second law.

LO : To understand the solubility and distribution phenomenon and laws of diffusion.

UNIT-II

Kinetics: Rates and orders of the reaction. Influence of temperature and other factors on reaction rates. Decomposition and stabilization of medicinal agents, kinetics in the solid state and accelerated stability analysis (relevant numerical problems). 10

LO : To understand kinetic rates, order of reaction, decomposition pathways and methods of stabilization, stability testing methods, accelerated stability analysis.

UNIT-III

Interfacial Phenomena: Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Surface active agents and systems of hydrophilic-lipophilic classification. Adsorption at solid interfaces. Electrical properties of interfaces. 08

LO : To understand theory of interfacial phenomenon, absorption, surfactants and theoretical properties of interfaces.

UNIT-IV

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

08

LO : To learn micromeritic characteristics and their applications and significance.



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UNIT-V

Rheology: Newtonian system, non-Newtonian system, thixotrophy, measurement and applications in formulations. Determination of viscosity and its applications. 08

LO : To understand rheology, types of flow, thixotrophy, its applications and viscosity.

UNIT –VI

Colloids: Introduction, types of colloidal systems, solubilization, Stability of colloids, optical properties, kinetic properties, electrical properties and Donnan Membrane equilibriaum. 08

LO : To know colloids – types – properties – stability considerations.

TEXT BOOKS

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5 Edition.
2. CVS Subhramanyam, Physical Pharmacy, Vallabhprakashan.
3. DeelipRaoDerle&Sai hanuman SagarBoddu. Essentials of Physical Pharmacy.
4. B. S. Bahl, Arunbahl and G. D. Tuli. Essentials of Physical Chemistry.

REFERENCE

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. M.E. Aulton, Pharmaceutics – The science of dosage form design, 2edition
3. Bentley's text book of Pharmaceutics. E. A. Rawlins.
4. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.
5. Pharmacopoeia (IP, BP, USP and European).



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II Year – I SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL MICROBIOLOGY(50 Hrs)

UNIT – I

10

Introduction to Microbiology: Origin, scope and discovery of spontaneous generations theory, contributions of Antony Von Leuwenhock, Pasteur, Koch and Lister.

Diversity of Microorganisms: Prokaryotes versus eukaryotes – eukaryotic and Prokaryotic cell structure, three domains of life (bacteria, archea and eukaryotics). Pharmaceutical significance of protozoa, algae, fungi, bacteria and viruses. Characterisation and identification of microorganisms.

LO : To understand diversity of microorganisms and their spontaneous generation and use and harmful nature.

UNIT – II

10

Nutrition and Growth of Microbes: Nutritional requirements, Types of Nutrient media and growth conditions and Nutritional types based on energy source.

Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determining bacterial numbers, mass and cell constituents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

Microorganisms and their Environment: Effects and microbial adaptations to environmental conditions – Temperature, oxygen desiccation, extreme cold ionic effect, electricity, osmotic pressure, radiant energy, hydrostatic pressure, mechanical impact, vibration.

LO : To understand that bacterial growth curve consist of rapid growth followed by stabilization and later decline due to exhaustion of nutrients and several parameters affects the above.

UNIT –III

08

Control of Microorganisms: General Concepts, Inhibition of growth and killing, sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial



activity. Chemotherapeutic agents, mode of action and applications, drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.

LO : To understand that moist heat, dry heat, radiation, filtration, chemicals can be used for sterilization and disinfection to provide aseptic condition in the filling areas, operation theatres etc

UNIT –IV

10

Bacterial Genetics: Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon). Mutagenesis, chemical and physical mutagens.

LO : To understand the concept of bacterial resistance to antibiotics and other conditions.

UNIT – V

04

Epidemiology of Diseases: Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhea, tetanus, food poisoning and infection hepatitis.

LO: To understand that microbes are responsible for causing certain diseases.

UNIT – VI

08

Application of Microbes in Pharmaceutical Industry

- Microbiological Assays:** Principles and Methods involved in Assay of Antibiotics,
Vitamins, Amino acids & Bio-Sensors in Analysis.
- Microbial Source & applications of various pharma products** like Antibiotics,
Vitamins, amino acids, solvents, enzymes & genetic engineered products etc.

LO : To understand that antibiotics/Vitamins can be standardized by microbial assays. And some useful products can be produced as a bacterial metabolites.



TEXT BOOKS

1. Pelczar and Reid, Text Book of Microbiology.
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi.
3. N.K. Jain, Pharmaceutical Microbiology.
4. Alcamo, Microbiology.

REFERENCES

- 1 Heritage. J, Introductory Microbiology.
- 2 Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
- 3 Hugo, W B Pharmaceutical Microbiology.
- 4 Tortora A. Gerard, Text Book of Microbiology.




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II Year – I SEMESTER

T	P	C
3+1	0	3

ENVIRONMENTAL SCIENCES

UNIT - I

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance– Need for Public Awareness. 01

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. 09

LO : To know environment, Natural resource, Conservation of national resources

UNIT - II

Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem :

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

10

LO : To understand various Ecosystems Characteristic features, structural functions of each.



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UNIT-III

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

LO : To understand biodiversity-basic principles-Conservation of Biodiversity.

UNIT -IV

Environmental Pollution : Definition, Cause, effects and control measures of :

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

10

LO : To know about environmental pollution, types of pollution-Causes-Measures to prevent and solid waste management-techniques/Methods.

UNIT - V

Social Issues and the Environment: Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Waste land reclamation, Consumerism and waste products. Environment Protection Act - Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

05

Human population & environment: Population growth, variation among nations, population explosion – family welfare programs. Environment and




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human health. Human rights. Value education. Women and child welfare. Role of technology in environment and human health. 05

LO : To know about social issues in environment, ethics, Acts related to environmental protection and conservation. Human population and environment, Human health issues.

UNIT -VI

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme. - Environment and human health. -Human Rights. -Value Education. HIV/AIDS. -Women and Child Welfare. - Role of information Technology in Environment and human health.

LO : Different aspects of human population and environment and their importance.

Text Books :

1. An Introduction to Environmental Studies by B. Sudhakara Reddy, T. SivajiRao, U. Tataji& K. Purushottam Reddy, Maruti Publications.

Reference:

1. Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.
3. Text Book of Environmental Sciences and Technology by M. Anji Reddy, BS Publications.




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II Year – I SEMESTER

T	P	C
0	3	2

PHARMACOGNOSY LAB – I

1. Collection of natural herbs and preparation of herbarium/laminated photos for five drugs.
2. Macroscopy & Microscopy of the following:
 - a. Any five carbohydrates mentioned in theory.
 - b. any five lipids mentioned in theory.
 - c. any five volatile oils mentioned in theory.
3. Chemical tests for the following:
 - a. Any five carbohydrates mentioned in theory.
 - b. any five lipids mentioned in theory.
 - c. any five volatile oils mentioned in theory.
4. Cultivation of medicinal plants: Maintenance of one plant in Medicinal garden.

REFERENCES

1. Kandhelwal, Practical Pharmacognosy.
2. C.K. Kokate et.al, Practical Pharmacognosy.
3. Iyengar, Practical Pharmacognosy.



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II Year – I SEMESTER

T	P	C
0	3	2

PHYSICAL PHARMACY-II LAB

1. Determination of bulk density, true density and percentage porosity.
2. Effect of particle size and effect of glidant on angle of repose.
3. Microscopic size analysis.
4. Determination of particle size by Andreason Pippette.
5. Determination of CMC of a surfactant.
6. Adsorption Isotherm.
7. Partition coefficient determination.
8. Determination of sedimentation volume and degree of flocculation.
9. Determination of Order of reaction – First order.
10. Determination of Second order reaction rate constant.
11. Effect of temperature on solubility of solid in liquid.
12. Effect of addition of Salt/pH/cosolvent on the solubility.
13. Surface tension using Stalagmometer.
14. HLB value estimation of surfactants.
15. Viscosity – by Ostwald Viscometer.
16. Preparation of Multiple emulsion - Demonstration.
17. Preparation of Micro emulsion- Demonstration.
18. Determination of Zeta potential - Demonstration.



II Year – I SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL MICROBIOLOGY LAB

1. Study of apparatus used in experimental microbiology.
2. Sterilization techniques and their validations.
3. Preparation of various culture media.
4. Sterilization of glass ware and culture media.
5. Aseptic transfer of culture into different types of medias.
6. Staining methods - Simple staining, Gram's staining, Acid fast and negative staining.
7. Motility testing by hanging drop method.
8. Enumeration of bacteria by pour plate/spread plate technique.
9. Enumeration of bacteria by direct microscopic count.
10. Isolation of pure cultures by streak plate, spread plate, pour plate.
11. Evaluation of antiseptics and disinfectants, sterility of pharmaceutical products as per IP requirements.
12. Observation of colony characteristics.
13. Bio chemical reactions:
 - i) Indole test.
 - ii) Methyl red test.
 - iii) Vogesproskauer test.
 - iv) Starch hydrolysis test.
 - v) Fermentation of carbohydrates.
14. Morphology of molds, yeasts.
15. Preseravation of microorganisms (slant and stab cultures).




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II Year – II SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL UNIT OPERATIONS – II

UNIT-I

Heat Transfer: Source of heat, heat transfer, steam and electricity as heating media, determination of requirement of amount of steam/electrical energy, steam pressure, boiler capacity, mathematical problems on heat transfer.

LO : To understand principles and theory of Heat flow/ Conductions, Convection, Radiation-Heat exchangers.

UNIT-II

Evaporation: Basic concept of phase equilibria, factors affecting the evaporation, evaporators, film evaporators, single effect and multiple effect evaporators.

LO : To understand evaporation, Phase equilibrium, Theory of evaporation-Evaporators.

UNIT-III

Distillation: Raoult's law, phase diagrams, volatility, simple steam and flash distillations, principles of rectification, Azeotropic and extractive distillation.

LO : Theory of distillation types of rectifiers, their application.

UNIT-IV

Drying: Moisture content and mechanism of drying, rate of drying and time of drying calculations, classification and types of dryers, dryers used in pharmaceutical industries tray dryer, Fluid bed dryer, spray dryer, vacuum oven and freeze-dryer.

LO : Drying, Moisture content, rate of evaporation, types of dryers construction working and Applications.

UNIT-V

Size Reduction: Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc.



LO : To understand theory of size reduction, factors involved in size reduction, equipments- Construction working and applications-selection of size reduction equipment.

UNIT-VI

Mixing: Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipment, double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.

LO : Theories of mixing solid-solid, solid-liquid & liquid-liquid mixing equipments.

TEXT BOOKS

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th ed., CBS publisher, Delhi.
2. CVS Subhramanyam, Pharmaceutical Engineering.
3. K. Samba Murthy, Pharmaceutical Engineering.
4. Mc Cabe & Smidth. Unit Operations.

REFERENCE BOOKS

1. W.I. Macebe and J. C. Smith Macro, Unit Operations To Chemical Engineering, Hill Int. Book Co., London.
2. L. Lachman, H. Lieberman & J. L Kaniz, The Theory And Practice of Industrial Pharmacy, Lee & Febiger Philadelphia, USA.
3. Badzer & Banchoro, Introduction to Chemical Engineering.
4. Perry's Handbook of Chemical Engineering.
5. M.E.Aulton, Pharmaceutics - The science of dosage form design, 2nd ed.
6. E.A. Rawlin's, Bentley's Text Book of Pharmaceutics, 8th ed ELBS.




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II Year – II SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL ANALYSIS –I

Unit-I

1. A general introduction to pharmaceutical analysis and general aspects of standardization of pharmaceutical chemicals and formulated products mentioned in Indian pharmacopoeia. Importance of proper sampling and general books for pharmaceutical standards like pharmacopoeias, National formularies.
2. Computation of analytical results, significant numbers, rejection of doubtful values with reference to volumetric and gravimetric analysis, sources of errors and calibration of analytical equipment used in volumetric and gravimetric analysis.

LO : To understand the concept of standardization by gravimetric and volumetric methods.

Unit-II

3. Acid-Base titrations: theoretical basis of neutralization reactions including electrolytic dissociation, application of law of mass action, relative strength of acids and bases, hydrolysis of salts and buffer solutions, theory of neutralization indicators and factors involved in the selection of indicators for different types of acid-base titrations. Procedures involved in different types of titrations using strong acid, weak base, strong base, weak base and back titration with blank determination. Assay of Boric acid Sodium bicarbonate, Borax, calcium hydroxide, zinc oxide, calcium carbonate, Acetyl salicylic acid, Formaldehyde, NaOH in presence of sodium carbonate.
4. Non-aqueous titrations: principles, advantages and pharmaceutical applications, solvents reagents and indicators used in Nonaqueous titrimetry, other methods of detecting end points. Examples of titrations of alkali metal and alkaline earth metal salts of organic acids, primary, secondary and tertiary amines, halogen acid salts of bases, titration of acidic substances. Assay of thiamine hydrochloride.

LO : To understand the concept of standardization by aqueous and non-aqueous titrations.



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Unit-III

5. Oxidation-reduction titrations: theoretical considerations including standard potentials, calculation of redox potentials, redox indicators, principle and procedure involved in different types of redox titrations using potassium permanganate, iodine. Titrations of released iodine and back titration of excess iodine, potassium iodate, ammonium ceric sulphate and titanous chloride. Assay of ferrous sulphate, Hydrogen peroxide, Sodium nitrate, Estimation of ascorbic acid with 2,6-dichlorophenol indophenols, Assay of mercuric chloride, Assay of sodium metabisulphite, Assay of copper sulphate.

LO : To understand the concept of standardization by oxidation – reduction methods.

Unit-IV

6. Precipitation titrations: principles and procedures involved in argentimetry, use of silver nitrate and ammonium thiocyanate. Indicators used in precipitation titrations including adsorption indicators, Mohr's and Volhard's methods with examples. Assay of potassium chloride, Ammonium thiocyanate, Assay of mercuric oxide.
7. Complexometric titrations: basic principles of complexometric analysis including theories of complex ions, chelating agents, properties of metal complexes with particular reference to EDTA. Basic principles of complexometric analysis including theories of complex formation. Werner's coordination number and structure of complex ions, chelating agents, properties of metal complexes with particular reference to EDTA, various examples of titrations of metal ions using disodium acetate, indicators and end point detection using indicators and by physical methods, masking and demasking agents, pharmaceutical applications of complexometry with particular reference to I.P. Assay of calcium gluconate injection/tablets, Calcium lactate and Assay of Aluminium sulphate.

LO : To understand that standardization can be done for some compounds by precipitation titrations.

Unit-V

8. A detailed study of gravimetric analysis including principles involved, critical factors and typical methods involving precipitation, coagulation, digestion, filtration and incineration procedures with suitable examples. Advantages and disadvantages, sources of errors and their elimination in gravimetric analysis.



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Determination of sulphate as barium sulphate, Estimation of magnesium as magnesium pyrophosphate, Determination of thiamine as silico tungstate.

LO : To understand that standardization can be done for some compounds by gravimetric method.

Unit-VI

9. Principles and procedures involved and application of nitrite titrations, titrations using 2, 6-dichlorophenol-indophenol. Aquametry including use of Karl-fisher reagent and moisture balances.
10. Gas analysis: principles of gas analysis use of hempel's gas burette and pipette, nitrometer, haldome's and orset's gas analysis apparatus and their operations. Examples of gas analytical methods of pharmaceutical significance.

LO : To understand that moisture in drugs can be determined by Karl-Fisher titration.

TEXT BOOKS:

1. Indian pharmacopoeia
2. Practical Pharmaceutical Chemistry by A.H. Becket and Stenlake.
3. Quantitative Inorganic Analysis by A.I. Vogel.




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II Year – II SEMESTER

T	P	C
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PHARMACOGNOSY – II(50 Hrs)

Definition, general tests and detailed pharmacognostic study of the following drugs.

UNIT I

08

Glycoside containing drugs:

- a. Saponin Glycosides : Glycyrrhiza, Ginseng, Discorea, Sarasaparilla & Senega.
- b. Cardioactive Glycosides : Digitalis, Squill, Strophanthus & Thevetia.
- c. Anthraquinone Glycosides : Aloe, Senna, Rhubarb & Cascara.
- d. Bitter Glycosides : Psoralea, Gentian & Chirata.

LO : To understand that Glycosides are isolated from plant sources and have varied action based on aglycone part.

UNIT II

10

Alkaloid containing drugs:

- a. Pyridine – Piperidine derivatives : Tobacco & Lobelia
- b. Tropane : Belladonna, Hyoscyamus, Datura, Coca & Aswagandha.
- c. Quinoline & Isoquinoline : Cinchona, Ipecac, Opium.
- d. Indole : Ergot, Rauwolfia, Vinca, Nux-vomica
- e. Imidazole : Pilocarpus
- f. Steroid : Kurchi
- a. Alkaloidal amine : Ephedra & Colchicum
- b. Glycoalkaloid : Solanum
- c. Purine : Coffee, Tea.


LO : To understand that Alkaloids of different structures are synthesized by different plants and possess varied activities based on structure.

UNIT - III

04

Study of Tannins & Tannin containing drugs: Gambir, Black catechu, Myroblan & Arjuna. Study of resins & drugs containing resins: Benzoin, Asafoetida, Balsam of Tolu, Podophyllum.




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LO : To understand that Tannins and Resins and their combination products are produced by different plants.

UNIT- IV

02

Biological sources, preparations, identification tests and uses of the following enzymes: Diastase, Papain, Pepsin, Trypsin, Pancreatin.

LO : To understand that different enzymes of useful nature are produced by plants.

UNIT-V

10

Biogenesis of Phytopharmaceuticals:

General techniques of biosynthetic studies and basic metabolic pathways.

Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.

Biosynthesis of -Tropane, Quinoline, Opium and Indole alkaloids, Steroids and Anthraquinone glycosides.

LO : To understand that Compounds of varied chemical nature are produced by plants (chemodiversity).

UNIT – VI

04

Study of plant fibers like cotton, cotton wood pulp, jute, hemp and flax used in surgical dressing and related products.

The applications of natural dyes like turmeric, henna, saffron, cochineal and marigold in pharmacy.

LO : Plants exhibit a lot of diversity in producing fibres useful for fabrics as well as Dyes to colour them.

TEXT BOOKS

1. Kokate C.K , Purohit AP & Gokhale, The Pharmacognosy S.B (Nirali)
2. Trease and Evans, Pharmacognosy, Latest Edition.
3. Tyler, Brady & Robert, Pharmacognosy.
4. Khare C.P, Indian Medicinal plants – An Illustrated dictionary.

REFERENCES

1. Atal C.K & Kapur B.M, Cultivation & Utilization of Medicinal Plants.
2. Wallis, Textbook of pharmacognosy, Pub by CBS Publishers and distributors, New Delhi.
3. Ayurvedic Pharmacopoeia of India, Pub by Govt. Of India.



II Year – II SEMESTER

T	P	C
3+1	0	3

MEDICINAL CHEMISTRY-I

UNIT-I

Heterocyclic compounds:

1. Five and six membered ring systems with heteroatoms: Furan, pyrrole, thiophene, pyridine, imidazole, pyrazole, oxazole, isoxazole, thiazole and pyrimidine.
2. Fused ring systems with heteroatoms: Quinolines, isoquinolines, acridine, benzimidazole and phenothiazine.

LO : Nomenclature (numbering), one or two methods of preparation, important reactions, mechanisms and examples of drugs having the above ring systems.

UNIT-II

1. **Drug activity and physico-chemical properties:** solubility, partition coefficient, hydrogen bonding, chelation, surface activity, bioisosterism, optical and geometrical isomerism, prodrugs and soft drugs.
2. **Mechanism of drug action:** receptor theories, enzyme stimulation and enzyme inhibition.
3. **Drug metabolism:** Phase I and Phase II reactions, factors affecting drug metabolism.

LO : Concepts involving receptors, drug-receptor interaction forces, mechanisms, equations, structures, advantages.

UNIT-III

Drugs acting on CNS:

1. Hypnotics and anxiolytics: Phenobarbital, diazepam and alprazolam.
2. Antipsychotics: chlorpromazine and haloperidol.
3. Antiepileptics: phenytoin, carbamazepine, valproate sodium.
4. Antidepressants: imipramine, amitriptyline, Isocarboxazide, iproniazide.
5. General anaesthetics: ketamine, halothane and thiopental sodium.

LO : Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.




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UNIT-IV

1. **Adrenergic drugs:** Amphetamine, salbutamol, ephedrine, phenylephrine and dopamine.
2. **Adrenergic blockers:** Prazosine, tolazoline, Propranolol, atenolol
3. **Cholinergic drugs:** Carbachol, bethanichol.
4. **Anticholinergics:** propantheline, dicyclomine.
5. **Neuromuscular blockers:** succinyl choline.

LO : Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT-V

1. **Analgesics and Non-steroidal anti-inflammatory agents (NSAIDs) :** paracetamol, aspirin, ibuprofen, indomethacin, diclofenac.
2. **Narcotic analgesics :** mepridine, methadone.
3. **Local anaesthetics :** benzocaine, procaine, lignocaine and dibucaine

LO : Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class, an understanding of morphinans, its agonists and antagonists.

UNIT-VI

1. **Oral antihyperglycemic agents:** tolbutamide, gliclazide, glipizide, glibenclamide, metformin and pioglitazone.
2. **Thyroid drugs:** methimazole, propylthiouracil.
3. **H1-receptor antagonists:** diphenhydramine, chlorpheniramine, chlorcyclizine, cetirizine.
4. **H2-receptor antagonists:** ranitidine
5. **Proton pump inhibitors:** Omeprazole, rabeprazole, lansaprazole.

LO : Definition, scope, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class, an understanding of morphinans, its agonists and antagonists.

TEXT BOOKS

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.



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2. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of mediacinal chemistry, SG Publ. Varanasi, 2003.
4. Rama Rao Nadendla, Medicinal Chemistry.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences; 20th Edition.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: l. Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford.




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II Year – II SEMESTER

T	P	C
3+1	0	3

HEALTH EDUCATION & PATHOPHYSIOLOGY(50 Hrs)

UNIT-I

Concepts of health & disease: Disease causing agents and prevention of disease. 05

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

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

LO : To understand that disorder is a physiological change while disease is caused by infecting organisms. Prevention is better than cure concept. First aid for emergency conditions before the patient is moved for medical treatment.

UNIT – II

05

Demography and family planning: Demography cycle, family planning and various contraceptive methods. Medical termination of pregnancy.

LO : Problems of over population in providing basic amenities and measures to be adopted for control.

UNIT-III


Basic Principles of cell injury and adaptation:

10

- Causes, pathogenesis and morphology of cell injury.
- Abnormalities in lipoproteinemia, glycogen infiltration and glycogen storage disease.
- Cellular adaptations, atrophy, hypertrophy.
- Disturbances of growth of cells
- General biology of tumors
- Differences between benign and malignant tumors
- Classification of tumors
- Etiology and pathogenesis of cancer
- Patterns of spread of cancer.

LO : Different phases of cell growth and disorders, to understand normal and tumor cells.




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UNIT-IV**Inflammation& Repair :**

08

- A) i. Pathogenesis of acute inflammation
ii. Chemical mediators in inflammation
iii. Pathogenesis of chronic inflammation
- B) i. Wound healing mechanisms and
ii. Factors affecting wound healing.
- C) Pain and its types.

LO : To understand that several substances are involved in producing inflammation and to understand different reasons for causing pain.

UNIT-V**Diseases of Immunity:**

03

- i) Introduction to T and B cells
- ii) MHC proteins or transplantation antigens
- iii) Immune Tolerance

A) Hypersensitivity

04

- i. Hypersensitivity type I, II, III, IV.
- ii. Biological significance of hypersensitivity.
- iii. Allergy due to food, chemicals and drugs

B) Auto-Immunity

05

- i. Mechanism of autoimmunity.
- ii. Classification of autoimmune diseases in man.
- iii. Transplantation and allograft reactions, mechanism of rejection of allograft.
- iv. Acquired Immuno Deficiency Syndrome (AIDS).

LO : To understand about allergy and body's resistance against diseases (Natural and adoptive immunity).

UNIT-VI**Pathophysiology of Cardiac disorders:**

03

Shock, stroke, hypertension, Angina, Myocardial infarction, Congestive

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cardiac failure, Atherosclerosis.

Pathophysiology of Common Disorders:

04

Diabetes Mellitus, Peptic ulcer, Alcoholic liver diseases, Acute and chronic renal failure, Asthma, Parkinsonism, Schizophrenia, Depression and Mania.

Infectious diseases:

03

Infective hepatitis, STD – Syphilis, Gonorrhea, HIV; Pneumonia, Typhoid, UTI, Tuberculosis, Leprosy, Malaria, Dysentery (Bacterial and amoebic).

LO : Abnormalities of cardiovascular system, metabolism, respiration, behavior and diseases caused by microorganisms and disorders caused by smoking and alcoholism.

TEXT BOOKS

1. Text book of Robbins Pathology basis of Disease – Robins, Cotran, Kumar.
2. Mary V. Buras, Pathophysiology: A self Instructional programme.
3. Mary Lou Mulvihill, Human Diseases: A Systemic approach.
4. General Pathology – Y M Bhende, S G Deodhare, SS Kelkar
5. Essentials of Pathophysiology for Pharmacy. Martin M. Zdanowicz. Published by Pharma Med Press.

REFERENCE BOOKS

1. A.C Guyton, Textbook of medicinal physiology by W.B.Prism books Pvt. Ltd., Delhi.
2. Joseph Dipiro, Patho Physiology and applied therapeutics.
3. M.P. Rang, M.N.Dale, J.M Riter, Anatomy & Physiology.




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II Year – II SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL UNIT OPERATIONS - LAB

1. Measurement of flow of fluids and their pressure, determination of Reynolds's number and calculation of frictional losses.
2. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration including filter aids.
3. Experiments to demonstrate applications of centrifugation.
4. Determination of Humidity-use of Dry Bulb and Wet Bulb thermometers and Psychometric charts.
5. Determination of overall Heat Transfer Coefficient.
6. Determination of rate of evaporation.
7. Experiments based on steam. Extractive and Azeotropic distillations.
8. Determination of rate of drying, free moisture content and bound moisture content.
9. Experiments to illustrate the influence of various parameters on the time of drying.
10. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction.
11. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.




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II Year – II SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL ANALYSIS –I LAB

Acid-base titrations :

1. Standardization of HCl
2. Standardization of H_2SO_4
3. Standardization of NaOH
4. Assay of boric acid
5. Assay of sodium bicarbonate
6. Assay of borax
7. Assay of calcium hydroxide
8. Assay of zinc oxide
9. Assay of calcium carbonate
10. Assay of acetyl salicylic acid
11. Assay of formaldehyde
12. Assay of NaOH in presence of sodium carbonate.

Redox titrations:

13. Standardization of iodine
14. Standardization of KMnO_4
15. Assay of ferrous sulphate
16. Assay of hydrogen peroxide
17. Assay of sodium nitrate
18. Estimation of ascorbic acid with 2,6-dichlorophenol indophenols
19. Assay of mercuric chloride
20. Assay of sodium metabisulphite
20. Assay of copper sulphate

Precipitation titrations :

21. Standardization of silver nitrate
22. Assay of potassium chloride
23. Assay of ammonium thiocyanate
24. Assay of mercuric oxide

Complexation titrations :

25. Standardization of EDTA
26. Assay of calcium Gluconate injection/tablets



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27. Assay of aluminium sulphate

Non-aqueous titrations :

- 28. Assay of thiamine hydrochloride
- 29. Any other assay involving perchloric acid

Gravimetry

- 30. Determination of sulphate as barium sulphate.
- 31. Estimation of magnesium as magnesium pyrophosphate.
- 32. Determination of thiamine as silico tungstate.

Limit tests :

- 33. Limit test for chlorides
- 34. Limit test for sulphates
- 35. Limit test for iron




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II Year – II SEMESTER

T	P	C
0	3	2

PHARMACOGNOSY – II LAB

1. Study of Microscopy, Macroscopy and powder characters of any three to four crude drugs under each type.
2. a. Glycoside s b. Alkaloids c. Tannins d. Resins
3. Identification test for two enzymes papain and casein.
4. Chemical tests for Asafoetida, Benzoin, Tannic acid, Pale catechu, Black catechu, Aloes, Digitalis, Senna and Quinine.
5. Quantitative microscopy:
 - a. Ratio values: Stomatal number and Stomatal Index.
 - b. Determination of dimension of starch grains and fibre lengths using eye piece micrometer and camera lucida methods.
 - c. Determination of purity of ginger powder using lycopodium spore method.
6. Determination of proximate values:
 - a. Moisture content
 - b. Ash value
 - c. Extractive values
7. Identification of markers of different phytoconstituents like glycerrhiza, aloe and cinchona by chromatographic techniques.




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III Year – I SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL BIOCHEMISTRY

UNIT - I

Introduction to Biochemistry: Outlines of the biochemistry organization of cell organelle, Molecular constituents of cell membrane, active and passive transport processes across the cell membranes.

LO : Introduction, essentials of biochemistry with respect to pharmacy, cell, structure and functions.

UNIT - II

Brief chemistry of carbohydrates

Carbohydrate metabolism: Brief chemistry, Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, Gluconeogenesis, Glycogenesis. Metabolic disorders of carbohydrate metabolism.

LO : Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT - III

Lipids, Proteins and nucleoproteins: Principles involved in biological oxidation.

Lipid metabolism: Brief chemistry, Oxidation of saturated (β - Oxidation), Ketogenesis and Ketolysis; Biosynthesis of Fatty acids, Lipids; Metabolism of cholesterol; Hormonal regulation of Lipid Metabolism. Defective metabolism of Lipids.

LO : Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT - IV

Protein Metabolism: Protein turnover. Metabolism of Amino acids (Transamination, deamination, de-carboxylation). Urea cycle and its metabolic disorders. Outlines of the Metabolism and regulation of Protein synthesis.

LO : Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

UNIT - V

1. Enzymes: Classification, mode of action, factors affecting enzymes action, Coenzymes.




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2. Brief outline of Energy rich compounds, Phosphate metabolism and detoxification mechanisms of the body.

LO : Introduction, properties, classes, biochemical role and mode of action.

UNIT - VI

1. Cell division and metastasis.
2. Biomolecules: Biological functions of Nucleic acids, Vitamins & Minerals.
3. Detoxification mechanisms and their biological significance.

LO : Introduction, basic concepts, structures, properties, significance and uses.

TEXT BOOKS

2. Harper, Biochemistry
3. A.L. Lehninger, Principles of Biochemistry.
4. J.L. Jain, Fundamentals of Biochemistry
5. Satyanarayana, Text Book of Biochemistry
6. Rama Rao, Text Book of Bio Chemistry.
7. Conn, Outlines of biochemistry

REFERENCES

1. L.Stryer, Text Book of Bio Chemistry.
2. E.E Conn & P.K. Stumpf, Outlines of Biochemistry by John Wiley & sons, New York.
3. B.Harrow and A. Mazur, Text Book of Biochemistry, WB Saunders Co., Philadelphia.
4. Boyer Rodney, Modern experimental Bio Chemistry.
5. West, Edward Text Book of Biochemistry.
6. Conn, Outlines of Biochemistry.
7. Plummer, Practical Bio Chemistry.
8. Denniston, Topping & Caret; General, Organic, and Biochemistry, McGraw-Hill.



III Year – I SEMESTER

T	P	C
3+1	0	3

MEDICINAL CHEMISTRY-II

UNIT - I

1. **Introduction to principles of chemotherapy**, chemotherapeutic index, drug resistance.
2. **Sulphonamides**: Sulfisoxazole, Sulphamethazole and Sulphathiazole.
3. **Antitubercular agents**: PASA, Isoniazid, Ethambutol
4. **Antileprotic agents**: Dapsone

LO : Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT - II

1. **Antimalarials**: Chloroquine, Primaquine and Pyrimethamine
2. **Anthelmintics**: Diethyl Carbamazine Citrate, Mebendazole, Tinidazole,
3. **Antiamoebic agents**: Metronidazole and Diloxanide furoate.
4. **Antifungal agents**: Clotrimazole, Fluconazole and Tolnaftate.

LO : Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT - III

1. **Antiviral agents**: Acyclovir, Zidovudine, Idoxuridine and Amantadine.
2. **Cytostatic agents**: Chlorambucil, Cyclophosphamide, Carmustine, 5-Flouro Uracil and Mercaptopurine

LO : Definition, current status, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT - IV

Antibiotics:

1. **Penicillins**: Ampicillin, Amoxycillin



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2. **Cephalosporins:** structures of important Cephalosporins (not synthesis)
 3. **Tetracyclins:** Oxytetracycline, Doxycycline
 4. **Aminoglycosides:** Streptomycin and Neomycin (structures).
 5. **Miscellaneous:** Chloramphenicol, Rifampicin (only structure)
- LO : Chemistry, structures of currently used drugs, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses and synthesis of compounds as given above under each class.

UNIT - V

Water soluble vitamins: structures of B1, B2, B6, B12, Nicotinic acid, Nicotinamide, Folic acid and Ascorbic acid.

LO : Chemistry, structural features, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses, biological role.

UNIT - VI

Fat soluble vitamins: structures of Vitamin A, Retinoic acid, Vitamin D, Ergosterol

LO: Chemistry including reactions, structural features, interconversions, classification, mode of action, Structure-Activity Relationship (SAR) wherever applicable, therapeutic uses, biological role.

TEXT BOOKS

1. William O. Foye, Textbook of Medicinal Chemistry, Lea & Febiger, Philadelphia.
2. JH Block & JM Beale, Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11th Ed, Lipincott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of medicinal chemistry, SG Publ. Varanasi, 2003.
4. Sri Ram, Medicinal Chemistry.
5. Rama Rao Nadendla, Medicinal Chemistry.



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REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003.
2. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences .
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, M.G.Mandel and F.I.Way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford 1991.
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.
8. Kadam, Textbook of Medicinal Chemistry Vol. 1 & 2.
9. O.P.Agarwal, Text book of natural products. Vol. 1 & 2.




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III Year – I SEMESTER

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PHARMACEUTICAL TECHNOLOGY - I

UNIT - I

Preformulation: Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, organoleptic additives, hydrolysis, oxidation reduction, recemization, polymerization, e.t.c. and their effect on formulation, stability and bioavailability study of prodrugs in solving problems related to stability & bioavailability in formulations. Stability testing of finished products as per ICH guidelines.

LO : To understand performulation parameters and their significance, methods, stability testing protocols, ICH guidelines.

UNIT - II

Liquid dosage forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubulizers, colors, flavours and other manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

LO : To understand liquid dosage formulations, additives, manufacturing, evaluation, packaging procedures, official preparations.

UNIT - III

Semisolid dosage forms: Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging.

Suppositories: Ideal requirements of bases, Different types of bases, manufacturing procedure packing and evaluation.

LO : To understand semisolid and suppositories preparations, their formulations, methods of preparations, evaluations and packaging.

UNIT - IV

Pharmaceutical aerosols: Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications.

Ophthalmic Preparations: Requirements, formulation, methods of preparation, containers, evaluation.



LO : To understand aerosols, ophthalmic preparations, their formulation, types, preparations, packaging and evaluation methods.

UNIT - V

Cosmeticology and Cosmetic Preparations - I: Fundamentals of cosmetic science, structures and functions of skin and hair. Formulation, preparation and packaging of cosmetics for skin & hair.

LO : To understand cosmetics science, functions of skin and hair, cosmetic properties and their formulations, preparations and evaluation methods.

UNIT - VI

Cosmeticology and Cosmetic Preparations – II: Formulation, preparation & packaging of dentrifices like tooth powders, pastes, gels etc., and manicure preparations like nail polish, lipsticks, eye lashes, baby care products etc.

LO : To understand formulation, preparations and packaging of various cosmetics preparations.

TEXT BOOKS

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of Industrial Pharmacy, Lea & Febieger, Philadelphia Latest Edn.
2. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.

REFERENCES

1. Shobha Rani, Text of Industrial Pharmacy, Hiremath Orient Longman.
2. Sagarian & MS Balsam, Cosmetics Sciences & Technology Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. E.A.Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publications.
5. HC Ansel Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York 1998.
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IV Ed, Marcel Dekker, USA, 2005.
8. Yiew Chien, novel drug delivery systems, Marcel Dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M Read With The Drugs and Cosmetic Rules 1945.



III Year – I SEMESTER

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PHARMACOLOGY – I

UNIT - I

General Pharmacology: Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, Structural activity and relationship (SAR), factors modifying drug action, tolerance and dependence; Pharmacogenetics; Enzyme Induction & Inhibition; Absorption, distribution metabolism and excretion of drugs; Principles of drug discovery and development of new drugs.

LO : Knowledge imparting basic concepts of Pharmacology, mechanism of action of drugs, SAR, Pharmacokinetics and drug discovery.

UNIT - II

Pharmacology of Autonomic Nervous System:

Neurohumoral transmission in peripheral nervous system (autonomic and Somatic).

Parasympathomimetics & parasympatholytics, sympathomimetics & sympatholytics.

Ganglionic-stimulants and blocking agents, skeletal muscle relaxants.

LO : To understand the basics of physiology and neurotransmitters and their roles. To gain knowledge on the drugs acting on ANS and muscle relaxants.

UNIT - III

Drugs acting on Central Nervous System:

Neurohumoral transmission in the C.N.S, General anesthetics, Alcohols and Disulfiram, Sedatives, hypnotics, & anti-anxiety agents.

LO : To understand the role of neurotransmitters in the CNS and pharmacology of various classes of drugs acting on CNS.

UNIT - IV

Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs, Narcotic analgesics & antagonists, Pharmacology of Local Anaesthetics

LO : To have knowledge on the pathophysiology on Analgesia, pyretics, inflammation, gout and drugs used in the above treatment.



UNIT - V

Antipsychotics & Lithium, Antidepressants, Pharmacology of Anti-epileptic drugs,

Pharmacological management of Parkinsonism & other movement disorders, C.N.S. stimulants, Drug Addiction & Drug Abuse.

LO : To impart knowledge on pathophysiology of various disease conditions of the above topics and pharmacology of drugs.

UNIT - VI**Drugs Acting on the Gastrointestinal Tract**

Antacids, Antisecretory & Anti-ulcer Drugs, Laxatives & Antidiarrhoeal drugs, Appetite Stimulants & Suppressants, Emetics & Anti-emetics, Carminatives, Demulcents, Protectives, Adsorbents, Astringents, Digestants, Enzymes & Mucolytics.

LO : To impart knowledge on pathophysiology and conditions relating to peptic ulcers and emesis and to understand the pharmacology of drugs used in GIT disorders.

TEXT BOOKS

1. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
2. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn.
3. Tripathi, Text book of Pharmacology.
4. Rang & Dale, Text book of Pharmacology.

REFERENCE BOOKS

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
2. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
3. J. Crossland, Lewis's Pharmacology, Church living stone.
4. Ruth Woodrow, Essentials of Pharmacology for Health Occupations.




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III Year – I SEMESTER

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PHARMACEUTICAL MANAGEMENT

UNIT - I

Features of Business Organisations & New Economic Environment:

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-Liberalisation scenario.

LO : To understand business organization – types – functions.

UNIT - II

Manufacturing Management: Goals of Production Management and Organisation – Production, Planning and Control – Plant location - Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), New Product Development.

LO : To understand production management and organization – Planning and control – Layout – Product development.

UNIT - III

Work Study - Basic procedure involved in Method Study and Work Measurement-Statistical Quality Control: \bar{X} chart, R chart, c chart, p chart, (simple Problems), Acceptance Sampling, Deming's contribution to quality.

LO : To understand principles of work study – Methods – Control charts – Principles – Contribution – Quality concepts.

UNIT - IV

Organisation of Distribution and Marketing: Functions of Marketing, Marketing Mix, Marketing Strategies based on Product Life Cycle., Channels of distribution – Factors influencing channels of distribution, sales organization and sales promotion.

LO : To understand concepts in organization – Distribution – Marketing – Functions – Strategies –Factors – Sales – Sales promotions.

UNIT - V

Pharma Industry: Growth of Pharma Industry in India – current status and its role in building national economy and national health – Structure of Pharma Industry in India – PSUs in Pharma Industry –Progress in the



manufacture of basic drugs, synthetic and drugs of vegetable origin. Export and import of drugs and pharmaceuticals – Export and import trade.

LO : To understand Pharma industry – Structure – Manufacturing of drugs and Pharmaceuticals – Exports and imports.

UNIT - VI

Insurance and Pharma: Various types of insurance including marine and health insurance.

Pharmaceutical associations and societies, statutory councils governing the profession. General Principles of medical detailing.

LO : To understand insurance – types – health insurance – association and society governing pharmacy profession.

TEXT BOOK

1. Aryasri and Subbarao, Pharmaceutical Administration, TMH.
2. Smarta, Strategic Pharma Marketing.
3. G.Vidya Sagar, Pharmaceutical Industrial Management.

REFERENCES

1. Subbarao Chaganti, Pharmaceutical Marketing in India – Concepts and Strategy Cases, BS Publications.
2. O.P.Khanna, Industrial Management, Dhanpatrai, New Delhi.



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III Year – I SEMESTER

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PHARMACEUTICAL BIOCHEMISTRY LAB

Experiments:

1. To prepare standard buffers (citrate, phosphate & carbonate) and measure the pH.
2. Titration curve for amino acids.
3. Separation of amino acids by two dimensional paper chromatography & gel electrophoresis.
4. The separation of lipids by T.L.C.
5. Identification of carbohydrates
6. Identification of amino acids.
7. Identification of lipids.
8. Estimation of glucose in urine.
9. Estimation of creatinine in urine.
10. Estimation of urea in blood.
11. Estimation of creatinine in blood.
12. Estimation of Serum protein.
13. Estimation of bile pigments in serum.
14. Estimation of alkaline phosphatase in serum
15. Effect of temperature on the activity of alpha-amylase.



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III Year – I SEMESTER

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PHARMACEUTICAL TECHNOLOGY – I LAB

A total of atleast 50 preparations are to be prepared belonging to various categories.

Preparation, evaluation and packaging of solutions, suspensions and emulsions, ointments. Suppositories, aerosols, eye drops, eye ointments etc. Formulation of various types of cosmetics for skin, hair, dentrifices and manicure preparations.



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III Year – I SEMESTER

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MEDICINAL CHEMISTRY LAB

I. Synthesis of some medicinal compounds and their analogues.

- i. Barbituric acid from Diethyl Malonate.
- ii. Phenytoin from Benzoin or Benzyl.
- iii. Paracetamol from *para*- nitro phenol or *para*- aminophenol.
- iv. 1,4- di hydro pyridine from ethyl aceto acetate.
- v. Quinazolinone from anthranilic acid via benzoxazinone.
- vi. Sulfanilamide from acetanilide
- vii. Isoniazid from γ -picoline.
- viii. Antipyrine from ethyl aceto acetate.
- ix. Benzocaine from *para*- nitro benzoic acid.

II. Qualitative estimation of some functional groups.

- i. Halogens (Strepheno's method).
- ii. Hydroxyl groups (Acetylation method)
- iii. Methoxyl groups (Zeissel's method)
- iv. Carboxyl groups (Silver salt method).

REFERENCES

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition.
2. R.K. Bansal, Laboratory Manual of Organic Chemistry.
3. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition.



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III Year –I I SEMESTER

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PHARMACEUTICAL TECHNOLOGY - II

UNIT - I

Capsules: Advantage and disadvantages of capsule dosage forms, material for production of hard and soft gelatin capsules, sizes of capsules, capsule filling, soft processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

LO : To understand Capsule formulation, Types, Manufacturing and evaluation – Quality Control – Stability testing-storage.

UNIT - II

Microencapsulation: Types of microencapsulation and importance of microencapsulation in pharmacy, microcapsulation by coacervation phase separator, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques, evaluation of microcapsules.

LO : To understand microencapsulation – Applications, Methods of Preparations. evaluation – Applications of Microcapsules.

UNIT - III

Tablets: Formulation of different types of tablets, granulation technology on large-scale by various techniques, types of tablet compression machinery and the equipments employed evaluation of tablets.

LO : To understand tablet formulations, additives- manufacturing methods-equipment-Evaluation of quality & Control.

UNIT - IV

Coating of Tablets: Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes, evaluation of coated tablets.

LO : To understand types of tablet coating – coating solutions- Equipment-Process- Evaluation of Coating tablets.



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UNIT - V**Parenteral Products**

- a. Preformulation factors, routes of administration, water for injection, treatment
apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- b. Formulation details, container and closures and selection.
- c. Prefilling treatment, washing and sterilization of containers and closures, preparation of
solution and suspensions, filling and closing of ampules, vials, infusion fluids,
lyophilization & preparation of sterile powders, equipment for large-scale manufacture
and evaluation of parenteral products.
- d. Aseptic techniques, sources of contamination and method of prevention.
Design of
aseptic area, laminar flow benches, services and maintenance.

LO : To understand Formulations, Preformulations, additives, Manufacturing methods, containers, Packaging, evaluation of Parenterals – quality control, Types of sterile powders, aseptic processing facilities.

UNIT - VI**Packaging of Pharmaceutical products:**

Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencing choice of containers, package testing, legal and other official requirements for containers, packing testing.

Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packing material, stability aspects of packaging.

LO : To understand Packaging components- types, specifications and evaluation methods of packaging materials and containers- legal and official requirements.

TEXT BOOKS

1. L. Lachman, H.A. Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn.
2. HC Ansel introduction to Pharmaceutical Dosage forms .
3. Pharmaceutical Dosage forms Tablet by Lieberman, Lachman.



4. CVS. Subramanyam, Pharmaceutical production and management, Vallabh Prakashan, New Delhi 2005.

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1. Sagarian & MS Balsam, Cosmetics Sciences & Technology, Vol.1, 2 & 3
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.A. Rawlkins Bentley's Text Book of Pharmaceutics, Elbs publ
4. S.H. Willing, M.M. Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, 2nd ed, Marcel Dekker, Inc., New York 1998.
5. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVth ed, marcel dekker, usa, 2005.
6. Yiew chien, novel drug delivery systems, 2nd ed, marcel dekker 2003.
7. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
8. Good Manufacturing Practices – Schedule M. Read With The Drugs And Cosmetic Rules 1945
9. M.E. Aulton, Pharmaceutics- The science of Dosage form Design 2nd ed.



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III Year –I I SEMESTER

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PHARMACEUTICAL BIOTECHNOLOGY

UNIT - I

Fermentation Technology: Isolation, Selection, Screening of Industrial important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment.

LO : To understand principles of fermentation technology- types of bioreactor – optimization of fermentation process – principles of effluent treatment.

UNIT - II

Specific Fermentations: Selection of organism, fermentation & purification of various antibiotics, vitamins, aminoacids, organic acids, solvents like Penicillin, Streptomycin, Tetracycline, Erythromycin, Riboflavin, Cynacobalamin, Glutamic Acid, Lysin, Citric Acid, Lactic Acid, Alcohol, Acetone etc.

LO : To understand Fermentations of various types of industrial and medicinal compounds.

UNIT - III

Microbial Transformations: Types, Methods of bioconversions & Application in Pharma Industry, Steroidal transformation.

Recombinant DNA Technology: Introduction to R-DNA technology and genetic engineering, steps involved, isolation of enzymes, vectors, recombination and cloning of genes.

Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB (Hepatitis B).

LO : To understand types, methods and applications of bioconversion – principles and production technology of recombinant DNA technology with examples.

UNIT – IV

Immunology & Immunological Preparations: Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antibody reactions, hypersensitivity and its applications.

Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoids, immuno serum & diagnostic agents.

LO : To understand principles of Immunology, Antigen- Antibody reactions – applications, active and passive immunizations – study of various vaccines and sera.

UNIT – V

Enzyme Technology: Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes.

Study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

LO : To understand techniques, applications and productions enzymes of medicinal importance.

UNIT - VI

Introduction, role, collection, process & storage of blood products, plasma substitutes and sutures & ligatures like whole human blood, human normal eg, dextran, catgut etc.

Introductory study & applications of bioinformatics, proteomics and genomics.

LO : To understand Blood products – collection processing, storage and uses of various blood products.

TEXT BOOKS

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2nd Ed, Publ-Panima publication co-operation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press
3. B.P. Nagori & Roshan Issari, Foundations in Pharmaceutical Biotechnology
4. Sambamurthy. K, Text Book of Pharmaceutical Biotechnology.
5. S. S. Kori, Pharmaceutical biotechnology.



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REFERENCES

1. Prescott and Dunne, "Industrial Microbiology" MC Caraw Hill Bool Company.
2. Peppler "Microbial Technology" Vol. 1 & 2.
3. K. Kielslich "Biotechnology" Vol 6, Verlegchemic, Switzerland.
4. PF Standury & A. Whitaker, "Principles of fermentation Technology" Pergamon Press.
5. OP Ward "Fermentation Technology, Principles, Processes products" Open University press, Milton Keynes, UK.
6. A. M. Campbell, Monoclonal antibody technology.
7. A. Wiseman, Handbook of enzyme biotechnology.
8. J. D. Watson, Recombinant DNA technology.
9. Smith and Hood, Molecular biology and biotechnology.
10. E.A. Rawlins, Bentley's, A text book of pharmaceutics, 8th Ed, 1982 Bailler Tindall & Co.
11. Alexander N. Glazer & Hiroshi Nikaido, Microbial biotechnology, W. H. Freeman Co.
12. Ahwood.T.K, Introduction to Bio Informatics.
13. Cassida, Industrial microbiology.
14. H.K. Das, Textbook of Biochemistry.



III Year –I I SEMESTER

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PHARMACOLOGY – II**UNIT - I**

Pharmacology of Cardiovascular System – Drugs used in congestive heart failure & Stimulants

Drugs used in cardiac arrhythmias, Antihypertensives, Drugs used in the treatment of Angina pectoris,

Drugs used in the therapy of shock.

LO : To acquire knowledge on CVS and its regulatory mechanisms, pathophysiology related to CVS diseases and disorders and Pharmacology of drugs used in the Cardio vascular diseases.

UNIT - II

Drugs acting on hematopoietic system

Anti-coagulants, Anti-platelets, Thrombolytics & hematinics.

Drugs acting on urinary system

Fluid and electrolyte balance, Diuretics & Antidiuretics.

LO : Grasping knowledge on pathophysiology of blood and blood forming organs, kidney – urine formation and the Pharmacology of drugs.

UNIT - III

Drugs acting on Endocrine system

Pancreatic hormone and Anti-Diabetic drugs, Thyroid & Anti-thyroid drugs, Gonadal hormones & Inhibitors, Adrenocortico steroids & Adrenocortical antagonists, Hypothalamic & Pituitary Hormones.

LO : Grasping knowledge on Physiological role of Endocrine glands and its pathological conditions and the Pharmacology of drugs used.

UNIT - IV

Autacoids: Histamine, Serotonin (5-HT) & their antagonists, Prostaglandins & leukotrienes, Pentagastrin, cholecystokinin, angiotensin, vasoactive peptides.

LO : To acquire knowledge on Autocoids, synthesis, metabolism and their Pharmacology.

UNIT - V

Drugs Acting on the Respiratory System



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Anti-asthmatic drugs including bronchodilators, Anti-tussives & expectorants, Respiratory stimulants.

LO : Impart knowledge on respiratory diseases and the Pharmacology of drugs.

UNIT - VI

Chemotherapeutic agents and their applications: General principles of chemotherapy,

Sulphonamides and co-trimoxazole, Antibiotics : Penicillins, cephalosporins, Beta lactams,

Chemotherapeutic agents and their applications: Tetracyclines aminoglycosides, chloramphenicol, erythromycin, quinolones and miscellaneous antibiotics.

Chemotherapy of tuberculosis & leprosy.

Chemotherapy of fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.

Chemotherapy of malignancy and immune suppressive Agents.

LO : To gain knowledge on Chemotherapeutics and various classes of drugs used for infection and diseases.

TEXT BOOKS

1. Rang & Dale, Textbook of Pharmacology.
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
3. Bertram. G. Katzung, Basic and clinical pharmacology, 9th Edn, Mc Graw hill
4. Tripathi, Textbook of Pharmacology, JAYPEE.
5. Leilani Grajeda, Understanding Pharmacology: A physiological Approach
6. F.S.K Barar, Essentials of Pharamcotheraptics.

REFERENCES

1. J.G. Hardman and Lee E. Limbard, Good Mann & Gilman: The Pharmacological basis of therapeutics, Mc Graw hill, Health Professions Dvn.
2. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4th Ed.
3. J. Crossland, Lewis 's Pharmacology, Church living stone.



III Year –I I SEMESTER

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MEDICINAL CHEMISTRY-III

UNIT I

A general introduction to advances in medicinal chemistry with emphasis on the principles of combinatorial chemistry, high throughput screening and QSAR studies.

LO : General concepts, principles, procedures, advantages, equations and methodologies.

UNIT II

1. Types of receptors, interaction forces
2. Preliminary aspects of molecular modeling studies: docking, pharmacophore modeling

LO : General concepts, principles, procedures, advantages and methodologies.

UNIT III

1. **Steroidal anti-inflammatory agents:** classification, structures, SAR, uses and toxicity
2. **Bile acids:** classification, structures and functions
3. **Estrogens and Progesterone:** structures, functions, interconversion of estrogens, uses of natural and synthetic estrogens, synthesis of Progesterone from Diosgenin.

LO : Acquaintance with steroidal structures, features, properties, uses, mode of action.

UNIT IV

1. **Antiarrhythmics:** classification, mode of action, uses and synthesis of Procainamide.
2. **Cardiac glycosides:** classification, structures and structural features, mode of action and therapeutic uses.

LO : Introduction to cardiovascular diseases, uses, mode of action.

UNIT V

1. **Antihypertensives:** classification, mode of action, SAR, currently used drugs and synthesis of Methyldopa, Clonidine, Losartan.



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2. **Antianginals and coronary vasodilators:** classification, mode of action, SAR and uses, synthesis of Isosorbide dinitrate.

LO : Introduction to cardiovascular diseases, uses, mode of action.

UNIT VI

1. **Diuretics:** Definition, classification, mode of action, SAR of different classes, uses and synthesis of Acetazolamide, Ethacrynic acid and Hydrochlorthiazide.

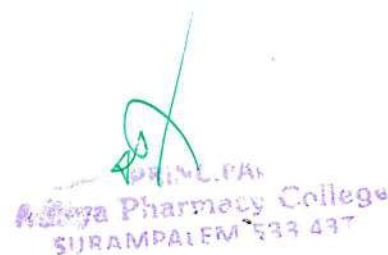
LO : Introduction, structures, methodology of synthesis, advantages.

TEXT BOOKS

1. William O. Foye, Textbook of Medicinal Chemistry by, Lea Febiger, Philadelphia.
2. JM Beale, Wilson & Giswold's Textbook of organic Medicinal Chemistry and pharmaceutical chemistry by (Eds), 11th Ed, Lipcott, Raven, Philadelphia, 2004.
3. S. N. Pandeya, Textbook of mediacinal chemistry, SG Publ. Varanasi, 2003.

REFERENCES

1. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
2. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences
3. L. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Delhi.
4. B.N. Lads, MG.Mandel and F.I. way, Fundamentals of drug metabolism & disposition, William & welking co, Baltimore USA.
5. C. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, oxford
6. Daniel lednicer, Strategies For Organic Drug Synthesis And Design, John Wiley, N. Y. 1998.
7. D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.



III Year –I I SEMESTER

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REGULATORY AFFAIRS, IPR & PATENTS**Unit-I**

Preformulations and Formulation Development – Regulatory requirements in Preformulations and Formulation Development of Solid, liquid and Semisolid dosage.

LO : To understand preformulations – protocols – regulatory – requirements – Formulation Development of Solid, liquid and Semisolid dosage.

Unit-II

Manufacturing- Regulatory requirements related to manufacturing-manufacturing formula, Records, Validations involved-GMP

Validations: Types- Validation of Process and Equipment – Raw materials, Excipients and solvents.

LO : To understand regulatory requirements related to manufacturing, validation – types, Validation of process, equipment, raw materials, excipients.

Unit-III

Regulatory requirements of packaging materials- Evaluation of Packaging materials.

Stability – Regulation for Stability testing of API, Solid and liquid dosage form as per ICH guidelines.

LO : To understand regulatory requirements of packaging materials, evaluation of packaging materials, stability testing as per ICH.

Unit – IV

Clinical Trials : Phase –I, II, III & IV studies – Regulations involved

LO : To understand regulatory requirements of Clinical Trials, Phase –I, II, III & IV studies.

Unit- V

A Study of Intellectual Property Rights : Definitions – Guidelines – National and international – Examples.

LO : To understand IPR with examples



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Unit- VI

Patents: patenting laws and Regulations – Procedures for obtaining and writing a patent – Examples.

LO : To understand patents, patent laws, procedures with examples.

References :

1. Quality Assurance guide by organization of Pharmaceutical Procedures of India
2. Drug formulation manual by D.P.S.Kohli and D.H.Shah. Eastern Publishers, New Delhi.
3. How to Practice GMPs By P.P.Sharma, Vandhana Publications, Agra.
4. Pharmaceutical Process Validation by FRA.R.Berry and Robert.A.Nash.
5. Pharmaceutical Preformulations by J.J.Wells.
6. Applied Production and Operations management by Evans, Anderson, Sweeny and Williams.
7. Basic principles of Clinical Research and methodology by Guptha.
8. Biopharmaceutics and Clinical Pharmacokinetics – An Introduction ; 4th Edition, Revised and Expanded by Robert E. Notary, Marcel Dekker incm, New york and Basel, 1987.



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III Year –II SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL TECHNOLOGY – II LAB

At least 25 Pharmaceutical preparations related to the topics are to be prepared

1. Experiments to illustrate preparation, stabilization, physical, chemical and biological evaluation of pharmaceutical products like capsules, tablets, parenterals, microcapsules etc.
2. Evaluation of materials used in pharmaceutical packaging.




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III Year –II SEMESTER

T	P	C
0	3	2

PHARMACOLOGY LAB

1. To calculate the p^{A2} value of mepyramine or chlorampheniramine using histamine as agonist on guinea pig ileum.
2. To record the CRC of 5-HT on rat fundus preparation.
3. To record the CRC of histamine on guinea pig ileum preparation.
4. To study the inotropic and chronotropic effects of drugs on isolated frog heart.
5. To study the effects of drugs on isolated normal and hypodynamic frog heart.
6. Experiments pertaining to analgesia. (*Only demonstration*).
7. Experiments pertaining to anti-convulsant activity. (*Only demonstration*).
8. Experiments pertaining to anti-inflammatory activity (*Only demonstration*).
9. To study the effect of drugs on rat ileum.
10. To determine the hypoglycemic activity of drugs (second generation anti-diabetic drugs) on rabbits / albino rats. (*Only demonstration*).



III Year –II SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL BIOTECHNOLOGY LAB

1. Isolation of antibiotic producing microorganism from soil.
2. Enzyme immobilization by Ca-alginate method.
3. Determination of minimum inhibitory concentration of the given antibiotic. Antibiotic assay by cup plate method.
4. Collection, Processing, Storage and fractionation of blood.
5. Standardization of Cultures.
6. Microbiological assay of Antibiotics / Vitamins.
7. Production of alcohol by fermentation techniques.
8. Comparison of efficacy of immobilized cells.
9. Sterility testing of Pharmaceutical products.
10. Isolation of mutants by gradient plate technique.
11. Preparation of bacterial vaccine.
12. Preparation of blood products / Human normal immunoglobulin injection.
13. Extraction of DNA.
14. Separation techniques : Various types of Gel Electrophoresis, Centrifugation.




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IV Year –I SEMESTER

T	P	C
3+1	0	4

PHARMACEUTICAL ANALYSIS – II

UNIT – I

Visible, UV & IR Spectrophotometry: Principle, Electron Transition, Beer-Lamberts Law & Deviations, Chromophores, Instrumentation – Construction of Single Beam and Double Beam Spectrophotometers, Applications.

LO : To understand principles, instrumentations and working of UV and its Spectrophotometers – applications with examples.

UNIT - II

NMR, Electron Spin Resonance Spectroscopy and Mass Spectrometry: Basic Principle, Instrumentation and Applications.

LO : To understand principles, instrumentations, applications with examples of NMR, ESR, Mass spectrometry.

UNIT - III

Basic Principles and applications of differential thermal analysis (DTA) and differential scanning calorimetry (DSC).

Basic Principles and applications of Atomic absorption spectroscopy, XRD, Emission spectroscopy and Raman spectroscopy.

Optical rotatory dispersion (ORD) and Circular dichroism: General Principle and Applications.

Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay.

LO : To understand basic principles and applications of DTA, DSC, XRD, Atomic absorption, Emission, Raman, ORD and Radio Immuno Assay.

UNIT – IV

Chromatography: Column chromatography, Paper chromatography, TLC, Ion exchange chromatography, Gel chromatography.

LO : To understand principles and procedures of various types of chromatography with examples.

UNIT – V

GLC, HPLC, HPTLC



LO : To understand principles, instrumentations and applications of GLC, HPLC, HPTLC .

UNIT – VI

LCMS and Electrophoresis: Scope, Different types Electrophoresis and applications.

LO : To understand principles, instrumentations and applications of LCMS and Electrophoresis.

TEXT BOOKS

1. R.M. Silvesterin and G.C. Bassler.Spectrometric Identification of Organic Compounds.
2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol.I&II CBS Publ.
3. AI Vogel, Quantitative Chemical Analysis.
4. Hobart. H. Willard and others, Instrumental methods of analysis, CBS publ and Distributors New Delhi.
5. Robert D. Brown, Introduction to Instrumental Analysis.
6. Skoog, Principles of Instrumental Analysis.
7. B.K.Sharma, Instrumental and Chemical Analysis, Goel Publ House , Hyderabad.

REFERENCES

1. Settle, Handbook of Instrumental Techniques for Analytical Chemistry.
2. Y.Anjaneyulu & Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. P.D. Sethi, Quantitative analysis of Drugs and Pharmaceuticals.
4. K. A. Connors, A Textbook of pharmaceutical analysis, Wiley Interscienc, NY.
5. A.M. Knevel & F.E. Digengl, Jenkin's quantitative pharmaceutical chemistry, Mc Graw Hill Book Co., NY.
6. Pharmacopoeia (IP, BP, USP, PhI, Eu. PhI).



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IV Year –I SEMESTER

T	P	C
3+1	0	4

BIOASSAYS & TOXICOLOGY**Unit I:**

Basic principles of Bioassays, merits and demerits, methods of bioassays.

Test for pyrogens and test for freedom undue toxicity.

LO : To gain knowledge on bioassays and its applications, its importance and need in the present context.

UNIT II

Bioassays of digoxins, posterior pituitary extract, Insulin and tetanus anti toxin.

LO : Principles and procedures involved in bioassays and their limitations.

UNIT III

History, scope of toxicology, principles of toxicology, mechanisms and risk assessment, biotransformation of xenobiotics and toxicokinetics.

LO : To grasp knowledge on scope, principles , mechanisms and risk assessment.

UNIT IV

Acute toxicity, subacute toxicity and chronic toxicity, Determination of LD₅₀.

Chemical Carcinogens: Definitions, mechanisms of action of chemical carcinogens, Test systems for carcinogenicity assessment, Chemical carcinogenesis in humans.

LO : To get an overview on acute, sub-acute and chronic toxicity studies, Carcinogenicity and chemical carcinogenesis in humans.

UNIT V

Target Organ Toxicity:

- Toxic responses of the blood.
- Toxic responses of the liver.
- Toxic responses of the kidney.
- Toxic responses of heart and vascular system.



General Principles of Poisoning: Signs, symptoms, treatment of acute and chronic poisoning due to heavy metals, snake venom.

LO : To acquire knowledge on toxic responses of target organs, poisoning and its treatment strategies.

UNIT VI

Toxic Agents:

- Toxic effects of pesticides.
- Toxic effects of metals.
- Toxic effects of solvents and vapours.
- Toxic effects of plants.

LO : To learn about intoxication produced by various toxicants.

Text Books:

1. Casarett&Doull's Toxicology The Basic Science of Poisons, Seventh edition. Editor- Curtis D. Klaassen, Ph.D.
2. Niesink R.J.M. de Vries J and Hollingers M.A. Toxicology, Principal and Applications, CRC Press 1996.
3. Harrison's Principles of Internal Medicine. Medical Toxicology (Ellen Horns).
4. Toxicology – Principles and Applications, Raymond J.M. Niesink, John de Vries, Manfred A. Hollinger.
5. Basis of Toxicology Testing Edited by Douald J Ecobichon.
6. Ellenhorns Medical toxicology 2nd Edition Williams and Wilkins, Baltimore, 1997.
7. Goldfrank's Toxicological Emergencies, ninth edition.




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IV Year –I SEMESTER

T	P	C
3+1	0	4

CHEMISTRY OF NATURAL PRODUCTS

UNIT-I

Carbohydrates : Classification and general properties. Knowledge of structure including Stereo Chemistry of glucose. General treatment of pharmaceutically important carbohydrates-maltose, lactose, starch, cellulose and dextrin.

LO : Introduction, basic understanding, structures, features, stabilities and uses.

UNIT-II

Amino acids and proteins : Classification and general reactions of amino acids and their relationship to proteins and polypeptides. Methods of preparation of amino acids, classification and general reactions of proteins, degradation of proteins-hydrolysis and end group analysis-protein hormones, oxytocin.

LO : Introduction, basic understanding, structures, features and uses.

UNIT-III

1. **Purines and xanthine derivatives**: Structure and synthesis of uric acid, Theobromine, theophylline, and caffeine. General aspects of nucleoproteins and nucleic acids,
2. **Lipids**: Fixed oils and fats. Fatty acids: chemistry and analysis of oils and fats.

LO : Introduction, basic understanding, structures, methodologies, significance and uses.

UNIT-IV

Terpenes : Occurrence, general methods of isolation and classification, chemistry of citral, limonene, α -terpineol, carvone, camphor and menthol.

LO : Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.

UNIT-V

Alkaloids : Classification, general methods of isolation, general methods of structural determination, chemical tests for alkaloids, Chemistry and uses of Ephedrine, Nicotine, Papaverine and Atropine.

LO : Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.

UNIT-VI

1. Vitamins: Classification, chemistry, physiological role and uses of Thiamine, Riboflavin and Ascorbic acid. Skeletal structures of vitamins official in I.P.
2. Steroids: Nomenclature and skeletal structures of Ergosterol, Stigmasterol, Cholesterol Diosgenin, Hecogenin. Chemical tests for steroids.

LO : Introduction, basic understanding, structures, chemistry and structural features, important degradative reactions, uses.

TEXT BOOKS

1. O.P.Agarwal, Natural products by. Vol.1 & 2, Goel publications – Meerut.
2. JB Harborne, Phyto Chemical methods.
3. I L Finar, Organic chemistry, Vol. 1 & 2, the English language book society, London, New Delhi.

REFERENCES

1. RT Morrison and R.N BOYD, Organic chemistry, Allyn and Bacon, inc., boston
2. Me – Wolf, ed., Burger's medicinal chemistry, J. Wiley & sons, NY.
3. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
4. RM. Acheson, an introduction to the chemistry of heterocyclic compounds, Interscience NY.
5. Duquesn & others, Practical Pharmacognosy, CBS Publ.




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IV Year –I SEMESTER

T	P	C
3+1	0	4

HOSPITAL & COMMUNITY PHARMACY

UNIT-I

Hospital Pharmacy: Organization and structure, organization of a hospital and hospital pharmacy, responsibilities of a hospital pharmacist, pharmacy and therapeutic committee, Budget preparation and implementation hospital formulary, organization of drug store, purchase and inventory control, patient counseling, role of pharmacist in community health care and education.

LO : To understand Hospital Pharmacy – organisation structure - Budget preparation and implementation hospital formulary, organization of drug store, purchase and inventory control, patient COUNSELLING, role of pharmacist in community health care and education.

UNIT-II

The pharmacy procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory Patient - dispensing of ancillary and controlled substances, drug information center.

LO : To understand The pharmacy procedural manual, drug distribution, dispensing to out-patients, in-patients and ambulatory Patient - dispensing of ancillary and controlled substances, drug information center.

UNIT-III

Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

LO : To understand Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases.

UNIT-IV

Introduction to community Pharmacy

- Community pharmacy Practice — definition.
- The role of the community pharmacy and its relationship to other local health care providers and services to nursing homes and clinics.



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- Professional responsibilities of community pharmacist (FIP & WHO Model).
- Prescribed medication order - interpretation and legal requirements

LO: To understand Community pharmacy – role and relationship, professional responsibilities and prescribed medication order.

UNIT-V

Communication skills - communication with prescribers and patients

Over-the-counter (OTC) Drugs

- Rational use of common OTC medications (Vitamins and tonics, iron preparations, analgesics, NSAIDs, cough mixtures, anti-diarrhoeal preparations)

LO : To understand communication with prescribers and patients, Rational use of common OTC medications.

UNIT-VI

1. Primary health care in community pharmacy

Family planning, First aid, Participation in primary health programs, Smoking cessation, Screening programs, Nutrition, Responding to common ailments

2. Community pharmacy management

Financial, materials, staff, infrastructure requirements, drug information resources, in community pharmacies, computer applications in community pharmacy, Education and training

3. Home Medicines Review (HMR) program: introduction and guidelines

LO : To understand Family planning, First aid, Participation in primary health programs, Smoking cessation, Screening programs, Nutrition, Responding to common ailments and Community pharmacy management and Home Medicines Review (HMR).

Text Books

1. Hospital Pharmacy - Hassan WE. Lee and Febiger publication.
2. Textbook of hospital pharmacy - Aliwood MC and Blackwell. Reference books (Latest editions)
3. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.
4. Remington Sciences and Practice of Pharmacy, 21st edition.



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5. Relevant review articles from recent medical and pharmaceutical literature.
6. Cooper & Gunns Dispensing Pharmacy, CBS, Publ. and Distributors New Delhi.
7. Gupta AK, Health Education and Community Pharmacy, CBS, Publ. and Distributors New Delhi.
8. JS Quadry, Hospital Pharmacy.
9. K.Sampath, Hospital & Clinical Pharmacy, Vikas Publications.
10. Lorria & William, Essential dosage calculations.

REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. William Hassan, Hospital Pharmacy.
3. R.M Metha, Dispensing Pharmacy.
4. E.A. Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ.
5. Hoover, Dispensing of Medication.
6. NK Jain, Health Education and Community Pharmacy by, CBS, Publ. and Distributors New Delhi.



IV Year –I SEMESTER

T	P	C
3+1	0	3

PHARMACEUTICAL JURISPRUDENCE**UNIT-I****Introduction**

- | | | |
|------------------------------------|---|-----------------|
| a. Pharmaceutical Legislations | - | A brief review |
| b. Drugs & Pharmaceutical Industry | - | A brief review |
| c. Pharmaceutical Education | - | A brief review. |
| d. Pharmaceutical ethics & policy | | |

LO : To understand Pharmaceutical Legislations, Drugs & Pharmaceutical Industry, Pharmaceutical Education and Pharmaceutical ethics & policy.

UNIT-II

Pharmacy Act 1948 and Drugs (Price control) order.

LO : To understand rules prescribed order, Pharmacy act, Drugs (Price control) order.

UNIT-III

Drugs and Cosmetics Act 1940 and Rules 1945

LO : To understand rules, schedules of Drugs and Cosmetics Act in detail.

UNIT-IV

Medicinal & Toilet Preparations (Excise Duties) Act 1955

Narcotic Drugs & Psychotropic Substances Act 1985 & A.P. N. D. P.S Rules 1986

LO : To understand and procedures under medicinal and toilet preparations act and Narcotic Drugs & Psychotropic Substances Act.

UNIT-V

Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules 1955.

LO : To understand the rules and procedures under drugs and magic remedies.

UNIT-VI

A study of the salient features of the following.

- a. Prevention of Cruelty to animals Act 1960.



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- b. AP State Shops & Establishments Act 1988 & Rules 1990.
- c. Factories Act 1948.
- d. WTO, GATT and The Indian Patents Act 1970
- e. Pharmaceutical Policy 2002.

LO : To understand the salient features of the above.

TEXT BOOKS

- 1. B.M.Mithal, Text book of Forensic Pharmacy, publ by Vallabh Prakashan.
- 2. Prof. Suresh Kumar J.N, Text book of Forensic Pharmacy by Frontline publications.
- 3. C.K.Kokate & S.B.Gokhale, Textbook of Forensic Pharmacy.

REFERENCE BOOK

- 1. Bare Acts and Rules Publ by Govt of India/state Govt from time to time.
- 2. AIR – reported judgments of Supreme Court of India and other High Courts.
- 3. Pharmaceutical policy of India
- 4. Notification from NPPA
- 5. Vijay Malik, Drugs & Cosmetics act 1940 and Rules, Eastern Law House Co. Delhi, Kolkata.
- 6. K.Sampath, Pharmaceutical Jurisprudence (Forensic Pharmacy).



IV Year –I SEMESTER

T	P	C
0	3	2

PHARMACEUTICAL ANALYSIS – II LAB

Experiments

1. Interpretation of IR Spectra.
2. Determination of λ -max of a drug.
3. Determination of concentration of glycerine by Abbe's refractometer.
4. Assay of ibuprofen - UV-spectro photometry.
5. Assay of paracetamol - UV-spectro photometry.
6. Assay of riboflavin - Colorimetric method.
7. Assay of rifampicin - Colorimetric method.
8. Ascending paper chromatography.
9. Radial paper chromatography.
10. Two dimension chromatography
11. Thin layer chromatography.
12. Column chromatography (*Demonstration Only*).
13. Paper electrophoresis of amino acids.
14. Gel electrophoresis (*Demonstration Only*).
15. HPLC (*Demonstration Only*).




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IV Year –I SEMESTER

T	P	C
0	3	2

BIOASSAYS & TOXICOLOGY LAB

To find the potency of test sample using a suitable isolated tissue

1. Matching point assay
2. Two-point assay
3. Three point assay
4. To calculate the p^{A2} value of Atropine using Acetyl Choline as an agonist on rat Ileum.
5. To find the acute toxicity of the given test drug (Digoxin, Nicotine, Aspirin, Paracetamol).
6. Test for Pyrogen
7. Test for freedom from undue toxicity
8. 4 point bioassay
9. Toxic responses of liver against chemical induced intoxication (Paracetamol, CCl_4).




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IV Year –I SEMESTER

T	P	C
0	3	2

CHEMISTRY OF NATURAL PRODUCTS LAB

1. Preparation of different alkaloids testing reagents like Dragondroff, Mayer, Wagner's, etc., and testing some alkaloids and plant extracts using these reagents.
2. Identification of alkaloids by specific colour tests.
3. Test for steroids, steroidal glycosides and cardiac glycosides. Liberman-Burchard test, Salkowski reaction, Kedde reaction etc.
4. Tests for flavanoids and their glycosides. Shinoda test (Mg/Hcl test), FeCl_3 test.
5. TLC and examination of alkaloids, steroids, steroidal glycosides and cardiac glycosides.
6. Identification of natural products.
7. Extraction of caffeine from tea leaves.
8. Extraction of lactose from milk.
9. Extraction of nicotine from tobacco.
10. Extraction of piperine from black pepper.
11. Extraction of lycopene from tomatoes.
12. Extraction of β -carotene from carrots.
13. Volatile oil production by steam distillation (*demonstration only*).

TEXT BOOKS

1. Indian Pharmacopoeia-1996.
2. Weagners, Phytochemical methods of Drug Analysis.
3. C.K.Kokate, Practical Pharmacognosy.

IV Year –I SEMESTER

T	P	C
0	0	0

PROJECT COMMENCEMENT



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IV Year –II SEMESTER

T	P	C
3+1	0	4

BIOPHARMACEUTICS AND PHARMACOKINETICS

UNIT - I

Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting

Biopharmaceutics: Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis) factors influencing absorption – physiochemical, physiological and pharmaceutical.

LO : To understand Biopharmaceutics, Pharmacokinetics and their applications –absorption mechanisms, factors, their application with examples.

UNIT - II

Drug distribution in the body, Factors influencing distribution.

Plasma protein binding, binding sites, factors influencing protein binding

LO : To understand drug distribution, protein binding – factors.

UNIT - III

Pharmacokinetics

Significance of plasma drug concentration measurement.

Compartment model: Definition and scope.

Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant using Wagner Nelson and Loo-riegelman method.

Volume of distribution and distribution coefficient.

LO : To understand the significance of plasma drug concentrations, compartment models - kinetics, parameters.

UNIT - IV

Comparative kinetics: One compartment and two compartment models. Determination of Pharmacokinetic parameters from plasma and urine data after drug administration by oral parenteral and other routes.

Curve fitting (Method of Residuals) Regression procedures.

Clearance concept, Mechanism of Renal clearance, clearance ratio, determination of renal clearance.



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Non-linear pharmacokinetics with special reference to one compartment model after I.V. Drug administration, Michaelis-Menten Equation, detection of non-linearity (Saturation mechanism).

LO : To understand pharmacokinetic models, Linear and Non-Linear kinetics, mechanisms and method of assessments.

UNIT - V

Clinical pharmacokinetics

Definition and scope

Dosage adjustment in patients with and without renal and hepatic failure.

Pharmacokinetic drug interactions and its significance in combination therapy.

LO : To understand clinical pharmacokinetics and their significance, drug interactions – Adjustment of dose.

UNIT - VI

Bioavailability and Bioequivalence.

Measures of bioavailability, C-max, T-max and Area Under the Curve (AUC)

Design of single dose bioequivalence study and relevant statistics.

Overview of regulatory requirements for conduction of bio-equivalence studies.

Bio availability and bio equivalence including evaluation testing protocols.

- In vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data in vitro, in vivo correlations.
- Bioavailability testing protocol and procedures.
- In vivo methods of evaluation – statistical treatment.

LO : To understand bioavailability, bioequivalence, concepts, assessments, design, regulation, invitro dissolution methods, Invitro-in vivo correlation.

TEXT BOOKS

- Venkateshulu, Fundamentals of Biopharmaceutics and Pharmacokinetics, Pharma Book Syndicate.
- Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate.
- DM Brahmankar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, Vallabh Prakasham, Delhi.



4. P.L. Madan, Biopharmaceutics and Pharmacokinetics, Jaypee Bros.

REFERENCES

1. Remington's pharmaceutical sciences, Mac Pub. Co., Easton Pennsylvania.
2. Modern pharmaceutics by banker Marcel Dekker Inc., NY
3. L. Iachman, H.A.Lieberman, J.L. Kanig, the theory and practice of industrial pharmacy, Varghese publ house, Mumbai.
4. A.R. Gennerio Remington: the science and practice of pharmacy, vol 1 & 2 Lippincott Williams & Wilkins, Philadelphia, 2004.
5. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, arceldekkerinc., NY
6. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & pharmacokinetics, 4th edn, Appleton – century – crofts, Connecticut, 2004.




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IV Year –II SEMESTER

T	P	C
3+1	0	3

**CLINICAL PHARMACY, THERAPEUTICS AND
PHARMACOVIGILANCE****UNIT - I**

General concept: Clinical Pharmacokinetics, Drug interactions, Adverse Drug Reactions, Parenteral Nutritions.

LO : To understand several concepts of clinical pharmacokinetics, Drug interactions and Adverse Drug Reactions

UNIT - II

Pharmacoeconomics, Pharmacogenomics, Pharmacovigilance, Therapeutic drug Monitoring, Neutraceuticals, Essential drugs and Rational drug usage, related drug therapy: Concept of posology, drug therapy for Neonates, Pediatrics and Geriatrics, drug used in Pregnancy and Lactation.

LO : To understand the concepts of Pharmacoeconomics, Pharmacogenomics, TDM, Posology etc.

UNIT - III

Drug therapy in Gastro intestinal, hepatic, renal, cardio vascular and respiratory disorders.

Drug therapy for Neurological and Psychological disorders.

Drug therapy in infections of Respiratory systems, Urinary system, Infective Meningitis, TB, HIV, Malaria and Filariasis.

LO : To understand drug therapy of above mentioned disorders.

UNIT - IV

Drug therapy for Thyroid and Para Thyroid disorders, Diabetes mellitus, menstrual cycle disorders, menopause and male sexual dysfunction.

LO : To understand the drug therapy of Endocrine disorders.

UNIT - V

Drug therapy for Malignant disorders like Leukemia, Lymphoma and solid tumors.

Drug therapy for Rheumatic, eye and skin disorders.

LO : To understand drug therapy of above mentioned disorders.



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UNIT - VI

Pharmacovigilance: Definition, history, importance, scope and outcomes.

Stake holders and their role in Pharmacovigilance.

Data reporting form, banned drug – regulatory considerations.

LO : To understand importance of Pharmacovigilance role in clinical practice as described above.


TEXTBOOKS

1. Clinical Pharmacy and Therapeutics: Roger Walker and Clive Edwords.
2. Clinical Pharmacy & Therapeutics, 4th edition by Eric T. Herfindal, Dick R. Gourley and Linda Lloyd hart.
3. A text book of Clinical Pharmacy Practice – Essential Concepts and skills by G. Parthasarathi, Karin Nyfort-Hansen, Malip C. Nahata.
4. Clinical Pharmacy by Dr. H. P. Tipnis, Dr. Amrita Bajaj; Career Publications.
5. Fundamentals of Clinical Pharmacy Practice by D. Sudheer Kumar, J. Krishnaveni, P. Manjula.
6. Contemporary perspectives on Clinical Pharmacotherapeutics: Kamlesh. Kohli.

REFERENCES

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
2. Pharmacotherapy – A Pathophysiologic Approach by Joseph T. Dipiro, Robert L. Talbert, Gary C. Yee, Gary R. Matzke, Barbara G. Wells, L. Michael Posey – 7th Edition – Mc Graw Hill Medical Publications.
3. Basic Principles of Clinical Research and Methodology by Sk Gupta, Institute of Clinical Research (India), Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.




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IV Year –II SEMESTER

T	P	C
3+1	0	4

CONTROLLED RELEASE AND NOVEL DRUG DELIVERY SYSTEMS**UNIT - I**

Controlled and sustained release: Factors to be considered – Principles involved in their design – regulatory considerations.

LO : To understand Controlled and sustained release: Factors to be considered – Principles involved in their design – regulatory considerations.

UNIT - II

Oral Control Drug Delivery Systems: Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems and altered density systems.

LO : To understand fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems and altered density systems.

UNIT - III

Transdermal Drug Delivery Systems: Fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

LO : To understand fundamentals, types of TDDS, Materials Employed and Evaluation of TDDS.

UNIT - IV

Mucoadhesive Delivery Systems: Mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of mucoadhesive-based systems.

LO : To understand mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of mucoadhesive-based systems.

UNIT - V

Targeted Drug Delivery Systems: Fundamentals and applications, formulation and evaluation of liposomes, resealed erythrocytes and nano particles.

LO : To understand fundamentals and applications, formulation and evaluation of liposomes, resealed erythrocytes and nano particles.



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UNIT - VI

Study of polymers for controlled release – Classification, study of biodegradable polymers & hydrogels – their applications.

LO : To understand classification, study of biodegradable polymers & hydrogels – their applications.

TEXT BOOKS

1. N.K. Jain, Control Drug Delivery Systems by
2. Y.Anjaneyulu&Maraiah, Quality Assurance & Quality Management in Pharmaceutical Industry.
3. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy by, Lea &Febieger, Philadelphia Latest Edn.
4. Shobhan Rani Hiremath Text Book of Industrial Pharmacy.

REFERENCES

1. Leon ShargelIsadoreKanfer, Generic Drug Product Development, Solid Oral Dosage Forms, Marcel Dekker.
2. Sagarian& MS Balsam, Cosmetics Sciences &Technology.Vol.1, 2 & 3
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
4. E.A Rawlkins, Bentley's Text Book of Pharmaceutics, ELBS publ
5. HC Ansel, Introduction to Pharmaceutical Dosage forms
6. S.H. Willing, M.M Tucherman and W.S. Hitchings IV, Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control, Marcel Dekker, Inc., New York
7. Gilbert S. Banker and Christopher T Rhodes, Modern Pharmaceutics, IVthed, marcel dekker, USA, 2005.
8. YiewChien, novel drug delivery systems, 2nded, marcel dekker 2003.
9. Robert. A. Nash, Pharmaceutical Process Validation, 3rd Ed Marcel Dekker, 2003.
10. Good Manufacturing Practices – Schedule M, Read with The Drugs And Cosmetic Rules 1945.
11. M.E. Aulton, Pharmaceuitcs- The science of Dosage form Design 2nded.
12. AukunuruJithan, Oral Drug Delivery Technology.



**IV Year –II
SEMESTER**

T	P	C
3+1	3	3

QUALITY ASSURANCE, GMP & GLP**UNIT - I**

Concept of Quality assurance, philosophy of GMP, CGMP and GLP.

LO : To understand Concept of Quality assurance, philosophy of GMP, CGMP and GLP.

UNIT - II

Organization and personnel, responsibilities, training hygiene - Premises: Location, design, plant layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination.

LO : To understand organization and personnel, responsibilities, training hygiene - Premises: Location, design, plant layout, construction, maintenance and sanitations, environmental control, sterile areas, control of contamination.

UNIT - III

Equipments: Selection, purchase specifications, maintenance, clean in place, sterilize in place - Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials.

LO : To understand selection, purchase specifications, maintenance, clean in place, sterilize in place - Raw materials: Purchase specifications, maintenance of stores, selection of vendors, controls and raw materials.

UNIT - IV

Manufacture and controls on dosage forms, manufacturing documents master formula, batch formula records, standard operating procedures, quality audits of manufacturing processes and facilities - In process quality control on various dosage forms: sterile, biological products and non-sterile, standard operating procedures for various operations like cleaning, filling, drying, compression, coating. Packaging and labeling controls.

LO : To understand manufacture and controls on dosage forms, manufacturing documents master formula, batch formula records, standard operating procedures, quality audits of manufacturing processes and facilities - In process quality control on various dosage



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forms: sterile, biological products and non-sterile, standard operating procedures for various operations. Packaging and labeling controls.

UNIT - V

Quality Control Laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage, quality control documents, retention samples, records, audits of quality control facilities - Finished products release: quality review, quality audits and batch release document.

LO : To understand responsibilities, good laboratory practices, routine controls, instruments, protocols, non-clinical testing, controls on animal house, data generation and storage, quality control documents, retention samples, records, audits of quality control facilities - Finished products release: quality review, quality audits and batch release document.

UNIT - VI

Distribution and Distribution records: Handling of returned goods, recovered materials and reprocessing Complaints and recalls, evaluation of complaints, recall procedures, related records and documents.

LO : To understand handling of returned goods, recovered materials and reprocessing. Complaints and recalls, evaluation of complaints, recall procedures, related records and documents.

TEXT BOOKS

1. The International Pharmacopoeia Vol. 1,2,3,4, 3rd edition General methods of analysis quality specifications for Pharmaceutical substances, Excipients, dosage forms.
2. Quality Assurance of Pharmaceuticals: A compendium of guidelines and related material Vol. 1 and Vol. 2., WHO, (1999).
3. GMP-Mehra.
4. Pharmaceutical Process validation by Berry and Nash

REFERENCE BOOKS

1. Basic tests for Pharmaceutical substances - WHO (1988 &1991)
2. How to practice GMP's – P.P.Sharma
3. The Drugs and Cosmetic Act 1940- Vijay Malik.
4. Q.A Manual by D.H.Shah.
5. SOP Guidelines by D.H.Shah.
6. Quality Assurance Guide by OPPI.



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IV Year –II SEMESTER

T	P	C
0	3	2

BIOPHARMACEUTICS AND PHARMACOKINETICS LAB

1. Experiments designed for the estimation of various pharmacokinetic parameters with given data.
2. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
3. In vitro evaluation of different dosage forms for drug release.
4. Absorption studies – *in vitro* and *in vivo*.
5. Statistical treatment of pharmaceutical data.




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IV Year –II SEMESTER

T	P	C
0	0	4

PROJECT WORK

IV Year –II SEMESTER

T	P	C
0	0	4

PROJECT SEMINAR

IV Year –II SEMESTER

T	P	C
0	0	2

COMPREHENSIVE VIVA




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