Dr. B.V.Raju Foundation

SHRI VISHNU COLLEGE OF PHARMACY (Autonomous)

Vishnupur, Bhimavaram – 534202

(Affiliated to Andhra University)

Rules & Syllabus for the Bachelor of Pharmacy (B. Pharm) Course –R-19

Effective from 2021-2022 Admitted Batch

[PCI -Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (B. Pharm) Course Regulations 2014]

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CHAPTER- I: REGULATIONS

1. Short Title and Commencement

These regulations shall be called as "The Revised Regulations for the B. Pharm. Degree Program of the Shri Vishnu College of Pharmacy (Autonomous), Bhimavaram". They shall come into effect from the Academic Year 2019-2020. The regulations framed are subject to modifications from time to time by Shri Vishnu College of Pharmacy (Autonomous), Bhimavaram.

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 Shri Vishnu College of Pharmacy (Autonomous), Bhimavaram.

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 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 222/223. 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 attain total credit points of 172 (163+9) to be eligible for the B. Pharm degree. Such students shall take up the remedial courses -'Communication Skills' (Theory and Practical), 'Environmental Scienes (Theory) and 'Computer Applications in Pharmacy - I' (Theory and Practical) equivalent to 3, 3 and 3 credit points respectively, to attain 9 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	Tutorials	Credits
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[$]	2	-	2
BP107P	Human Anatomy and Physiology – I Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical	2	-	1
BP112RBP	Remedial Biology – Practical[#]	2	-	1
	Total	**34[$]/36[#]**	**4**	**29[$]/30[#]**

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

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

Table-II: Course of Study for Semester II

Course Code	Name of the Course	No. of Hours	Tutorials	Credits
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	Pharmaceutical Microbiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy –I Theory	2	-	2
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	Pharmaceutical Microbiology – Practical	4	-	2
BP211P	Computer Applications in Pharmacy – I Practical*	2	-	1
	Total	35	4	30

Table-III: Course of Study for Semester III

Course Code	Name of the Course	No. of Hours	Tutorials	Credits
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pathophysiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	5	1	6
BP305T	Computer Applications in Pharmacy –II Theory	2	-	2
BP306P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP307P	Physical Pharmaceutics I – Practical	4	-	2
BP308P	Pharmaceutical Engineering –Practical	4	-	2
BP309P	Computer Applications in Pharmacy – II Practical*	2	-	1
BP310PS	Practice School – I*	-	-	1
	Total	30	4	28

*Non University Examination

Table-IV: Course of Study for Semester IV

Course Code	Name of the Course	No. of Hours	Tutorials	Credits
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
BP410PS	Practice School – II*	-	-	1
	Total	31	5	29

* Non University Examination (NUE)

Table-V: Course of Study for Semester V

Course Code	Name of the Course	No. of Hours	Tutorials	Credits
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial Pharmacy I– 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 Pharmacy I – 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	Tutorials	Credits
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
BP607T	Advanced Computer and Communication skills	2	-	2
BP608P	Medicinal chemistry III – Practical	4	-	2
BP609P	Pharmacology III – Practical	4	-	2
BP610P	Herbal Drug Technology – Practical	4	-	2
BP611P	Advanced Computer and Communication skills Practical	2	-	1
	Total	34	6	33

Table-VII: Course of Study for Semester VII

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

* Non University Examination (NUE)

Table-VIII: Course of Study for Semester VIII

Course Code	Name of the Course	No. of Hours	Tutorials	Credits
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	Pharmacological Screening Methods			
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	29$ / 30#
II	30
III	28
IV	29
V	26
VI	33
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	222$ / 223#

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

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

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

10. Program Committee

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

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

3. Duties of the Program Committee:

i. Periodically reviewing the progress of the classes.

ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.

iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.

iv. Communicating its recommendation to the Head of the institution on academic matters.

v. The Program Committee shall meet at least thrice in a semester preferably at the end of each Sessional exam (Internal Assessment) and before the end semester exam.

11. **Examinations/Assessments** The scheme for internal assessment and end semester examinations is given in Table – X.

11.1. End 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 Sem. Exams		Total Marks
		Continuous Mode	Sessional Exams			Marks	Duration	
			Marks	Duration	Total			
BP101T	Human Anatomy and Physiology I – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP102T	Pharmaceutical Analysis I-Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP103T	Pharmaceutics-Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP104T	Pharmaceutical Inorganic Chemistry-Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP105T	Communication skills-Theory	5	10	2 Hrs.	15	35	2 Hrs.	50
BP106T	Remedial Biology/Mathematics – Theory	5	10	2 Hrs.	15	35	2 Hrs.	50
BP107P	Human Anatomy and Physiology I – Practical	5	10	2 Hrs.	15	35	4 Hrs.	50
BP108P	Pharmaceutical Analysis I-Practical	5	10	2 Hrs.	15	35	4 Hrs.	50
BP109P	Pharmaceutics-Practical	5	10	2 Hrs.	15	35	4 Hrs.	50
BP110P	Pharmaceutical Inorganic Chemistry-Practical	5	10	2 Hrs.	15	35	4 Hrs.	50
BP111P	Communication skills-Practical	5	5	2 Hrs.	10	15	2 Hrs.	25
BP112P	Remedial Biology - Practical	5	5	2 Hrs.	10	15	2 Hrs.	25
	Total	**75$/80#**	**145$/150#**	**30$/32#**	**220$/230#**	**505$/520#**	**33$/35#**	**725$/750#**

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

$Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics

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

.Semester II								
Course Code	**Name of the Course**	Internal Assessment				End Sem. Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP203T	Biochemistry – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP204T	Pharmaceutical Microbiology – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP205T	Computer Applications in Pharmacy –I Theory*	10	20	2 Hrs.	30	70	3 Hrs.	100
BP206T	Environmental sciences – Theory*	10	20	2 Hrs.	30	70	3 Hrs.	100
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	Pharmaceutical Microbiology – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP211P	Computer Applications in Pharmacy – I Practical*	5	10	4 Hrs.	15	35	4 Hrs.	50
	Total	**85**	**170**	**32 Hrs.**	**255**	**595**	**38 Hrs.**	**850**

Semester III								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP302T	Physical Pharmaceutics I –Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP303T	Pathophysiology – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP304T	Pharmaceutical Engineering – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP305T	Computer Applications in Pharmacy–II Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP306P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP307P	Physical Pharmaceutics I – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP309P	Computer Applications in Pharmacy – II – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP310PS	Practice School-I*							50
	Total	**70**	**140**	**26**	**210**	**490**	**31Hrs.**	**750**

* Students will be doing the Mini Projects – in the areas of their choice – chemistry/Analysis/Pharmaceutics/Pharmacology etc., under the guidance respective faculty, over a period of 7 to 10 days. At the end they will be submitting the technical report, certified by the guides which is subjected for evaluation.

Semester IV								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III - Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP402T	Medicinal Chemistry I-Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP403T	Physical Pharmaceutics II - Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP404T	Pharmacology I - Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP405T	Pharmacognosy I - Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP406P	Medicinal Chemistry I-Practical	5	10	4 Hrs.	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
BP410PS	Pharmacy Practice-II*							50
	Total	**70**	**140**	**26 Hrs.**	**210**	**490**	**31 Hrs.**	**750**

* Students will be doing the Mini Projects – in the areas of their choice – Chemistry/Analysis/Pharmaceutics/Pharmacology etc., under the guidance respective faculty, over a period of 7 to 10 days. At the end they will be submitting the technical report, certified by the guide which is subjected for evaluation.

Semester V								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP501T	Medicinal Chemistry II – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP502T	Industrial Pharmacy I– Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP503T	Pharmacology II – Theory	10	20	2 Hrs	30	70	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	20	2 Hrs	30	70	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence –Theory	10	20	2 Hrs	30	70	3 Hrs	100
BP506P	Industrial Pharmacy I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
	Total	**65**	**130**	**22 Hrs.**	**195**	**455**	**27 Hrs.**	**650**

Semester VI								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP602T	Pharmacology III – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP603T	Herbal Drug Technology – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP605T	Pharmaceutical Biotechnology– Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP606T	Quality Assurance– Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP607T	Advanced computer and communication skills-Theory	10	20	2Hrs .	30	70	3 Hrs.	100
BP608P	Medicinal chemistry III – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP609P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP610P	Herbal Drug Technology – Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP611P	Advanced computer and communication skills-Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
	Total	**90**	**180**	**30 Hrs.**	**270**	**630**	**37 Hrs.**	**900**

Semester VII								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis– Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP702T	Industrial Pharmacy – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP703T	Pharmacy Practice – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP704T	Novel Drug Delivery System – Theory	10	20	2 Hrs.	30	70	3 Hrs.	100
BP705 P	Instrumental Methods of Analysis– Practical	5	10	4 Hrs.	15	35	4 Hrs.	50
BP706 PS	Practice School- III*	25	-	-	50	100	5 Hrs.	150
	Total	**70**	**90**	**12 Hrs.**	**185**	**415**	**21 Hrs.**	**600**

* Students will be doing the Mini Projects – in the areas of their choice – Chemistry/Analysis/Pharmaceutics/Pharmacology etc., under the guidance respective faculty, over a period of 7 to 10 days. At the end they will be submitting the technical report, certified by the guides which is subjected for evaluation.

Semester VIII								
Course Code	Name of the Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	20	2Hrs.	30	70	3Hrs.	100
BP802T	Social and Preventive Pharmacy– Theory	10	20	2Hrs.	30	70	3Hrs.	100
BP803ET	Pharmaceutical Marketing – Theory	10 +10 = 20	20 +20 = 40	1 + 1 = 2Hrs.	30 +30 = 60	70 + 70 = 140	3 + 3 = 6 Hrs.	100 +100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science -Theory							
BP810ET	Pharmacological Screening Methods– Theory							
BP811ET	Advanced Instrumentation Techniques -Theory							
BP812PW	Project Work					150	4 Hrs.	150
	Total	**40**	**80**	**4 Hrs.**	**120**	**430**	**16 Hrs.**	**550**

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

Table-XI: Scheme for Awarding Internal Assessment: Continuous Mode

Theory	
	Maximum marks
Attendance (Refer Table – XII)	3
Academic activities(Average of any three activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	7
Total	10
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
Greater than 94	3	2
87-93	2	1.5
81-86	1	1
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 35 marks and shall be computed for 10 marks

Question Paper Pattern for Theory Sessional Examinations Duration: 2 Hours

I. Multiple Choice Questions (MCQs)
(Answer all the questions) = 20x 0.5M=10
II. Short Answers (Answer all the questions) = 4 x 2 M = 08
III. Long Answers (Answer 3 out of 5) = 3 x 4 M = 12

Total = 30 Marks

Non University Examination Duration: 2 Hours

I. Short Answers (Answer all the questions) =5 x 2 M = 10
II. Long Answers (Answer 4 out of 5) =4 x 5 M = 20

Total = 30 Marks

Question Paper Pattern for Practical Sessional Examination Duration: 4 Hours

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

Total = 35 Marks

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12. Promotion and Award of Grades

A student shall be declared PASS and eligible for getting grade in a course of B. Pharm. program if he/she secures at least an aggregate of 50% marks (internal assessment + end semester examination) in that particular course wherein the student shall get minimum 40% (28 out of 70 Marks) in the semester end examinations.. For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

13. Carry Forward of Marks

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

14. Improvement of Internal Assessment

Theory: A student who could not attend regular sessional examination with genuine medical reasons / obtained less than 40% on average of two sessionals shall have the opportunity to request to attend the improvement sessional examination immediately after the second sessional examination that may be accepted by Program Coordinator and Principal. However, such an examination should cover entire syllabus and an average of best two performances shall be considered.

In case, a student who do not appear for two sessional examinations, there shall be only one improvement examination and half of the marks obtained are taken as sessional marks. Semester end theory examination shall be conducted for 70 marks.

Practical: A student who could not attend regular internal practical examination with genuine medical reasons shall have the opportunity to request to attend the improvement practical examination immediately after the examination that may be accepted by Program Coordinator and Principal.

15. Re-examination of end Semester (Supplementary) Examinations

Re-examination of end semester examination shall be conducted within 15 days from the date of announcement of revaluation results if any. There shall be no provision for revaluation of supplementary examination.

Table-XIII: Tentative Schedule of End Semester Examinations

Semester	For Regular Candidates	For Failed Candidates
I,III, V and VII	November/December	Within 15 days from the date of semester results declaration
II,IV,VI and VIII	May/June	Within 15 days from the date of semester results declaration

Question Paper Pattern for End-Semester Theory Examinations for 70 Marks Paper

I. Multiple Choice Questions(MCQs)
(Answer all the questions) = 20 x 1M = 20
II. Short Answers (Answer 6 out of 9) = 6 x 5 M = 30
III. Long Answers (Answer 2 out of 3) = 2 x 10 M = 20

Total = 70 marks

For 35 marks paper
I. Short Answers (Answer 5 out of 5) = 5 x 2 M = 10
II. Long Answers (Answer 5 out of 8) = 5 x 5 M = 25

Total **= 35 marks**

Question Paper Pattern for End Semester Practical Examinations

I. Synopsis = 5 M
II. Experiments (Major 15+ Minor 10) = 25 M
III. Viva voce = 5 M

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, III,IV,V,VI and VII semesters to the VIII semester.

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, V,VI and VII semesters till the VIII semester examinations. 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.

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.

16. Grading of Performances

16.1. 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 – XIV.

Table – XIV: 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.

17. The Semester Grade Point Average (SGPA)

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

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

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

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

18. 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:

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

where C1, C2, C3,…. is the total number of credits for semester I,II,III,…. and S1,S2, S3,….is the SGPA of semester I,II,III,…. .

19. 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

20. 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 subjects 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 soon after the semester end theory examination. Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

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

Total	**75 Marks**

Evaluation of Presentation:

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

Total	**75 Marks**

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

21. 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, Pharma-ceutical R&D, Hospital (Clinical Pharmacy), Clinical Research Organization, Community Pharmacy, etc., after 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.

22. 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.

23. 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.

24. Award of Degree

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

25. 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.

26. 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:

- Explain the gross morphology, structure and functions of various organs of the human body
- Describe the various homeostatic mechanisms and their imbalances
- Identify the various tissues and organs of different systems of human body
- Perform the various experiments related to special senses and nervous system
- 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, hemopoeisis, 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 **08hours**

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 brothersmedical publishers, New Delhi
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological Basis of Medicalpractice-Best&Tailor.Williams&Wilkins Co,Riverview,MI USA
4. Text Book of Medical Physiology- Arthur C, Guyton and John.E. Hall. Miamisburg, OH, U.S.A
5. Principles of Anatomy and Physiology by Tortora Grabowski, Palmetto, GA, U.S.A.
6. Text Book of Human Histology by Inderbir Singh, Jaypee brother's Medical Publishers, New Delhi
7. Text Book of Practical Physiology by C.L. Ghai, Jaypee Brother's Medical Publishers, NewDelhi
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 & Tailor.Williams&Wilkins Co,Riverview, MI, USA
2. Text Book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, .S.A
3. Human Physiology (vol 1and 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 develops 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 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 titrations and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **10 Hours**

Precipitation Titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method and 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

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 (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 **10 Hours**

Monophasic Liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Ear drops, 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

UNIV–V **07 Hours**

Semisolid Dosage Forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi- solid dosage forms. Evaluation of semi solid dosages forms

BP109P. PHARMACEUTICS (Practical)

3 Hours / Week

Syrups:	**a)** Syrup IP'66	**b)** Compound syrup of Ferrous Phosphate BPC'68
Elixirs:	**a)** Piperazine citrate elixir	**b)** Paracetamol pediatric elixir.
Linctus:	**a)** Terpin Hydrate Linctus IP'66	**b)** Iodine Throat Paint (Mandles Paint)
Solutions:	**a)** Strong solution of ammonium acetate	**b)** Cresol with soap solution
	c) Lugol's solution	
Suspensions:	**a)** Calamine lotion	**b)** Magnesium Hydroxide mixture
	c) Aluminimum Hydroxide gel	
Emulsions:	**a)** Turpentine Liniment	**b)** Liquid paraffin emulsion
Powders and Granules:	**a)** ORS powder (WHO)	**b)** Effervescent granules
	c) Dustingpowder	**d)** Dividedpowders
Suppositories:	**a)** Glycero gelatin suppository	**b)** Cocoa butter suppository
	c) Zinc Oxide suppository	
Semisolids:	**a)** Sulphur ointment	**b)** Non staining-iodine ointment with methyl salicylate
	c) Carbopal gel	
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. Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi
3. M.E. Aulton, Pharmaceutics, Churchill Livingstone, Edinburgh
4. Indian Pharmacopoeia
5. British Pharmacopoeia
6. Lachman Lieberman's, Theory and Practice of Industrial Pharmacy, Lea & Febiger Publication, 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, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, New York
11. Dilip.M.Parikh: Handbook of Pharmaceutical Granulation Technology,Marcel Dekker, 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 nitrite

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

Limit tests for following ions

a) Limit test for Chlorides and Sulphates
b) Modified limit test for Chlorides and Sulphates
c) Limit test for Iron
d) Limit test for Heavy metals
e) Limit test for Lead
f) Limit test for Arsenic

Identification test

a) Magnesium hydroxide
b) Ferrous sulphate
c) Sodium bicarbonate
d) Calcium gluconate
e) Copper sulphate

III. Test for Purity

a) Swelling power of Bentonite
b) Neutralizing capacity of Aluminium hydroxide gel
c) Determination of Potassium iodate and iodine in Potassium Iodide

IV. Preparation of Inorganic Pharmaceuticals

a) Boric acid
b) Potash alum
c) 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 Edn.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edn.
4. M.LSchroff, Inorganic Pharmaceutical Chemistry
5. Bentleyand Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

BP105T. COMMUNICATION SKILLS (Theory)

40 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:

- Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non Verbal)
- Effectively manage the team as a team player
- Write letters and Emails effectively

Course Content

UNIT–I **08 Hours**

Vocabulary & Grammar:

Vocabulary Development: Word Roots- Antonyms and Synonyms-Words often confused

Grammar: Sentence formation and types of sentences-Usage, Conversion of Sentences-Voice-Active- Passive & Speech-Direct-Indirect

UNIT–II **06 Hours**

Communication Skills: Introduction, Definition, Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context- Body Language

Barriers to Communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers-Overcoming Barriers

UNIT–III **10 Hours**

Writing Effectively: Paragraph Development- Content- Discussion-Coherence & Cohesion-Completeness- Linking paragraphs with Transitional Words/Phrases

UNIT-IV **10 Hours**

Letter Writing and Email Etiquette: Letter Writing-Components-Layouts- Body of the Letter- Coherence-What comes First- Introduction-Discussion-Conclusion- For Information and Seeking Action

Email Etiquette: Components of Email- Do's and Dont's while using Email- Email Etiquette

UNIT-V **06 Hours**

Reading Skills: Reading for Pleasure and Leisure- Reading for Understanding & Information-Reading for specific Information- Reading Comprehension Practice Test- Basic Level (BEC Primary Level)

BP111P. COMMUNICATION SKILLS (Practical)

2 Hours / Week

The following learning modules are to be conducted using:

K-Van Solution's Communication Skills Language Lab Software designed as per PCI norms

Basic Communication

Starting a Conversation-Self Introduction- Introducing Others-Meeting People-Asking Questions -Making Friends -What did you do? Do's and Dont's Just A Minute Sessions (JAM)

Pronunciation-English Phonetics and Sound System

Consonant Sounds Vowel Sounds Pronunciation-Nouns and Verbs Accent and Intonation in English

Advanced Learning

Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations- Listening Comprehension Test (BEC Model)

Giving Directions and Taking Directions

Telephonic Etiquette & Role Plays

Recommended Books (Latest Editions):

1. Textbook of English Phonetics for Indian Students, T. Balasubrahmanian- Laxmi Pubublications
2. A Manual for English Language Communication Skills Laboratories. D. Sudha Rani, Pearson Education India; 1st Edn.(2012)
3. Communication skills, Sanjay Kumar, Pushpalata, 1st Edn. Oxford Press, 2011
4. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edn. Pearson
5. Technical and Practice Communication Principles, Meenakshi Raman and Sangeetha Sharma, Oxford University Press
6. Basic Communication Skills for Technology, Andrea. J. Ruther Ford, 2nd Edn., Pearson Education

BP106 RBT. 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 specialreference to human

Course Content

UNIT I **07 Hours**

Living World: Definition and characters of living organisms, Diversity in the living world

Binomial nomenclature, Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus

Morphology of Flowering Plants: Morphology of different parts of flowering plants –Root, stem, inflorescence, flower, leaf, fruit, seed. General Anatomy of Root, stem, leaf of monocotyledons and Dicotylidones

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 aneuron

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

Recommended Books (Latest Editions):

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

Reference Books

1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C. Dutta
4. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan
5. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112 RBP. 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. Studyof 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

Recommended Books (Latest Editions):

1. Practical Human Anatomy and Physiology by S.R.Kale & 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

BP106 RMT. REMEDIAL MATHEMATICS (Theory)

30 Hours

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

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

- Know the theory and their application in Pharmacy
- Solve the different types of problems by applying theory
- 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 (**Є** - δ definition)

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

UNIT II **6 Hours**

Matrices and Determinants

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

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 *xn w.r.t*x,where *n* is any rational number, Derivative of *ex,*, Derivative of loge *x* , Derivative of *ax,* Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at appoint and Applications

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 Editions):

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

Semester - II

BP201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

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

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

- Explain the gross morphology, structure and functions of various organs of the human body
- Describe the various homeostatic mechanisms and their imbalances
- Identify the various tissues and organs of different systems of human body
- 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 **10 Hours**

Respiratory System: Aatomy 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

BP207P. 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
4. Textbook of Medical Physiology- Arthur C, Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee Brothers Medical Publishers, New Delhi
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee Brothers Medical Publishers, New Delhi
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother's Medical Publishers, New Delhi.

Reference Books (Latest Editions):

1. Physiological Basis of Medical Practice-Best and Tailor, Williams & Wilkins Co, MI, U.S.A.
2. Textbook 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

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:

- Write the structure, name and the type of isomerism of the organic compound
- Write the reaction, name the reaction and orientation of reactions
- Account for reactivity/stability of compounds
- Identify/confirm the identification of organic compound

Course Content

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, Stereoisomerism, Optical activity, enantiomerism, diastereoisomerism, meso compounds, DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers.

UNIT-II **10 Hours**

Alkanes*, Alkenes* and Conjugated dienes*: SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III **10 Hours**

Alkyl Halides*: SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1versus 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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours/Week

1. Systematic qualitative analysis of unknown organic compounds like
    a. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
    b. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne'stest
    c. Solubility test
    d. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides
    e. Melting point/Boiling point of organic compounds
    f. Identification of the unknown compound from the literature using melting point/ boiling point
    g. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point
    h. 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 Chemistryby 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 Ahluwaliah/Chatwal

BP203T. 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:

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

Course Content

UNIT I **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. Oxidative phosphorylation & its mechanism and substrate level Phosphorylation. Inhibitors ETC and oxidative phosphory-lation/ 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, fattyliver and obesity.

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

UNIT IV **10 Hours**

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

UNIT V **07 Hours**

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

BP209P. 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

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 Edn.
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna
11. Practical Biochemistry by Harold Varley

BP204T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45 Hours

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

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

- Understand methods of identification, cultivation and preservation of various microorganisms
- To understand the importance and implementation of sterlization in pharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products
- Carried out microbiological standardization of Pharmaceuticals
- 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 **07 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research

BP210P. PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hours / 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 Editions):

1. W.B. Hugo & A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific pub. Oxford London
2. Prescott and Dunn, Industrial Microbiology, 4th Edn., 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. Edn. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution
8. Peppler: Microbial Technology
9. Indian Pharmacopoeia, British Pharmacopoeia and United States Pharmacopoeia
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

BP205T. Computer Applications in Pharmacy-I

30 Hours

Course Content

UNIT-I **10 hours**

Computer Architecture & Ms Dos-Disk Operating System: Evolution of Microprocessors, Computer Generations, Architecture of the General purpose computer, Memories, Optical Disks, Cache memories, Input/output Devices, , Assemble languages, Machine languages. Introduction Need of Operating System, Functions of Operating System, Introduction of Ms Dos, Directory structure of Ms Dos Internal commands, External commands

UNIT-II **10 hours**

Number System: Binarynumbersystem,Decimalnumbersystem,Octalnumbersystem,Hexadecimalnumbersystems,conversiondecimaltobinary,binarytodecimal,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 lifecycle, planning and managing theproject.

UNIT-III **10 hours**

MS Office Applications: Introduction of MS word, Word Control functions, Editing Document, Find and Replace, Tab stops, Formatting the documents, Spell check, Tables & Graphic preparation, Graphic Advance Tools. Introduction of MS Excel, Excel Basics, Editing cell contents, Work sheet, Command for Work sheet, Introduction of MS PowerPoint, Steps to a Presentation, Adding new slides, Editing & Formatting new slides, Creating slide show

BP211P. COMPUTER APPLICATIONS IN PHARMACY- I PRACTICAL

Use of MS-DOS commands like DATE, TIME, DIR,COPY CON, MD, CD,RD,COPY, DEL, FORMAT, PATH etc.
At least five exercises each in MS-WORD and MS-EXCEL using various features available/ preparation of documents-editing-tabulation of data generation of charts. Convert the binary number 11001 to decimal. Convert the decimal number 45 to binary Convert the hexadecimal number B2 to Binary Convert the binary number 11011 to hexadecimal.

Recommended Books (Latest Edition):

1. Fundamentals of Computers – E. BalaguruSamy
2. MS Office 2007 In A Nutshell - Sanjay Saxena (Reprint Edition 2015)
3. Computer Applications In Pharmaceutical Sciences Ukaaz Publications, Syed Mohiuddin and A.Venkateswar Reddy

Online Resources:-

a. http://www.tutorialspoint.com/computer_fundamentals/index.html
b. http://www.tutorialspoint.com/computer_fundamentals/computer_number_system.html
c. https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_office_tools

BP206T. 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:

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

Course Content

UNIT-I **10 hours**

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources: Naturalresources 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 **10 hours**

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

SEMESTER- III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds is also studied. 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:

- Write the structure, name and the type of isomerism of the organic compound
- Write the reaction, name the reaction and orientation of reactions
- Account for reactivity/stability of compounds
- Prepare 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

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

Reactions of benzene-nitration, sulphonation, halogenation-reactivity, Friedel Craft's alkylation-reactivity, limitations and Friedel Craft's acylation

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

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 and 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.

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

UNIT- III **10 Hours**

Fats and Oils: Fatty acid –reactions

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

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:

Synthesis, reactions, 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 and Sachse Mohr's theory (Theory of strainless rings)

BP306P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hours/Week

1. Experiments involving Laboratory Techniques: Recrystallization and Steam distillation
2. Determination of following oil values (including standardization of reagents) Acid value, Saponification value & Iodine value
3. Preparation of Compounds
   a. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/Phenol /Aniline by acylation reaction.
   b. 2, 4, 6-Tribromo aniline/Para bromo acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction.
   c. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitrobenzene by nitration reaction.
   d. Benzoic acid from Benzyl chloride by oxidation reaction.
   e. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
   f. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
   g. Benzil from Benzoin by oxidation reaction.
   h. Dibenzal acetone from Benzaldehyde by Claisen- Schmidt reaction, Cinnammic acid from Benzaldehyde by Perkin reaction
   i. 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
8. Introduction to Organic Laboratory Techniques by Pavia, Lampman and Kriz

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45 Hours

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

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

- Understand various physicochemical properties of drug molecules in the designingthe dosage forms
- Know the principles of chemical kinetics and to use them for stability testing and determination of expiry date of formulations
- 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 **10 Hours**

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 and polymorphism

Physicochemical Properties of Drug Molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III **10 Hours**

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

UNIT-IV **08 Hours**

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 stabilityconstants

UNIT-V **07 Hours**

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

BP307P. PHYSICAL PHARMACEUTICS –I (Practical)

4 Hours/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 CCl_4 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 charcoal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubilitymethod
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, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, Volume-1 to 3, Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and Manavalan R.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP303T. PATHOPHYSIOLOGY (THEORY)

45 Hours

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:

- Describe the etiologyand pathogenesis of the selecteddisease states
- Name the signs and symptoms of the diseases
- Mention the complications of the diseases

Course Content

UNIT-I **10 Hours**

Basic Principles of Cell Injury and Adaptation:

Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,** Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage)**,** Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,** Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance.

Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

UNIT-II **10 Hours**

Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)

Respiratory System: Asthma, Chronic obstructive airways diseases

Renal system: Acute and chronic renal failure

UNIT-III **10 Hours**

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B_{12} and folic acid), sickle cell anemia, thalasemia, 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 **08 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

UNIT-V **07 Hours**

Infectious Diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections

Sexually Transmitted Diseases: AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions):

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran Pathologic Basis of Disease; South Asia Edn.; India; Elsevier; 2014
2. Harsh Mohan; Text Book of Pathology; 6th Edn.; India; Jaypee Publications; 2010
3. Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th Edn. 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 Edn.; 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 Edn. London; ELBS/Churchill Livingstone; 2010
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th Edn. WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th Edn. London; McGraw-Hill Medical; 2014
9. V.Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th Edn. Philadelphia; WB Saunders Company; 1997
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd Edn. 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

BP304T. 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 to:

- Know various UNIT operations used in Pharmaceutical industries
- Understand the material handling techniques
- Perform various processes involved in pharmaceutical manufacturing process
- Carry out various tests to prevent environmental pollution
- Appreciate and comprehend significance of plant lay out design for optimum use of resources
- 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 and 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 and elutriation tank

UNIT-II **10 Hours**

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers and 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 and molecular distillation

UNIT- III **10 Hours**

Drying: Objectives, applications and 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 and 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

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/Week

1. Determination of radiation constant of brass, iron, unpainted and painted glass
2. Steam distillation –To calculate the efficiency of steam distillation
3. To determine the overall heat transfer coefficient by heat exchanger
4. Construction of drying curves (for calcium carbonate and starch)
5. Determination of moisture content and loss on drying
6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method
7. Description of Construction working and application of Pharmaceutical Machinerysuch as rotary tablet machine, fluidized bed coater, fluid energy mill and dehumidifier
8. Size analysis by sieving –To evaluate size distribution of tablet granulations –Construction of various size frequency curves including arithmetic and logarithmic probabilityplots
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
12. To study the effect of time on the Rate of Crystallization
13. To calculate the uniformity Index for given sample by using Double Cone Blender

Recommended Books(Latest Editions):

1. Introduction to Chemical Engineering – Walter L Badger & Julius Banchero
2. Solid Phase Extraction, Principles, Techniques and Applications by Nigel J.K. Simpson
3. UNIT Operation of Chemical Engineering –Mcabe Smith
4. Pharmaceutical Engineering Principles and Practices – C.V.S Subrahmanyam et al.,
5. Remington Practice of Pharmacy- Martin
6. Theory and Practice of Industrial Pharmacy by Lachmann
7. Physical Pharmaceutics- C.V.S Subrahmanyam et al.
8. Cooper and Gunn's Tutorial Pharmacy, S.J. Carter

BP305T. Computer Applications in Pharmacy- II

Course Content **30 Hours**

UNIT-I **10 Hours**

Application of computers in Pharmacy: Introduction, Networking Communication system elements, Internet protocols, OSI Models. Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to data bases, MYSQL, Pharmacy Drug database. Drug information storage and retrieval, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherencemonitoring

UNIT-II **10 Hours**

Bioinformatics: Origin and History of Bioinformatics, Features of biological databases, Bioinformatics database, Brief classification of Database, Concept of bioinformatics, Impact of Bioinformatics in Vaccine Discovery. Web-based Sequence Analysis: Introduction to NCBI and Entrez, Introduction Basic Local Alignment Search Tool (BLAST), purpose of BLAST, BLAST Analysis, Working of BLAST Algorithm, Biological Analysis of BLASTN, Introduction to FASTA

UNIT-III **10 Hours**

Computers as data analysis in Preclinical development:Computers as data analysis in Preclinical development, Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS), Applications of LIMS, Benefits of LIMSText Information Management System (TIMS)

BP309P 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. Networks Uses in Computers
4. Introduction to NCBI and Entrez Applications
5. Analysis, Working of BLAST & FASTA Algorithm
6. Laboratory Information Management System (LIMS)
7. Text Information Management System (TIMS)
8. Chromatographic Dada Analysis (CDS)

Recommended Books (Latest Editions):

1. Microsoft Office Access 2003, Application Development Using VBA, SQL Server, DAP and Info Path– Cary N. Prague–Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, NewDelhi–110002
2. Computer Applications In Pharmaceutical Sciences Ukaaz publications, authors Syed Mohiuddin, A. Venkateswar Reddy
3. LIMS by Stavros Archondakis, Anastasia Kastania, Anastasias Moumtzoglou. Publisher: IGI Global Release Date: July 2014 ISBN: 9781466663206
4. Lab Information Management (LIMS) for Cannabis Quality Assurance www.lablynx.com published by: Lab Lynx Press.
5. Bioinformatics: Basics, Algorithms and Applications Publisher: Universities Press; First Edn. Paperback – 2010
6. http://www.w3schools.com/hTml/html_intro.asp https://www.tutorialspoint.com/ms_access/
7. https://www.bits.vib.be/training-list/111-bits/training/previous-trainings/122-basic-bioinformatics
8. https://www.slideshare.net/JYOTIRMOYROY11/laboratory-information-management-system-lims- 76379668

SEMESTER- IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY–III (Theory)

45 Hours

Scope: This subject imparts knowledge on stereochemical 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:

- Understand the methods of preparation and properties of organic compounds
- Explain the stereochemical aspects of organic compounds and stereochemical reactions
- 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**

Stereoisomerism 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, reactions of cyclopropane and cyclobutane

UNIT-II **10 Hours**

Geometrical isomerism, nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems). Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic Compounds: Nomenclature and Classification Synthesis, reactions and medicinal uses of following compounds/derivatives- Pyrrole, Furan, and Thiophene. Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **08 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, Beckmann's 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 structural activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

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

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship (SAR) of different class of drugs
- Write the chemical synthesis of some drugs

Course Content

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structural 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, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline, Xylometazoline

Indirect Acting Agents: Hydroxyamphetamine, 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*, Metipranolol, Atenolol, Betaxolol, 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, Isofluorphate, Echothiophate iodide, Parathion, Marathon

Cholinesterase Reactivator: Pralidoxime chloride

Cholinergic Blocking Agents: SAR of cholinolytic agents

Solanaceous Alkaloids and Analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropiumbromide*

Synthetic Cholinergic Blocking Agents: Tropicamide, Cyclopentolate hydrochloride, Clidiniumbromide, 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, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscellaneous: Amides & Imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehydes & 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 Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine

Fluro Buterophenones: Haloperidol, Droperidol, Risperidone

Beta Amino Ketones: Molindone hydrochloride

Benzamides: Sulpiride

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

Barbiturates: Phenobarbitone, Metharbital

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine Diones: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and Monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin and Felbamate

UNIT-V **07 Hours**

Drugs acting on Central Nervous System

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

- **a)** 1, 3-pyrazole
- **b)** 1, 3-oxazole
- **c)** Benzimidazole
- **d)** Benztriazole
- **e)** Diphenyl quinoxaline
- **f)** Benzocaine
- **g)** Phenytoin
- **h)** Phenothiazine
- **i)** Barbiturate

II Assay of Drugs

- **a)** Chlorpromazine
- **b)** Phenobarbitone
- **c)** Atropine
- **d)** Ibuprofen
- **e)** Aspirin
- **f)** 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
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

BP403T. PHYSICAL PHARMACEUTICS-II (Theory)

45 Hours

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

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

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
- 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 **08 Hours**

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

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

UNIT-III **10 Hours**

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

UNIT-IV **10 Hours**

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

UNIT-V **10 Hours**

Drug Stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical products: 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

BP407P. PHYSICAL PHARMACEUTICS- II (Practical)

4 Hours/Week

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

Recommended Books (Latest Editions):

1. Physical Pharmacy by Alfred Martin, Sixth Edn.
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, 2, 3. Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage Forms. Disperse systems, Volume 1, 2, 3. Marcel Dekkar In
7. Physical Pharmaceutics by Ramasamy C and Manavalan R.

BP404T. PHARMACOLOGY-I (Theory)

45 Hours

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

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases
- Observe the effect of drugs on animals by simulated experiments
- 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 Parkinson's disease and Alzheimer's disease

c. CNS stimulants and nootropics

d. Opioid analgesics and antagonists

e. Drug addiction, drug abuse, tolerance and dependence

BP408 P. PHARMACOLOGY-I (Practical) **4 Hours/Week**

1. Introduction to experimental pharmacology
2. Commonly used instruments in experimental pharmacology
3. Study of common laboratory animals
4. Maintenance of laboratory animals as per CPCSEA guidelines
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies
6. Study of different routes of drugs administration in mice/rats
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye
10. Effects of skeletal muscle relaxants using rota-rod apparatus
11. Effect of drugs on locomotor activity using actophotometer
12. Anticonvulsant effect of drugs 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 Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., 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.,, Applied Therapeutics, Lippincott Williams
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 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 M.N., Fundamentals of Experimental Pharmacology, Hilton & Company, Kolkata
10. Kulkarni SK., Handbook of Experimental Pharmacology, Vallabh Prakashan

BP405T. 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:

- To know the techniques in the cultivation and production of crude drugs
- To know evaluation of crude drugs as per WHO & ICH Guidelines
- To know the crude drugs, their uses and chemical nature
- To know the evaluation techniques for the herbal drugs
- 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

UNIT-II **10 Hours**

Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods. Evaluation of Drugs: WHO & ICH guidelines for the assessment of herbal drugs. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida

UNIT- III **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. Biodynamic Agriculture. Good agricultural practices in cultivation of medicinal plants including Organic farming, Biopesticides/Bioinsecticides. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. Conservation of medicinal plants

UNIT- IV **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-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

BP408P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

1. Analysis of crude drugs by chemical tests: (i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) Starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and palisideratio.
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 sporemethod
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 index

Recommended Books (Latest Editions):

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th Edn., W.B. Sounders & Co., London
2. Tyler V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia
3. Textbook of Pharmacognosy by T.E. Wallis
4. Mohammad Ali, Pharmacognosy and Phytochemistry, CBS Pub. New Delhi
5. Textbook of Pharmacognosy by C.K. Kokate, Purohit, 37th Edn.,Nirali Prakashan, New Delhi
6. Herbal Drug Industry by R.D. Choudhary (1996), 1st Edn., Eastern Publisher, New Delhi
7. Essentials of Pharmacognosy, Dr. SH. Ansari, 2nd Edn., Birla publications, New Delhi
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar

SEMESTER- V

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 structural activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class

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

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effects and therapeutic value of drugs
- Know the Structure-Activity Relationship of different classes of drugs
- 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 human body

H1–Antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelennamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenindamine tartrate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatadine maleate, Astemizole, Loratadine, Cetirizine, Levocetirizine, Cromolyn sodium

H2-Antagonists: Cimetidine*, Famotidine, Ranitidin

Gastric Proton Pump Inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Antineoplastic Agents:

Alkylating Agents: Mechlorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant Products: Etoposide, Vinblastine sulphate, Vincristine sulphate

Miscellaneous: Cisplatin, Mitotane

UNIT-II **10 Hours**

Anti-anginal

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

Calcium Channel Blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine

Diuretics:

Carbonic Anhydrase Inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide

Thiazides: Chlorothiazide*, 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 monosulfate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine Hydrochloride

UNIT- III **10 Hours**

Antiarrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol

Anti-Hyperlipidemic Agents: Clofibrate, Lovastatin, Cholestyramine, 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, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol

Drugs for Erectile Dysfunction: Sildenafil, Tadalafil

Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel

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

Sulfonylureas: 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, Meprylcaine, Cyclomethycaine, Piperocaine

Amino Benzoic Acid Derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate

Lidocaine/Anilide Derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine

Miscellaneous: Phenacaine, Diperodon, 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. 1 to 5
9. Indian Pharmacopoeia
10. Textbook of Practical Organic Chemistry- A.I.Vogel

BP502T INDUSTRIAL PHARMACY I (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:

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

Course Content

UNIT-I **07 Hours**

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

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

Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significance. 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: Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling

Tablet Coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. 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, equipment for manufacture of pellets

UNIT-IV **10 Hours**

Parenteral Products: Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity. Production procedure, production facilities and controls, aseptic processing. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. 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

BP506 Industrial Pharmacy I (Practical) 4 Hours /Week

1. Preformulation studies on paracetamol/aspirin/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 tablets/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Quality 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, Vol. 1 -3 by H.A. Liberman, Leon Lachman
2. Pharmaceutical Dosage Form - Parenteral Medication vol- 1 & 2 by Liberman
3. Pharmaceutical Dosage Form Disperse System VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edn.
5. Remington: The Science and Practice of Pharmacy, 20th Edn.
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics-The Science of Dosage Form Design by M.E.Aulton, Churchill livingstone
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea & Febiger, Philadelphia, 5th Edn.
9. Drug Stability - Principles and Practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol.107

BP503T. 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 the body and in addition, emphasis on the basic concepts of bioassay

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

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

Course Content

UNIT-I **10 Hours**

1. Pharmacology of Drugs Acting on Cardiovascular 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 **10 Hours**

1. Pharmacology of Drugs Acting on Cardiovascular 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 **10 Hours**

3. Autocoids and Related Drugs

a. Introduction to autacoids and classification

b. Histamine, 5-HT and their antagonists.

c. Prostaglandins, Thromboxanes and Leukotrienes

d. Angiotensin, Bradykinin and Substance P

e. Non-steroidal anti-inflammatory agents

f. Anti-gout drugs

g. Antirheumatic drugs

UNIT-IV **08 Hours**

4. Pharmacology of Drugs Acting on Endocrine

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

e. Insulin, Oral Hypoglycemic agents and glucagon

f. ACTH and corticosteroids

UNIT-V **07 Hours**

5. Pharmacology of Drugs Acting on Endocrine

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

BP507P.PHARMACOLOGY-II (Practical) **04 Hours / Week**

1. Introduction to *In-vitro* pharmacology and physiological salt solutions
2. Effect of drugs on isolated frog hearts
3. Effect of drugs on blood pressure and heart rate of dogs
4. Study of diuretic activity of drugs using on 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 PA2 value of prazosin using rat anococcygeus muscle (by Schild Plot method)
12. Determination of PD2 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., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Basic and Clinical Pharmacology, Tata McGraw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y and at al., Applied Therapeutics, Lippincott Williams
5. Mycek M.J, Gelnet S.B Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6. K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Publishers. 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

BP504T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory) 45 Hours

Scope: The main purpose of the subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate, identify and produce them industrially.

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

- Know the basic pathways leading to the formation of secondary metabolites
- Know the modern extraction techniques and isolotation of phytoconstituents
- Characterization and analysis of herbal drugs and phytoconstituents

Course Content

UNIT-I **07 Hours**

Metabolic Pathways in Higher Plants and Their Determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathway and Amino acid pathway
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies

UNIT-II **14 Hours**

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

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium
Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other Terpenoids & Naphthoquinones: Gentian, Artemisia, Taxus, Carotenoids
Identification tests for individual categories of the secondary metabolites

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisinin

b) Glycosides: Glycyrrhetinic acid, Rutin

c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine

d) Resins: Podophyllotoxin, Curcumin

Suitable analysis method for the respective compounds (preferably TLC)

UNIT-IV **10 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.

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT-V **08 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

BP508P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical) 04 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. Trease and Evans Pharmacognosy, 16th Edn. W.B. Sounders & Co., London, 2009
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Pub. New Delhi
3. Textbook of Pharmacognosy by C. K. Kokate, 37th Edn., Nirali Prakashan, New Delhi
4. Herbal Drug Industry by R. D. Choudhary 1st Edn, Eastern Publisher, New Delhi
5. Essentials of Pharmacognosy, Dr.S. H. Ansari, 2nd Edn, Birla Publications, New Delhi
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 by James Bobbers, Marilyn KS, VE Tylor
10. The Formulation and Preparation of Cosmetic, Fragrances and Flavours, Louis Appell, Micelle Press; 2nd Revised Edn.
11. Remington's Pharmaceutical Sciences
12. Textbook of Biotechnology by Vyas and Dixit
13. Textbook of Biotechnology by R.C. Dubey

BP505T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45Hours

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:

- The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals
- Various Indian pharmaceutical Acts and Laws
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- 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:

Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & Drugs and Magic Remedies Act and other Acts

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 and Drug Inspectors

UNIT-III **10 Hours**

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

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

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

UNIT-IV **08 Hours**

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

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

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

UNIT-V **07 Hours**

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

Code of Pharmaceutical Ethics: Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

Medical Termination of Pregnancy Act

Right to Information Act

Introduction to Intellectual Property Rights (IPR)

Books (Latest Edition):

1. Forensic Pharmacy by B. Suresh
2. Textbook of Forensic Pharmacy by B.M. Mithal
3. Handbook of Drug Law-by M.L. Mehra
4. A Textbook 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 the Government and Reference Books

SEMESTER- VI

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:

- Understand the importance of drug design and different techniques of drug design
- Understand the chemistry of drugs with respect to their biological activity
- Know the metabolism, adverse effects and therapeutic value of drugs
- 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: Penicillins, Cepholasporins, 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

Macrolides: 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 dihydrotriazines: Cycloguanil pamoate, Proguanil

Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovoquone

UNIT-III **10 Hours**

Anti-Tubercular Agents

Synthetic anti tubercular Agents: Isoniozid*, 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, Cciprofloxacin, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxcin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral Agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir and Ritonavir

UNIT-IV **08 Hours**

Antifungal Gents:

Antifungal Antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin

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

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

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

Sulphonamides and Sulfones

Historical development, Chemistry, Classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine

Folate Reductase Inhibitors: Trimethoprim*, Co-trimoxazole. **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, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques

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

BP608P. MEDICINAL CHEMISTRY- III (Practical)

4 Hours / Week

1. **Preparation of Drugs and Intermediates**
   a) Sulphanilamide **b)** 7-Hydroxy, 4-Methyl Coumarin **c)** Chlorobutanol **d)** Triphenyl imidazole **e)** Tolbutamide **f)** Hexamine
2. **Assay of Drugs**
   a) Isonicotinic acid hydrazide **b)** Chloroquine **c)**.Metronidazole **d)** Dapsone **e)** Chlorpheniramine maleate **f)** Benzyl penicillin
3. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique
4. Drawing structures and reactions using ChemDraw®
5. 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 (Lipinski's 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. Textbook of Practical Organic Chemistry- A.I.Vogel.

BP602T. 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:

- Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
- Comprehend the principles of toxicology and treatment of various poisonings
- Appreciate correlation of Pharmacology with related medical sciences

Course Content

UNIT-I **10 Hours**

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 **10 Hours**

Chemotherapy

a) General principles of chemotherapy **b)** Sulfonamides and Co-trimoxazole.

c) Antibiotics- Penicillins, Cephalosporins, Chloramphenicol,

Macrolides, Quinolones and Fluoroquinolins, Tetracycline and Aminoglycosides

UNIT-III **10 Hours**

Chemotherapy

a) Antitubercular agents **b)** Antileprotic agents **c**) Antifungal agents

d) Antiviral drugs **e)** Anthelmintics **f)** Antimalarial drugs **g)** Antiamoebic agents

UNIT-IV **08 Hours**

1. Chemotherapy

a) Urinary tract infections and sexually transmitted diseases **b)** Chemotherapy of malignancy

2. Immunopharmacology

a) Immunostimulants **b)** Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07 Hours**

1. 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

2. Chronopharmacology

a) Definition of rhythm and cycles **b)** Biological clock and their significance leading to chronotherapy

BP609P. PHARMACOLOGY-III (Practical)

4 Hours/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- auto analyser
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 and 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., Rang and Dale's Pharmacology, ChurchilLivingstone Elsevier
2. Katzung B. G., Masters S. B., Basic and Clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K and at al.. Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J,& Gelnet S.B Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Pub.
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
10. Kulkarni SK. Handbook of Experimental PharmacologyVallabh Prakashan
11. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology

BP603T. 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 materials, guidelines for quality control 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:

- Understand the significance of herbs as raw materials and as therapeuticnan agents
- To know principles of traditional systems of medicine
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- 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

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

Indian Systems of Medicine:

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy

b) Preparation and standardization of Ayurvedic formulations viz Arista and Asava, Ghutika, Churna, Lehya and Bhasma

UNIT-II **07 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: Alfa-alfa, 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, Ginkgo biloba, Ginseng, Garlic, Pepper and 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: Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscositybuilders, disintegrants, flavors and perfumes.

Herbal Formulations: Conventional herbal formulations like syrups, mixtures and tablets & Novel dosage forms like phytosomes

UNIT- IV **10 Hours**

Evaluation of Drugs, Stability testing of herbal drugs

Patenting and Regulatory Requirements of Natural Products:

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

b)Patenting aspects of Traditional Knowledge and Natural Products

c) 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**

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

BP 610 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. Pharmacopoeial 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

BP604T. 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 arised therein.

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

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

Course Content

UNIT-I **10 Hours**

Introduction to Biopharmaceutics

Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes

Distribution: Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein binding. Kinetics of protein binding, Clinical significance of in binding of drugs

UNIT-II **10 Hours**

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

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

UNIT- III **10 Hours**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, 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 - Ke , t1/2, Vd, AUC, Ka, Clt and CLR- definitions, methods of eliminations, understanding of their significance and application.

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-menten 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 Edn., Prentice-Hall
4. Biopharmaceutics and Pharmacokinetics-A Treatise by D. M. Brahmankar Vallabh Prakashan Pitampura
5. Pharmacokinetics by Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science
7. Biopharmaceutics by Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications by Malcolm Rowland and Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995
9. Dissolution, Bioavailability and Bioequivalence, by Abdou H.M, Mack, Pub. Company,Pennsylvania 1989
10. Biopharmaceutics and Clinical Pharmacokinetics 4th edn. by Rebort F Notari Marcel Dekker Inn
11. Remington's Pharmaceutical Sciences by Mack Publishing Company, Pennsylvnia

BP605T- 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:

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

Course Content

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
b) Hypersensitivity reactions, Immune stimulation and Immune suppressions
c) General method of preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum- immune blood derivatives and other products relative to immunity
d) Storage conditions and stability of official vaccines
e) Hybridoma technology- Production, Purification and Applications
f) Blood products and Plasma Substitutes

UNIT-IV **08 Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting
b) Genetic organization of Eukaryotes and Prokaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons
d) 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, equipment's, 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,Glutamicacid, Griseofulvin
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, Plasma Substituties

Recommended Books (Latest Editions):

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

BP606T. PHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Scope: This Course deals with various aspects of Quality control and Quality Assurance aspects ofPharmaceutical Industry. It deals with important aspects like cGMP, QC tests, Documentation, Quality Certifications and Regulatory Affairs.

Objectives: Upon Completion of the Course, the 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 Industry
- 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 Personnel 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 Non-Clinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT–IV **08 Hours**

Complaints: Complaints and Evaluation of Complaints, Handling of Return goods, Product Recall 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 Edn., Sandy Weinberg Vol.69
3. Quality Assurance of Pharmaceuticals Vol. I, WHOPublications
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's –P P Sharma
6. ISO9000 and TotalQuality Management–Sadhank G Ghosh
7. The International Pharmacopoeia –Vol. I to IV- General Methods of Analysis and Quality Specification for Pharmaceutical Substances, Excipients and Dosage Forms
8. Good Laboratory Practices –Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 Guidelines

BP607T. Advanced Computers & Communication Skills

40 Hours

Course Content

UNIT-I **03 Hours**

Data Base Management System (DBMS)

Introduction of DBMS, History of DBMS, Components of DBMS, Data Structure, Database query language, DBMS views, advantages and disadvantages of database management system, concept and objectives of DBMS, examples of DBMS packages

UNIT-II **04 Hours**

Introduction to AI Applications in Pharmacy

Artificial Intelligence Introduction, Problem Solving, Knowledge Representation, Python Programming & Applications in Healthcare (FDA approved applications)

UNIT-III **03 Hours**

Computers in Community Pharmacy

Computerizing the Prescription dispensing process, Use of computers for Pharmaceutical care in community pharmacy, Computers in medical device networking, computers in patient education, computers in patient monitoring system, computers maintenance management system

Recommended Books (Latest Editions):

1. Computer Applications In Pharmaceutical Sciences Ukaaz Publications, author' Syed Mohiuddin, A. Venkateswar Reddy
2. Statistical Methods and Computer Applications Pharmaplus Publications
3. Pharmaceutical Statistics- Practical and Clinical Applications, Sanford Bolton 3rdedition, Publisher Marcel Dekker Inc. New York
4. Drug Information- Hill Publications 2006, 3rd Edn., Patrick M Malone, Karen L. Kier
5. Artificial Intelligence – A Modern Approach (3rd Edition), James V Stone

BP611P. Advanced Computers & Communication Skills (Practical)

03 Hours/Week

List of Activities: **10 Hours**

- Create database in Ms-Access and excel, create spreadsheet application in DBMS
- Selecting cell with the keyboard, Entering and editing text in DBMS, multi user access to a single database
- Preserve and maintain some relevant backups, support of online documentation.
- Enrolment of patients, Patient dairy maintenance, Dispensing and allotment of
- Medications, real time reporting

Useful URLs for Reference:

- ✓ https://clinirex.com/
- ✓ https://www.medscape.com/public/medscapeapp
- ✓ https://play.google.com/store/apps/details?id=com.truven.druginfonative.customer&hl=en_IN
- ✓ https://play.google.com/store/apps/details?id=com.drugscom.app&hl=en_IN

Advanced English & Communication Skills

List of Activities: **20 Hours**

Course Content

Advanced Vocabulary & Grammar **04 Hours**

Word Analogy-Prefixes and Suffixes-Antonyms and Synonyms-One Word Substitions Spotting Errors and Correction of Sentences

Reading Comprehension **04 Hours**

Reading for information- Skimming & Scanning- Critical Reading and Reading Between/Beyond the Lines- Inference-Practice Tests for Reading (BEC-Model) CEFR Level

Interview Skills **04 Hours**

Preparing Resume-Attending a Job Inteview: Preparing for an Interview- Being Assertive-Projecting One's Self as a Prospective Candidate-Do's and Dont's

Presentation Skills **04 Hours**

Planning your Presentation, Know Your Audience-Structuring –Managing Time-Delivering- Managing Stage Fear- Body Language & Eye Contact- Handling Q&A Session

Group Discussion **04 Hours**

Introduction-Communication Skills in Group Discussion-Group Dynamics in GD- Do's and Dont's of Group Discussion

Recommended Books (Latest Editions):

1. English Language Laboratories: A Comprehensive Manual, Konar, Prentice Hall India Learning Private Limited (2011)
2. Communication Skills, Sanjay Kumar, Pushpalata, 1st Edn., Oxford Press, 2011
3. Objective General English (New Revised Edition-2018), R. S. Aggarwal & Vikas Aggarwal, S. Chand Publishing
4. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edn., Pearson, 2013

SEMESTER - VII

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 fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic 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 interaction of matter with electromagnetic radiations and its applications in drug analysis
- Understand the chromatographic separations and analysis of drugs
- 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 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 application

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)

04 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. Textbook of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Textbookof 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

BP702T. INDUSTRIAL PHARMACY-II (Theory)

45 Hours

Scope: This Course is designed to impart fundamental knowledge on Pharmaceutical Product Development and transitition from laboratory Scale to Market Scale.

Objectives: Upon Completion of the Course, the Student shall be able to:

- Know the Process of Pilot plant and Scale up of Pharmaceutical Dosage Forms
- Understand the process of Technology Transfer from Lab scale to Commercial Batch Scale
- Know different Laws and Acts that regulate PharmaceuticalIndustry
- 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, RawMaterials, Pilot Plant Scale-up Considerations for Solids, Liquid orals, Semi-Solids and relevant Documentation, SUPAC Guidelines, Introduction to PlatformTechnology.

UNIT-II **10 Hours**

Technology Development and Transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer Protocol, Quality Risk Management, Transferfrom 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 relatedDocumentation- 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 / BEStudies,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 NewDrugs.

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. Textbook of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' 2nd Edn.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.html

BP703T. 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:

- Know various drug distribution methods in a hospital
- Appreciate the pharmacy stores management and inventory control
- Monitor drug therapy of patient through medication chart review and clinical review
- Obtain medication history interview and counsel the patients
- Identify drug related problems
- Detect and assess adverse drug reactions
- Interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
- Know pharmaceutical care services
- Do patient counseling in Community pharmacy
- Appreciate the concept of Rational drug therapy

Course Content

UNIT-I **10 Hours**

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

b) **Hospital Pharmacy and its Organization:** Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacist.

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) **Drug Information Services:** 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 **08 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 **07 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 and 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 Edn., B.S. Shah Prakakshan;
2. Parthasarathi G, Karin & Nyfort-Hansen. A Textbook Clinical Pharmacy Practice, 1st Edn. Orient Longman Pvt.Ltd.
3. William E. Hassan. Hospital Pharmacy, 5th Edn. Philadelphia: Lea & Febiger; 1986
4. Tipnis Bajaj. Hospital Pharmacy, 1st Edn. Career Publications
5. Scott LT. Basic skills in interpreting laboratory data, 4th Edn. American Society of Health System Pharmacists Inc.
6. Parmar N.S. Health Education and Community Pharmacy, 18th Edn. CBS Publishers

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)

BP704T. 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 to:

- Understand various approaches for development of novel drug delivery systems.
- Uunderstand 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 Edn.Marcel Dekker, Inc., New York.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York,
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, John Wiley and Sons, Inc, New York.
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers, 1st Edn.,
5. S.P.Vyas and R.K.Khar, Controlled Drug Delivery, Vallabh Prakashan, New Delhi, 1st Edn.

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. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Scope: To understand the applications of Biostatics 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 and 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) and Least Significance Difference

UNIT-III **10 Hours**

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

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

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot and 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 and various phases

UNIT-IV **08 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 **07 Hours**

Design and Analysis of Experiments

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

Response Surface Methodology: Central composite design, Historical design and Optimization Techniques

Recommended Books (Latest Editions):

1. Pharmaceutical Statistics by Sanford Bolton, publisher Marcel Dekker Inc. NewYork
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

BP802T. SOCIAL AND PREVENTIVE PHARMACY

45 Hours

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; The 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 Editions):

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edn., JAYPEE Pub.
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edn. JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edn. JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edn. JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edn. Banarsidas Bhanot Publishers.
6. Community Pharmacy Practice, Ramesh Adepu, BSP Publishers, Hyderabad

Recommended Journals: 1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP804ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45 Hours

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:

- Know about the process of drug discovery and development
- Know the regulatory authorities and agencies governing the manufacture and sale ofpharmaceuticals
- Know the regulatory approval process and their registration in Indian and international markets

Course Content

UNIT-I **10 Hours**

New Drug Discovery and Development: Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT-II **10 Hours**

Regulatory Approval Process: Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), and Abbreviated New Drug Application (ANDA). Changes to an approved NDA /ANDA.

Regulatory Authorities and Agencies: Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications).

UNIT-III **10 Hours**

Registration of Indian Drug Product in Overseas Market: Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) Research.

UNIT-IV **08 Hours**

Clinical Trials: Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee- formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

UNIT-V **07 Hours**

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

Recommended Books (Latest Editions):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, 2nd Edn. Edited by Ira R. Berry and Robert P. Martin, Vol.185. Informa Health Care Publishers
3. New Drug Approval Process By Richard A Guarino, MD, 5th Edn., Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs, 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 By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, 2nd Edn. by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, 2nd Edn. By Rick Ng

BP806ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

45 hours

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:

- Know WHO guidelines for quality control of herbal drugs
- Know Quality assurance in herbal drug industry
- Know the regulatory approval process and their registration in Indian and internationalmarkets
- Appreciate EU and ICH guidelines for quality control of herbal drugs

Course Content

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: cGMP, GAP, GMP and GLP in traditional systems of medicine WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines

WHO Guidelines on GACP for Medicinal Plants

UNIT-III **10 Hours**

EU and ICH guidelines for quality control of herbal drugs
Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

UNIT- IV **08 hours**

Stability testing of herbal medicines

Application of various chromatographic techniques in standardization of herbal products

Preparation of documents for New Drug Application and export registration

GMP requirements and Drugs & Cosmetics Act provisions

UNIT-V **7 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., Textbook of Pharmacognosy and Phytochemistry, Vol. I, Career 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. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998
9. 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
10. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd Edn. World Health Organization, Geneva, 1981
11. WHO Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999
12. 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
13. WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants World Health Organization, Geneva, 2004

BP807ET. 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, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA

UNIT-III **10 Hours**

Molecular Modeling and Virtual Screening Techniques

Virtual Screening Techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,

Molecular Docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design

UNIT-IV **08 Hours**

Informatics & Methods in Drug Design: Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases

UNIT-V **07 Hours**

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination

Recommended Books (Latest Editions):

1. Robert GCK, Edn., "Drug Action at the Molecular Level" University Prak Press Baltimore
2. Martin YC. "Quantitative Drug Design" Dekker, New York
3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Textbook of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York
4. Foye WO, Principles of Medicinal Chemistry, Lea & Febiger
5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience
6. Wolf ME, Edn. "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, Edn., "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

BP809ET. COSMETIC SCIENCE (Theory)

45 Hours

Scope:

The purpose of this course is to introduce the students to the principles and formulation aspects of cosmetics. This course also introduced the fundamentals of cosmeceuticals.

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

- Know the principles and formulation of various cosmetics and cosmeceuticals
- Evaluate cosmetics according to the specifications
- Identify the excipients for formulating various cosmetics and cosmeceuticals

Course Content

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**

Role of herbs in Cosmetics: Sun protection, Classification of Sunscreens and SPF
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

Recommended Books (Latest Editions):

1) Harry's Cosmeticology, Wilkinson, Moore, 7th Edn., George Godwin

2) Cosmetics– Formulations, Manufacturing and Quality Control, P.P.Sharma, 4th Edn., Vandana Pub.

3) Textbook of Cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers

BP810ET. PHARMACOLOGICAL SCREENING METHODS (Theory)

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

Course Content

UNIT-I **08 Hours**

a. **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 and euthanasia

b. **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

UNIT-II **10 Hours**

Preclinical screening Models for CNS Activity: Analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiParkinsonism and Alzheimer's disease

UNIT-III **10 Hours**

Preclinical screening models for ANS activity: Sympathomimetics, sympatholytics, parasympathomimetics, skeletal muscle relaxants, drugs acting on eye and local anaethetics

UNIT-IV **12 Hours**

Preclinical screening Models for CVS Activity: -Antihypertensives, antiarrhythmic, anti plate and anticoagulants
Preclinical screening models for antiulcer, diuretics, antidiabetic, antidyslipidemic, anticancer and antiasthmatics

UNIT-V **05 Hours**

Research Methodology and Bio-statistics

Selection of research topic, review of literature, research hypothesis and studydesign Pre-clinical data analysis and interpretation use Students't' test and One-way ANOVA. Graphical representation of data

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. Introduction to Biostatistics and Research Methods by PSS Sundar Rao and J Richard
6. Biostatistics - A Foundation for Analysis in the Health Sciences - 10th Edition by Daniel W Wayne and Chad L Cross

BP811ET. 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_{13}-NMR, Chemical shift, factors affecting chemical shift, coupling constant, Spin - Spin coupling, relaxations, Instrumentation and Applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electronic impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation and applications

UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of Thermo gravimetric Analysis (TGA), Differential Thermal Analysis (DTA) and 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, 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. Textbook of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Textbook 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