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Course Structure and Syllabus

of

B.Pharm

School of Pharmacy and Life Sciences

2024

COURSE STRUCTURE AND SYLLABI

B. Pharm

2024-25 Batch

Centurion UNIVERSITY

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School of Pharmacy and Life Sciences
CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT
Odisha-752050, India

Web Site: - www.cutm.ac.in

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT, ODISHA

CERTIFICATE

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This is to certify that the syllabus of the B. Pharm Programme of the School of Pharmacy and Life sciences is approved in the 14th Academic Council Meeting held on 22nd November 2024.

Dean
School of Pharmacy and Life Sciences
CUTM, Odisha

SCHOOL OF PHARMACY AND LIFE SCIENCES

Centurion UNIVERSITY

Shaping Lives...
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Pharmacy Council of India

New Delhi

Rules & Syllabus for the

Bachelor of Pharmacy (B. Pharm) Course

[Framed under Regulation 6, 7 & 8

of the Bachelor of Pharmacy (B. Pharm) course regulations 2014]

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT

www.cutm.ac.in

2024

VISION:

To be a globally recognized centre for Teaching, Research and Entrepreneurial Training in Pharmaceutical Sciences and to provide Healthcare services for Societal needs.

MISSION:

- To nurture young minds into knowledgeable, skillful and ethical professionals to serve for the society.
- To support research in diverse ways by launching partnerships and collaborations.
- To ensure affordable health care by developing pharmaceutical formulations using in house resources.
- To inculcate the mindset for entrepreneurship and innovativeness to enrich the healthcare system.

PROGRAMME OBJECTIVES (PEOs):

PEO1: To produce Pharmacy graduates with strong basics and high technical knowledge to cater the various areas of Pharmaceutical industry.

PEO2: To provide the required training in all aspects to the graduates to work as a health care professional in community and hospital pharmacy.

PEO3: To cultivate an inclination for higher learning, entrepreneurial and research.

PEO4: To provide a Pharmacists to the society with skill and will to make and serve quality pills.

PROGRAMME OUTCOMES (POs):

At successfully completing the B. Pharm program, student should have achieved the following program outcomes mentioned below:

PROGRAM OUTCOMES (POs)	
PO 1	**Pharmacy Knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioural, social, and administrative pharmacy sciences; and manufacturing practices.
PO 2	**Planning Abilities:** Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
PO 3	**Problem analysis:** Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyse, evaluate and apply information systematically and shall make defensible decisions.
PO 4	**Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
PO 5	**Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfilment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and well-being.
PO 6	**Professional Identity:** Understand, analyse and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
PO 7	**Pharmaceutical Ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behaviour that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
PO 8	**Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
PO 9	**The Pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
PO 10	**Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO11	**Entrepreneurship**: Develop entrepreneurship skills that support the growth of Pharmaceutical Industry / Pharmaceutical Services leading to economic development.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

CHAPTER- I:
REGULATIONS

1. Short Title and Commencement

These regulations shall be called as "The Revised Regulations for the B. Pharm. Degree Program (CBCS)of the Pharmacy Council of India, New Delhi". They shall come into effect from the Academic Year 2017-18. The regulations framed are subject to modifications from time to time by Pharmacy Council of India.

2. Minimum qualification for admission

2.1 First year B. Pharm:

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

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

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

3. Duration of the program

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

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

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

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon

the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

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

7.2. Minimum credit requirements

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

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

8. Academic work

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

9. Course of Study

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

Table-I: Course of study for Semester-I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
	Total	**32/34$/36#**	**4**	**27/29$/30#**

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

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

* Non University Examination (NUE)

Table-II: Course of study for semester-II

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

Table-III: Course of study for semester-III

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

Table-IV: Course of study for semester-IV

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

Table-V: Course of study for Semester-V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial 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	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
	Total	**30**	**6**	**30**

Table-VII: Course of study for semester-VII

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

Table-VIII: Course of study for semester-VIII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813ET	Pharmaceutical Product Development			
BP813PW	Project Work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	**27/29$/30#**
II	**29**
III	**24**
IV	**28**
V	**26**
VI	**30**
VII	**24**
VIII	**22**
Extracurricular/ Co-curricular activities	**01***
Total credit points for the program	**211/213$/214#**

*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 university 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 university/college level and the marks/grades shall be submitted to the university.

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

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy andPhysiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112RBP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
Total		**70/75$/80#**	**115/125$/130#**	**23/24$/26# Hrs**	**185/200$/210#**	**490/525$/540#**	**31.5/33$/35# Hrs**	**675/725$/750#**

Semester II

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

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

Semester III

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

Semester IV

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

Semester V

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

Semester VI

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

Semester VII

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

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

Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing Management – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812ET	Dietary Supplements and Nutraceuticals– Theory							
BP813ET	Pharmaceutical Product Development– Theory							
BP812PW	Project Work	-	-	-	-	150	4 Hrs	150

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

11.2. Internal assessment: Continuous mode

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

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

Theory		
Criteria	**Maximum Marks**	
Attendance (Refer Table – XII)	4	**2**
Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	**3**	**1.5**
Student – Teacher interaction	**3**	**1.5**
Total	**10**	**5**

Practical	
Attendance (Refer Table – XII)	**2**
Based on Practical Records, Regular viva voce, etc.	**3**
Total	**5**

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

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

11.2.1. Sessional Exams

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

Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. Similarly, Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks.

Question paper pattern for theory Sessional examinations

For subjects having University examination

Category	**Particulars**	**Marks Distribution**
I	Multiple Choice Questions (MCQs) OR Objective type Questions (Answer all the questions)	10 X 1=10 OR 05 X 2=10
II	Long Answers (Answer 1 out of 2)	1 X 10 =10

III	Short Answers (Answer 2 out of 3)	2 X5= 10
	Total	**30 Marks**

For subjects having Non University Examination

Category	Particulars	Marks Distribution
I	Long Answers (Answer 1 out of 2)	10 X 1=10
II	Short Answers (Answer 4 out of 6)	4 X 5 =20
	Total	**30 Marks**

Question paper pattern for practical Sessional examinations

Category	Particulars	Marks Distribution
I	Synopsis	10
II	Experiments	25
III	Viva voce	05
	Total	**40 Marks**

12. Promotion and award of grades

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

13. Carry forward of marks

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

14. Improvement of internal assessment

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

15. Re-examination of end semester examinations

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

Table-XIII: Tentative schedule of end semester examinations

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

Question paper pattern for end semester theory examinations

For 75 marks paper

Category	Particulars	Marks Distribution
I	Multiple Choice Questions (MCQs) OR Objective Type Questions (10 x 2) (Answer all the questions)	20 X 1=20 OR 10 x 2=20
II	Long Answers (Answer 2 out of 3)	2 X 10 =20
III	Short Answers (Answer 7 out of 9)	7 X5= 35
	Total	**75 Marks**

For 50 marks paper

Category	Particulars	Marks Distribution
I	Long Answers (Answer 2 out of 3)	2 X 10 =20
II	Short Answers (Answer 6 out of 8)	6 X5= 30
	Total	**50 Marks**

For 35 marks paper

Category	Particulars	Marks Distribution
I	Long Answers (Answer 1 out of 2)	1 X 10 =10
II	Short Answers (Answer 5 out of 7)	5 X5= 25
	Total	**35 Marks**

Question paper pattern for end semester practical examinations

Category	Particulars	Marks Distribution
I	Synopsis	5
II	Experiments	25
III	Viva voce	5
	Total	**35 Marks**

16. Academic Progression:

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

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

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

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

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

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

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

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

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

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

17. Grading of performances

17.1 Letter grades and grade points allocations:

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

Table – 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.

18. The Semester grade point average (SGPA)

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

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

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

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

19. Cumulative Grade Point Average (CGPA)

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

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

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

20. Declaration of class

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

First Class with Distinction = CGPA of. 7.50 and above

First Class = CGPA of 6.00 to 7.49

Second Class = CGPA of 5.00 to 5.99

21. Project work

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subject opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

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

Evaluation of Dissertation Book:

Particulars	Marks Distribution
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:

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

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

22. Industrial training (Desirable)

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

23. Practice School

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

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

24. Award of Ranks

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

25. Award of degree

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

26. Duration for completion of the program of study

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

27. Re-admission after break of study

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

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

CHAPTER - II: SYLLABUS

SEMESTER-I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

Course Objective:

- Understand the structure and function of the human body at cellular and systemic levels.
- Explore physiological processes that maintain body functions and homeostasis.
- Apply anatomical and physiological knowledge to clinical scenarios and medical conditions.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	Accurately ***define*** and ***describe*** core anatomy and physiology concepts.	PO1,PO12
CO-2	***Creat***e diagrams and summaries of main body systems and their functions.	PO1,PO2,PO12
CO-3	*Analyze* blood components, coagulation, and immune roles in the lymphatic system.	PO1,PO2,PO12
CO-4	***Differentiate*** tissue types and sensory organs, linking structure to function.	PO1,PO2, PO12
CO-5	***Interpret*** physiological responses and predict how different body systems interact.	PO1,PO2,PO3,PO12

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 **08 hours**

- **Peripheral nervous system**:
  Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.
  Origin and functions of spinal and cranial nerves.
- **Special senses**
  Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V **07 hours**

Cardiovascular system

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

BP107P. HUMAN ANATOMY AND PHYSIOLOGY-I (Practical)

Course Objective:

- Identify anatomical structures using models and microscopy.
- Demonstrate physiological functions through practical experiments.
- Apply practical knowledge in basic clinical assessments.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Identify*** and ***describe*** epithelial, connective, muscular, and nervous tissues under a microscope.	PO1,PO3 PO12
CO-2	***Draw*** and label structures of different human tissues and major bones.	PO,PO12
CO-3	***Distinguish*** and ***explain*** the functions of WBCs, RBCs, and haemoglobin in blood analysis.	PO1,PO2,PO12
CO-4	***Measure*** and interpret vital signs, including blood pressure, heart rate, and pulse rate.	PO1,PO2,PO3,PO4,PO12
CO-5	***Compare*** and ***classify*** axial and appendicular bones in the human skeleton.	PO1, PO12

Course Content:

4 Hours/week

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

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

Recommended Books (Latest Editions)

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

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

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

Course Objective:

- Understand analytical principles for assessing pharmaceutical substances.
- Apply analytical techniques to analyze pharmaceutical products.
- Interpret data for quality control and regulatory compliance.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** key pharmaceutical analysis techniques and their applications.	PO1,PO2,PO3,PO4,PO12
CO-2	***Identify*** and ***compare*** different titration methods.	PO1,PO2,PO3,PO4,PO12
CO-3	***Explain*** redox titrations and electrochemical analysis techniques.	PO1,PO2,PO3,PO4,PO12
CO-4	***Identify*** sources of errors and methods to minimize them.	PO1,PO2,PO3,PO4,PO12
CO-5	***Apply*** titration methods to estimate substance concentrations.	PO1,PO2,PO3,PO4,PO12

Course Content:

UNIT-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

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

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

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

UNIT-II

10 Hours

- **Acid base titration:** Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves
- **Non aqueous titration:** Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **10 Hours**

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

- Basic Principles, methods and application of diazotization 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)

Course Objective:

- Develop skills in pharmaceutical analysis using techniques like titration and chromatography.
- Perform quality control tests to assess pharmaceutical substances.
- Interpret and analyze results to meet regulatory standards.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** key techniques like limit tests and titrations.	PO1, PO2, PO3, PO4, PO12
CO-2	***Identify*** methods for solution standardization.	PO1, PO2, PO3, PO4, PO12
CO-3	***Explain*** the steps in different titration techniques.	PO1, PO2, PO3, PO4, PO12
CO-4	***Distinguish*** and minimize errors in analysis.	PO1, PO2, PO3, PO4, PO12
CO-5	***Summarize*** and ***interpret*** titration and test result.	PO1, PO2, PO3, PO4, PO12

4 Hours / Week

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

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

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

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

Recommended Books: (Latest Editions)

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

BP103T. PHARMACEUTICS- I (Theory)

45 Hours

Course Objective:

- Understand basic pharmaceutics principles in drug formulation.
- Explore drug formulation processes for various dosage forms.
- Apply knowledge to drug delivery systems for effective therapy.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Know*** the history of profession of pharmacy.	PO1, PO6, PO9, PO12
CO-2	***Comprehend*** the basics of different dosage forms, pharmaceutical incompatibilities, and pharmaceutical calculations.	PO1,PO3,PO12
CO-3	***Understand*** the professional way of handling the prescription.	PO1,PO2,PO3,PO12
CO-4	***Preparation*** of various conventional dosage forms	PO1,PO12
CO-5	***Formulate*** and evaluate dosage forms, identify incompatibilities, and apply pharmaceutical calculations.	PO1, PO3,PO12

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, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

- **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

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-I (Practical)

Course Objective:

- Prepare various dosage forms, including syrups, elixirs, and powders.
- Learn to prepare and evaluate ointments, gels, and suppositories.
- Develop skills to evaluate liquid formulations like gargles and mouthwashes.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Classify and prepare*** various pharmaceutical formulations like syrups, elixirs, and emulsions.	PO1, PO2, PO3, PO4, PO12
CO-2	***Compare and contrast*** suspension and semisolid formulations, focusing on stability and uses.	PO1, PO2, PO3, PO4, PO12
CO-3	***Apply knowledge*** in the preparation of solutions and powders for pharmaceutical practice.	PO1, PO2, PO3, PO4, PO12
CO-4	***Distinguish and prepare*** different types of suppositories for therapeutic applications.	PO1, PO2, PO3, PO4, PO9, PO12
CO-5	***Prepare and evaluate*** gargles and mouthwashes for clinical use.	PO1, PO2, PO3, PO4, PO9, PO12

3 Hours / week

1. Syrups a) Syrup IP
b) Paracetamol pediatric syrup

2. Elixirs a) Piperazine citrate elixir
b) Paracetamol pediatric elixir

3.Linctus a) Simple Linctus BPC

4. Solutions a) Strong solution of ammonium acetate
b) Cresol with soap solution

5. Suspensions a) Calamine lotion
b) Magnesium Hydroxide mixture

5. Emulsions a) Turpentine Liniment
b) Liquid paraffin emulsion

6. Powders and Granules
a) ORS powder (WHO)
b) Effervescent granules
c) Dusting powder

7. Suppositories a) Glycero gelatin suppository

b) Soap glycerin suppository

8. Semisolids a) Sulphur ointment

b) Non staining iodine ointment with methyl salicylate

c) Bentonite gel

9. Gargles and Mouthwashes

a) Potassium chlorate gargle

b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

Course Objective:

- Understand the principles of inorganic chemistry in pharmaceuticals.
- Explore the role of inorganic compounds in drug formulations.
- Analyze the therapeutic and toxic effects of inorganic substances in medicine.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Relate*** the principles of limit tests for impurities to their role in pharmaceutical quality control.	PO1, PO2, PO3, PO12
CO-2	***Explain*** buffer capacity and the use of buffers in pharmaceutical systems.	PO1, PO2, PO3, PO9, PO12
CO-3	***Analyze*** the uses of antacids, cathartics, and fluoride in treatment.	PO1, PO2, PO3, PO9, PO12
CO-4	***Understand*** the functions of key electrolytes and their use in replacement therapies	PO1, PO2, PO3, PO9, PO12
CO-5	***Assess*** the properties, applications, and safety of radiopharmaceuticals in clinical settings.	PO1, PO2, PO3, PO9, PO12

Course Content:

UNIT I **10 Hours**

- **Impurities in pharmaceutical substances:** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate
- **General methods of preparation**, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes

UNIT II **10 Hours**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes**: Functions of major
- physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.
- **Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

UNIT III **10 Hours**

- **Gastrointestinal agents**
  Acidifiers: Ammonium chloride* and Dil. HCl
  Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture
  Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite
  Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen

peroxide*, Chlorinated lime*, Iodine and its preparations

UNIT IV **08 Hours**

- **Miscellaneous compounds**
  Expectorants: Potassium iodide, Ammonium chloride*.
  Emetics: Copper sulphate*, Sodium potassium tartarate
  Haematinics: Ferrous sulphate*, Ferrous gluconate
  Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333
  Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 Hours**

- **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of á, â, ã 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)

Course Objective:

- Identify inorganic compounds through practical testing.
- Perform quality control tests for impurities in pharmaceuticals.
- Apply analytical techniques to assess purity and medicinal properties.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Perform*** and ***interpret*** limit tests for impurities like chlorides, sulphates, and heavy metals.	PO1, PO2, PO3, PO4, PO12
CO-2	***Identify*** inorganic compounds such as magnesium hydroxide and sodium bicarbonate.	PO1, PO2, PO3, PO4, PO12
CO-3	***Evaluate*** purity through tests like bentonite swelling power and aluminum hydroxide neutralizing capacity.	PO1, PO2, PO3, PO4, PO12
CO-4	***Prepare*** inorganic pharmaceuticals including boric acid and ferrous sulphate.	PO1, PO2, PO3, PO4, PO12
CO-5	***Summarize*** and ***compare*** analytical results for quality control purposes.	PO1, PO2, PO3, PO4,PO9, PO12

4 Hours / Week

I. Limit tests for following ions

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavy metals

Limit test for Lead

Limit test for Arsenic

II. Identification test

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III. Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV. Preparation of inorganic pharmaceuticals

Boric acid
Potash alum
Ferrous sulphate

Recommended Books (Latest Editions)

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

BP105T. COMMUNICATION SKILLS (Theory)

30 Hours

Course Objective:

- Develop clear verbal and non-verbal communication skills.
- Enhance listening and interpersonal abilities for effective engagement.
- Apply communication strategies across diverse contexts and audiences.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** the communication process and identify barriers to effective communication.	PO2,PO3, PO5, PO8,PO12
CO-2	***Compare*** and ***apply*** different communication styles in various contexts.	PO5,PO6,PO8,PO12
CO-3	***Develop*** active listening skills for better engagement in discussions.	PO5,PO6,PO8,PO12
CO-4	***Construct*** clear and organized written communications for specific audiences.	PO2,PO5, PO6, PO8, PO12
CO-5	***Distinguish*** techniques for interviews, presentations, and group discussions and apply them effectively.	PO4, PO5, PO6, PO8, PO12

Course content:

UNIT – I **07 Hours**

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

UNIT – II **07 Hours**

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

UNIT – III **07 Hours**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations
- **Effective Written Communication:** Introduction, When and When Not to Use Written

Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of
- Meaning, Formal Communication
- **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

- **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview
- **Giving Presentations:** Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V **04 Hours**

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

BP111P. COMMUNICATION SKILLS (Practical)

Course Objective:

- Develop effective verbal and non-verbal communication skills.
- Enhance active listening and feedback abilities.
- Practice professional communication techniques for interviews, presentations, and group discussions.

Course Outcomes: On completion of this course, the successful students would be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** communication techniques in social interactions and identify dos and don'ts.	PO2, PO4, PO5, PO6, PO8, PO12
CO-2	***Compare*** and ***differentiate*** pronunciation patterns for consonant and vowel sounds.	PO2, PO4, PO8, PO12
CO-3	***Construct*** and categorize effective writing, including emails and reports.	PO2, PO3, PO4, PO8, PO12
CO-4	***Distinguish*** and *investigate* figures of speech to enhance communication.	PO2, PO4, PO8, PO12
CO-5	***Classify*** and ***contrast*** interview and presentation skills for different situations.	PO2, PO3, PO4, PO5, PO6, PO8, PO12

2 Hours / week

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

Basic communication covering the following topics
Meeting People
Asking Questions
Making Friends
What did you do?
Do's and Dont's

Pronunciations covering the following topics
Pronunciation (Consonant Sounds)
Pronunciation and Nouns
Pronunciation (Vowel Sounds)

Advanced Learning
Listening Comprehension / Direct and Indirect Speech
Figures of Speech
Effective Communication
Writing Skills
Effective Writing

Interview Handling Skills
E-Mail etiquette
Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 199

BP106RBT. REMEDIAL BIOLOGY (Theory)

30 Hours

Course Objective:

- Understand basic biological concepts for foundational knowledge.
- Identify key biological processes such as cell functions and genetics.
- Develop problem-solving skills in biology for real-world applications.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** biological systems such as circulatory, respiratory, and excretory systems.	PO1, PO12
CO-2	***Compare*** and ***differentiate*** plant and animal physiology in processes like digestion and respiration.	PO1, PO12
CO-3	***Distinguish*** cell structures and functions, focusing on cell division and tissue formation.	PO1, PO12
CO-4	***Categorize*** and ***classify*** organisms based on the five kingdoms of life.	PO1, PO12
CO-5	***Investigate*** plant growth and nutrition, focusing on processes like photosynthesis and nitrogen fixation.	PO1, PO12

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

Chemical coordination and regulation

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

Human reproduction

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

UNIT IV **05 Hours**

Plants and mineral nutrition:

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

Photosynthesis

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

UNIT V **04 Hours**

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

- Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators

Cell - The unit of life

- Structure and functions of cell and cell organelles. Cell division

Tissues

- Definition, types of tissues, location and functions.

Recommended Books: (Latest Edition):

Text Books

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

Reference Books

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

BP112RBP. REMEDIAL BIOLOGY (Practical)

30 Hours

Course Objective:

- Classify organisms based on morphology and anatomy.
- Conduct experiments on biological processes like growth, respiration, and digestion.
- Analyze biological samples and interpret data on processes like circulation and photosynthesis.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** and ***examine*** cells, tissues, and plant parts using lab techniques.	PO1,PO2,PO3,PO4,PO12
CO-2	***Compare*** and ***differentiate*** plant and animal structures and tissues.	PO1,PO2,PO3,PO12
CO-3	***Investigate*** and ***classify*** anatomical features using models and microscopy.	PO1,PO2,PO3,PO4,PO12
CO-4	***Research*** and ***construct*** knowledge on physiological processes like blood pressure and tidal volume.	PO1,PO2,PO3,PO4,PO12
CO-5	***Distinguish*** and ***categorize*** biological tissues based on structure and function.	PO1,PO2,PO3,PO4, PO12

1. Introduction to experiments in biology
    a) Study of Microscope
    b) Section cutting techniques
    c) Mounting and staining
    d) Permanent slide preparation

2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

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

BP106RMT. REMEDIAL MATHEMATICS (Theory)

30 Hours

Course Objective:

- Understand basic mathematical concepts like algebra, geometry, and calculus.
- Develop problem-solving skills through practical exercises.
- Analyze mathematical relationships and their real-world applications.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** and ***classify*** functions and apply them to pharmaceutical problems.	PO2,PO3, PO12
CO-2	***Compare*** and ***contrast*** matrix operations and their pharmacokinetic applications.	PO1,PO2,PO3,PO12
CO-3	***Examine*** and ***distinguish*** differentiation techniques in pharmaceutical contexts.	PO1, PO2,PO3,PO12
CO-4	***Investigate*** and ***research*** integration methods for solving related problems.	PO2,PO3,PO12
CO-5	***Construct*** and ***apply*** differential equations and Laplace transforms in chemical and pharmacokinetics.	PO1,PO2,PO3,PO12

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 ($\in$ - δ definition) , $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1,$

UNIT – II **06 Hours**

- **Matrices and Determinant:**

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a

matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem,Applicationof Matrices in solving Pharmacokinetic equations

UNIT – III **06 Hours**

- **Calculus**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n *w.r.t*x,where *n* is any rational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x,Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT – IV **06 Hours**

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

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

UNIT-V **06 Hours**

- **Differential Equations:** Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**
- **Laplace Transform:** Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**

Recommended Books (Latest Edition)

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

SEMESTER-II

BP201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

Course Objective:

- Explain the structure and function of body systems, including respiratory, excretory, and reproductive.
- Describe homeostasis and regulation of body fluids, circulation, and hormones.
- Analyze physiological processes like digestion, respiration, and neural control.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apprise*** the structure and functions of key body systems (nervous, digestive, respiratory, urinary, endocrine).	PO1, PO12
CO-2	***Assess*** physiological processes in respiration, digestion, and excretion.	PO1, PO12
CO-3	***Compare*** and *relate* the anatomy and functions of various organs and systems.	PO1, PO12
CO-4	***Critique*** hormonal mechanisms and their impact on body functions.	PO1, PO12
CO-5	***Summariz***e reproduction and genetics, and solve related physiological problems.	PO1, PO12

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

Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration

Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

• Urinary system

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

Unit IV **10 hours**

•Endocrine system

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

Unit V **09 hours**

•Reproductive system

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

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

BP207P. HUMAN ANATOMY AND PHYSIOLOGY-II (Practical)

Course Objective:

- Demonstrate human organ systems using models and specimens.
- Assess physiological parameters like reflex activity, body temperature, and lung volumes.
- Examine lab techniques such as blood count analysis and BMI determination.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apprise*** the structure and function of various body systems using models and specimens.	PO1,PO4,PO12
CO-2	***Assess*** neurological functions, reflexes, and physiological parameters like tidal volume and body temperature.	PO1,PO4,PO12
CO-3	***Compare*** and ***relate s***ensory and physiological system functions.	PO1, PO4,PO12
CO-4	***Critique*** **feedback** mechanisms and evaluate vital statistics like BMI and blood count.	PO1, PO4,PO12
CO-5	***Solve*** reproductive health issues and summarize results from practical tests.	PO1,PO4,PO12

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

Reference Books:

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

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY–I (Theory)

45 Hours

Course Objective:

- Classify and name organic compounds, understanding isomerism and IUPAC nomenclature.
- Explain the structure, reactivity, and mechanisms of alkanes, alkenes, alkyl halides, and alcohols.
- Analyze the properties and reactions of carbonyl compounds, carboxylic acids, and amines.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** and ***describe*** organic compound classification, nomenclature, and isomerism.	PO1, PO2, PO3, PO12
CO-2	***Explain*** reactions and properties of alkanes, alkenes, dienes, alkyl halides, and alcohols.	PO1, PO2, PO3, PO12
CO-3	***Compare*** mechanisms of carbonyl compound reactions.	PO1, PO2, PO3, PO12
CO-4	***Identify*** and ***distinguish*** carboxylic acids and amines.	PO1, PO2, PO3, PO12
CO-5	***Summarize*** and ***predict*** the effects of substituents on compound properties.	PO1, PO2, PO3, PO12

Course Content:

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

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

UNIT-I **07 Hours**

- **Classification, nomenclature and isomerism**

  Classification of Organic Compounds

  Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds)

  Structural isomerisms in organic compounds

UNIT-II **10 Hours**

- **Alkanes*, Alkenes* and Conjugated dienes***

  SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

  Stabilities of alkenes, SP^2 hybridization in alkenes

  E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

  Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III **10 Hours**

- **Alkyl halides***
  SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.
  SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions
  Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.
- **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV **10 Hours**

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

UNIT-V **08 Hours**

- **Carboxylic acids***
  Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester
  Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid
- **Aliphatic amines* -** Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

Course Objective:

- Identify and analyze functional groups in organic compounds using systematic qualitative tests.
- Perform solubility, melting/boiling point determinations, and confirm compound identity through derivatives.
- Construct molecular models and relate experimental data to compound structure and properties.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** and ***describe*** preliminary tests and element detection in organic compounds.	PO1,PO2,PO3,PO4,PO12
CO-2	***Identify*** and ***explain*** functional group tests and solubility.	PO1,PO2,PO3,PO4,PO12
CO-3	***Compare*** and ***relate*** boiling/melting points for unknown compound identification.	PO1,PO2, PO3,PO12
CO-4	***Infer*** and ***summarize*** unknown compound analysis using derivatives.	PO1,PO2, PO3, PO4,PO12
CO-5	***Construct*** molecular models and predict analysis outcomes.	PO1, PO2,PO3,PO4,PO12

4 Hours / week

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

II. Preparation of suitable solid derivatives from organic compounds

III. Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd

2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

BP203T. BIOCHEMISTRY (Theory)

45 Hours

Course Objective:

- To understand the structure and function of biomolecules.
- To study key metabolic pathways and energy production.
- To explore enzyme kinetics and their applications.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** biomolecules and their biological roles.	PO1,PO3,PO12
CO-2	***Explain*** key metabolic pathways and their significance.	PO1,PO2,PO3,PO12
CO-3	***Identify*** and predict metabolic disorders and their impact.	PO1,PO3,PO12
CO-4	***Relate*** nucleic acid processes and distinguish DNA/RNA functions.	PO1,PO3,PO12
CO-5	***Describe*** enzyme properties, kinetics, and applications.	PO1,PO3,PO12

Course Content

UNIT I **08 Hours**

- **Biomolecules**
  Introduction, classification, chemical nature and biological role of carbohydrates, 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 phosphorylation/Uncouplers

UNIT III **10 Hours**

- **Lipid metabolism**

  â-Oxidation of saturated fatty acid (Palmitic acid)

  Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid)

  Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

  Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

- **Amino acid metabolism**

  General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders

  Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

  Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

  Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV **10 Hours**

- **Nucleic acid metabolism and genetic information transfer**

  Biosynthesis of purine and pyrimidine nucleotides

  Catabolism of purine nucleotides and Hyperuricemia and Gout disease

  Organization of mammalian genome

  Structure of DNA and RNA and their functions

  DNA replication (semi conservative model)

  Transcription or RNA synthesis

  Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **07 Hours**

- **Enzymes**

  Introduction, properties, nomenclature and IUB classification of enzymes

  Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

  Enzyme inhibitors with examples

  Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation

  Therapeutic and diagnostic applications of enzymes and isoenzymes

  Coenzymes –Structure and biochemical functions

BP209P. BIOCHEMISTRY (Practical)

Course Objective:

- To analyze carbohydrates, proteins, and enzymes in biological samples.
- To identify biomarkers like creatinine, glucose, and cholesterol.
- To study the effects of temperature and substrate concentration on enzyme activity.
-

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** and ***describe*** qualitative and quantitative analysis methods for carbohydrates, proteins, and enzymes.	PO1,PO2,PO3,PO4,PO12
CO-2	***Identify*** abnormal constituents in urine and determine blood parameters like creatinine, sugar, and cholesterol.	PO1,PO2,PO3,PO4,PO12
CO-3	***Relate*** the effect of environmental factors such as temperature and substrate concentration on enzymatic activity.	PO1,PO2,PO3,PO12
CO-4	***Compare*** various methods for the analysis of proteins, reducing sugars, and enzymatic activity.	PO1,PO2,PO3,PO4,PO12
CO-5	***Explain*** the preparation of buffer solutions and the measurement of pH in biological systems.	PO1,PO2,PO3,PO12

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

BP204T. PATHOPHYSIOLOGY (THEORY)

45 Hours

Course Objective:

- To understand fundamental principles of pathophysiology.
- Analyze cell injury, inflammation, and repair in systemic diseases.
- To understand the pathophysiology of major disorders and how they affect the functioning of the human body.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** mechanisms of cell injury, inflammation, and repair, and classify cellular adaptations.	PO1,PO2,PO3,PO12
CO-2	***Compare*** pathophysiology of cardiovascular, respiratory, renal, and gastrointestinal diseases.	PO1,PO2,PO3,PO12
CO-3	***Examine*** hematological, endocrine, and neurological disorders, and investigate their causes.	PO1,PO2,PO3,PO12
CO-4	***Classify*** bone and joint diseases, and research cancer pathogenesis.	PO1,PO2,PO3,PO4,PO12
CO-5	***Investigate*** infectious diseases and report on their causes and treatments.	PO1,PO2,PO3,PO12

Course content:

Unit I **10Hours**

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

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

Unit II **10Hours**

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

Unit III **10Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 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 **8 Hours**

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

Unit V **7 Hours**

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

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

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

BP205T.COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2Hrs/Week)

Course Objective:

- Understand number systems and binary operations in computing.
- Explore web technologies and databases in pharmacy applications.
- Apply computer tools in drug information and preclinical data analysis.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apply*** number systems and binary operations in computing.	PO1,PO2,PO3,PO12
CO-2	***Explain*** web technologies and databases in pharmacy applications.	PO1,PO2,PO3,PO12
CO-3	***Distinguish*** computer applications in pharmacy and healthcare.	PO1,PO2,PO3,PO9,PO12
CO-4	***Relate*** bioinformatics tools to pharmaceutical research.	PO1,PO2,PO3,PO9,PO12
CO-5	***Model*** computer usage in preclinical development and data analysis.	PO1,PO2,PO3,PO9,PO12

Course content:

UNIT – I **06 hours**

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

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

UNIT –II **06 hours**

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

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

UNIT – III **06 hours**

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System

UNIT – IV **06 hours**

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of

Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

UNIT-V **06 hours**

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

BP210P.COMPUTER APPLICATIONS IN PHARMACY (Practical)

Course Objective:

- Design digital content using HTML and MS Access.
- Manage databases for patient and drug information.
- Apply web technologies for data sharing.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Design*** a questionnaire and apply web technologies for data collection.	PO1,PO2,PO3,PO4,PO12
CO-2	***Create*** and manage a patient database in MS Access.	PO1,PO2,PO3,PO4,PO9,PO12
CO-3	***Generat***e patient reports from MS Access.	PO1,PO2,PO3,PO4,PO9,PO12
CO-4	***Develop*** drug information pages using HTML and MS Access.	PO1,PO2,PO3,PO4,PO9,PO12
CO-5	***Expor***t and share data using MS Access and web tools.	PO1,PO2,PO3,PO4,PO12

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

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.

2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA

3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)

4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

BP206T.ENVIRONMENTAL SCIENCES (Theory)

30 hours

Course Objective:

- Apply sustainable practices for natural resource conservation.
- Classify and understand different ecosystem types and their functions.
- Identify causes of pollution and model solutions for environmental protection.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apply*** sustainable practices for conserving natural resources.	PO1,PO9, PO10,PO12
CO-2	***Classify*** ecosystems by structure, function, and characteristics.	PO1,PO9,PO10,PO12
CO-3	***Discover*** human impacts on resources and **report** environmental issues.	PO1,PO9,PO10,PO12
CO-4	***Prepare*** summaries on different ecosystem types.	PO1,PO9,PO10,PO12
CO-5	***Show*** causes/effects of pollution and **model** solutions.	PO1,PO9,PO10,PO12

Course content:

Unit-I **10hours**

The Multidisciplinary nature of environmental studies
Natural Resources
Renewable and non-renewable resources:
Natural resources and associated problems
a. Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources

Unit-II **10hours**

Ecosystems
Concept of an ecosystem.
Structure and function of an ecosystem.
Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- III **10hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

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

SEMESTER-III

BP301T.PHARMACEUTICAL ORGANIC CHEMISTRY–II (Theory)

45 Hours

Course Objective:

- Understand the structure, aromaticity, and reactivity of benzene and its derivatives.
- Explore the acidity/basicity of phenols, amines, and acids, focusing on substituent effects.
- Learn the chemistry and applications of fats, oils, and cycloalkanes, including stability and analytical methods.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** the structure and aromatic stability of benzene using Huckel's rule.	PO1,PO3,PO12
CO-2	***Compare*** the acidity/basicity of phenols, amines, and acids, noting substituent effects.	PO1,PO3,PO12
CO-3	***Examine*** benzene reactions (nitration, sulphonation, halogenation, Friedel-Crafts) and their reactivity.	PO1,PO3,PO12
CO-4	***Investigate*** fats/oils through analytical constants and **classify** their chemical uses.	PO1,PO3,PO12
CO-5	***Classify*** cycloalkane stability theories and point out cyclopropane/butane reactions.	PO1,PO3,PO12

Course Content:

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

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

UNIT I **10 Hours**

- **Benzene and its derivatives**
  - **A.** Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule
  - **B.** Reactions of benzene - nitration, sulphonation, halogenation-reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.
  - **C.** Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction
  - **D.** Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II **10 Hours**

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts

- **Aromatic Acids* –**Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III **10 Hours**

- **Fats and Oils**
  a. Fatty acids – reactions.
  b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
  c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value,

Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV **08 Hours**

- **Polynuclear hydrocarbons:**
    a. Synthesis, reactions
    b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V **07 Hours**

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

Course Objective:

- Learn organic synthesis techniques like acylation and halogenation.
- Measure acid, saponification, and iodine values using standard methods.
- Master recrystallization, steam distillation, and reagent standardization.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apply*** techniques like recrystallization and steam distillation to purify compounds.	PO1,PO3,PO4,PO12
CO-2	***Choose*** methods to determine oil values in pharmaceutical formulations.	PO1,PO3,PO4,PO12
CO-3	***Prepare*** compounds like Benzanilide and Benzoic acid through various reactions.	PO1,PO3,PO4,PO12
CO-4	***Classify*** organic reactions and apply them to synthesize target compounds.	PO1,PO3,PO4,PO12
CO-5	***Produce*** and report experimental results, analyzing purity and yield.	PO1,PO3,PO4,PO12

4 Hrs/week

I. Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

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

- Acid value
- Saponification value
- Iodine value

III. Preparation of compounds

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

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45 Hours

Course Objective:

- Understand factors affecting solubility and solute-solvent interactions.
- Learn states of matter and key drug properties.
- Apply surface tension and complexation principles in drug formulation.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apply*** solubility and diffusion principles in drug formulation.	PO1,PO3,PO12
CO-2	***Classify*** states of matter and show effects of drug physicochemical properties.	PO1,PO3,PO12
CO-3	***Report*** on surface phenomena and model surfactant use in formulations.	PO1,PO3,PO12
CO-4	***Analyze*** drug-protein complexation and interpret stability constants.	PO1,PO3,PO12
CO-5	***Choose*** suitable pH buffers and apply buffer calculations in pharmaceuticals.	PO1,PO3,PO12

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, Dissolution & drug release, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions, azeotropic mixtures, fractional distillation. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II

10Hours

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

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

UNIT-III **10Hours**

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

UNIT-IV **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 stability constants.

UNIT-V **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

Course Objective:

- Learn factors affecting drug solubility.
- Study pKa, partitioning, and surface tension.
- Use stability constants for drug formula.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Apply*** solubility and partitioning techniques for drug analysis.	PO1,PO2,PO3,PO4,PO12
CO-2	***Discover*** drug pKa using neutralization methods.	PO1,PO2,PO3,PO4,PO12
CO-3	***Classify*** liquids by surface tension.	PO1,PO12
CO-4	***Prepare*** stability constants for drug complexes.	PO1,PO12
CO-5	***Model*** surfactant properties through HLB and micellar concentration.	PO1,PO3,PO4,PO12

4 Hrs/week

1. Determination of the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hassel Balch 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 char coal.
9. Determination of critical micellar concentration of surfactants.
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method.
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method.

Recommended Books: (Latest Editions)

1. Physical pharmacy by Alfred Martin
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP303T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Course Objective:

- Understand the fundamentals of microbiology and its relevance to the pharmaceutical field.
- Demonstrate knowledge of microbial classification, structure, and growth.
- Comply with regulatory standards and ethical guidelines in pharmaceutical microbiology.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** microbiology concepts and their pharmaceutical relevance.	PO1,PO12
CO-2	***Describe*** bacterial, fungal, and viral morphology and cultivation.	PO1,PO12
CO-3	***Identify*** bacterial identification and sterilization techniques.	PO1,PO2,PO3,PO12
CO-4	***Distinguish*** sterilization and disinfection methods.	PO1,PO2,PO3,PO12
CO-5	***Explain*** contamination, spoilage, and preservation of pharmaceuticals.	PO1,PO12

Course content:

Unit I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance.
Introduction to Prokaryotes and Eukaryotes
Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).
Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

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 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 Virus.
Classification and mode of action of disinfectants
Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions
Evaluation of bactericidal & Bacteriostatic.
Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit IV **08 Hours**

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

Unit V **07Hours**

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

BP307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

Course Objective:

- Demonstrate the use of essential microbiological equipment and techniques relevant to pharmaceuticals.
- Apply methods of sterilization, culturing, and staining for effective microbial analysis.
- Execute microbiological assays and sterility evaluations for pharmaceutical products.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** microbiological equipment and processing techniques.	PO1,PO3,PO4,PO12
CO-2	***Describe*** sterilization, subculturing, and staining methods.	PO1,PO2,PO3,PO4,PO12
CO-3	***Identify*** pure culture isolation and microbiological assay methods.	PO1,PO2,PO3,PO4,PO12
CO-4	***Explain*** sterility testing and bacteriological analysis.	PO1,PO2,PO3,PO4,PO12
CO-5	***Distinguish*** between different sterilization and testing techniques.	PO1,PO2,PO3,PO4,PO12

4 Hrs/week

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

Recommended Books (Latest edition)

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

BP304T.PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

Course Objective:

- Understand core principles of pharmaceutical engineering in drug manufacturing.
- Analyze equipment and processes for mixing, filtration, and drying.
- Apply engineering concepts to design efficient pharmaceutical processes.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Describe*** fluid flow, size reduction, and separation principles in pharmaceuticals.	PO1,PO9,PO12
CO-2	***Explain*** heat transfer, evaporation, and distillation equipment.	PO1,PO12
CO-3	**Identify** drying and mixing equipment and their uses.	PO1,PO12
CO-4	***Distinguish*** between filtration and centrifugation techniques.	PO1,PO12
CO-5	***Recognize*** suitable construction materials and corrosion prevention methods.	PO1,PO12

Course content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.
- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.
- **Distillation:** Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT- III **10 Hours**

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

vacuum dryer, freeze dryer.

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

UNIT-IV **08 Hours**

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

UNIT- V **07 Hours**

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

Recommended Books: (Latest Editions)

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

BP308P. PHARMACEUTICAL ENGINEERING (Practical)

Course Objective:

- Understand the principles of thermal properties, heat transfer, and distillation in pharmaceutical processes.
- Operate pharmaceutical machinery for size reduction, drying, and filtration.
- Analyze factors influencing filtration, evaporation, and crystallization efficiency.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Measure*** radiation constants of materials.	PO1,PO2,PO3,PO4,PO12
CO-2	***Calculate*** steam distillation efficiency and heat transfer coefficients.	PO1,PO2,PO3,PO12
CO-3	***Construct*** drying curves and analyze moisture content.	PO1,PO2,PO3,PO12
CO-4	***Evaluate*** pharmaceutical machinery performance.	PO1,PO2,PO3,PO4,PO12
CO-5	***Assess*** factors affecting filtration, evaporation, and crystallization rates.	PO1,PO2,PO3,PO12

4 Hours/week

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

SEMESTER-IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY–III (Theory)

45 Hours

Course Objective:

- Understand stereoisomerism and its role in drug design.
- Learn synthesis and medicinal uses of heterocyclic compounds.
- Gain knowledge of key synthetic reactions for pharmaceutical applications.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Explain*** the role of stereochemistry in enhancing the effectiveness of pharmaceutical compounds.	PO1,PO2,PO3,PO12
CO-2	***Evaluate*** the reactivity and medicinal significance of essential heterocyclic compounds.	PO1,PO2,PO3,PO12
CO-3	***Differentiate*** between reduction and rearrangement reactions used in drug synthesis.	PO1,PO2,PO3,PO12
CO-4	***Outline*** methods of racemic modification and the synthesis of chiral molecules.	PO1,PO2,PO3,PO12
CO-5	***Analyze*** stereospecific reactions and their impact on the biological activity of drugs.	PO1,PO2,PO3,PO12

Course Content:

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

UNIT-I **10 Hours**

Stereo isomerism

Optical isomerism –
Optical activity, enantiomerism, diastereoisomerism, meso compounds
Elements of symmetry, chiral and achiral molecules
DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers
Reactions of chiral molecules
Racemic modification and resolution of racemic mixture.
Asymmetric synthesis: partial and absolute

UNIT-II **10 Hours**

Geometrical isomerism

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

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification
Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene
Relative aromaticity, reactivity and Basicity of pyrrole

UNIT-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

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

BP402T.MEDICINAL CHEMISTRY– I (Theory)

45 Hours

Course Objective:

- Understand drug chemistry and its pharmacological effects.
- Learn drug metabolism, adverse effects, and therapeutic value.
- Know SAR of drug classes and their chemical synthesis.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Define*** essential medicinal chemistry concepts impacting drug action.	PO1,PO2,PO3,PO12
CO-2	***Describe*** neurotransmitter mechanisms and related drugs.	PO1,PO2,PO3,PO12
CO-3	***Identify*** SAR for autonomic and CNS drug classes.	PO1,PO2,PO3,PO12
CO-4	***Recogniz***e phases and factors in drug metabolism.	PO1,PO2,PO3,PO12
CO-5	***Draw*** structures of key drugs like sympathomimetics and sedatives.	PO1,PO2,PO3,PO12

Course Content:

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

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

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

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and 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*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT- III **10 Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

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

UNIT- IV **08 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

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

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines : SAR of Phenothiazeines – Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

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

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

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

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine diones: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT- V **07 Hours**

Drugs acting on Central Nervous System

General anesthetics:

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

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

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

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

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

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

BP406P.MEDICINAL CHEMISTRY– I (Practical)

Course Objective:

- Extend practical skills in drug synthesis and characterization.
- Relate drug chemistry concepts to assay techniques.
- Explain methods for determining pharmacological properties.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Extend*** knowledge on drug preparation techniques and intermediates.	PO1,PO2,PO3,PO4,PO9,PO12
CO-2	***Relate*** drug assay methods to quality control in pharmaceuticals.	PO1,PO2,PO3,PO4,PO9,PO12
CO-3	***Distinguis*h** between drug classes based on their chemical properties.	PO1,PO2,PO3,PO12
CO-4	***Compare*** the pharmacological effects of selected drugs.	PO1,PO2,PO3,PO12
CO-5	***Explain*** the importance of partition coefficient in drug absorption.	PO1,PO2,PO3,PO12

4 Hours/Week

I. **Preparation of drugs/ intermediates**

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

II. **Assay of drugs**

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

III. **Determination of Partition coefficient for any two drugs**

Recommended Books (Latest Editions)

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

Course Objective:

- Analyze the physicochemical properties of colloidal dispersions and their impact on drug formulation.
- Examine the principles of rheology and micromeretics in pharmaceutical applications.
- Investigate techniques for drug stability and dosage form preservation.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** the properties of colloidal systems in pharmaceutical formulations.	PO1,PO2,PO3,PO9,PO12
CO-2	***Compare*** rheological properties and their application in drug formulation.	PO1,PO2,PO3,PO9,PO12
CO-3	***Differentiate*** between emulsions, suspensions, and microemulsions.	PO1,PO2,PO3,PO12
CO-4	***Examine*** methods for determining particle size and surface area.	PO1,PO2,PO3,PO12
CO-5	**Investigate** pharmaceutical stability and strategies for stabilization.	PO1,PO2,PO3,PO12

Course Content:

UNIT-I **07 Hours**

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

UNIT-II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatants, 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 **08 Hours**

Micromeretics: Particle size and distribution, average 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 powder, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V **10 Hours**

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

BP407P. PHYSICAL PHARMACEUTICS- II (Practical)

Course Objective:

- Analyze the physical properties of drugs and their formulations.
- Examine the effect of suspending agents on suspension stability.
- Determine the reaction kinetics and stability of dosage forms.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Analyze*** the effect of particle size determination methods on formulation properties.	PO1,PO2,PO3,PO4,PO12
CO-2	***Compare*** the impact of different suspending agents on sedimentation volume.	PO1,PO2,PO3,PO4,PO12
CO-3	***Examine*** the relationship between viscosity and formulation stability.	PO1,PO2,PO3,PO4,PO12
CO-4	***Investigate*** the influence of lubricants on powder flow properties.	PO1,PO2,PO3,PO4,PO12
CO-5	***Determine*** the reaction rate constants for drug stability studies.	PO1,PO2,PO3,PO4,PO12

3 Hrs/week

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

Recommended Books: (Latest Editions)

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

BP404T.PHARMACOLOGY-I (Theory)

45 Hours

Course Objective:

- Explain pharmacokinetics and pharmacodynamics principles.
- Distinguish drug classes affecting the nervous system and their effects.
- Analyze drug discovery, evaluation, and Pharmacovigilance processes.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Explain*** the processes of drug absorption, distribution, metabolism, and excretion.	PO1,PO2,PO12
CO-2	***Distinguish*** between drug mechanisms, receptor types, and signal transduction.	PO1,PO2,PO3,PO12
CO-3	***Compare*** drugs affecting the peripheral and central nervous systems.	PO1,PO2,PO3,PO12
CO-4	***Extend*** knowledge on drug interactions and clinical trial phases.	PO1,PO2,PO3,PO9,PO12
CO-5	***Predict*** drug effects based on neurotransmitter and receptor interactions.	PO1,PO2,PO3,PO12

Course Content:

UNIT-I **08 hours**

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**

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**

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**

Pharmacology of drugs acting on central nervous system

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

BP408P.PHARMACOLOGY-I (Practical)

Course Objective:

- Explain experimental pharmacology techniques and drug administration methods.
- Analyze drug effects on laboratory animals, including anticonvulsant and muscle relaxant activity.
- Demonstrate pharmacological assays on ciliary motility, eye effects, and anesthetics.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	**Cos & POs Mapping**
CO-1	***Explain*** experimental pharmacology principles and laboratory techniques.	PO1,PO2, PO3,PO4,PO12
CO-2	***Distinguish*** drug effects on animal models like locomotor activity and anticonvulsants.	PO1,PO2,PO3,PO4,PO12
CO-3	***Compare*** the effects of different drugs on animals, including muscle relaxants and anxiolytics.	PO1,PO2,PO3,PO4,PO12
CO-4	***Infer*** the impact of hepatic enzyme inducers on drug metabolism.	PO1,PO2,PO3,PO4,PO12
CO-5	***Summarize*** drug administration methods and animal ethics per CPCSEA guidelines.	PO1,PO2,PO3,PO4,PO12

4Hrs/Week

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

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

Recommended Books (Latest Editions)

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

BP405T.PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Theory)

45 Hours

Course Objective:

- Explain the scope and sources of drugs in Pharmacognosy.
- Analyze drug classification methods and quality control techniques.
- Examine secondary metabolites and their role in drug discovery.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	**Cos & POs Mapping**
CO-1	***Explain*** the sources, classification, and quality control of natural drugs.	PO1,PO2,PO12
CO-2	***Distinguish*** between drug cultivation methods and conservation techniques.	PO1,PO2,PO12
CO-3	***Compare*** the use of Pharmacognosy in different medicinal systems.	PO1,PO2,PO3,PO12
CO-4	***Analyze*** the role of secondary metabolites in medicinal plants.	PO1,PO3,PO12
CO-5	***Summarize*** the uses of primary metabolites in pharmaceuticals.	PO1,PO2,PO3,PO9,PO12

Course Content

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

a. Definition, history, scope and development of Pharmacognosy
b. Sources of Drugs – Plants, Animals, Marine & Tissue culture
c. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

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

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

UNIT-II **10 Hours**

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

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III **07 Hours**

Plant tissue culture:

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

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V **08 Hours**

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

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

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

Carbohydrates: Acacia, Agar, Tragacanth, Honey

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

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

Marine Drugs:

Novel medicinal agents from marine sources.

BP409P. PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Practical)

Course Objective:

- Apply analytical techniques for evaluating crude drugs.
- Demonstrate practical skills in determining drug quality.
- Interpret results of pharmacognostic tests.

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Explain*** methods for chemical analysis of crude drugs.	PO1,PO2,PO3,PO4,PO12
CO-2	***Distinguish*** between various techniques for drug evaluation.	PO1,PO2,PO3,PO4,PO12
CO-3	***Compare*** quality control methods like extractive and ash values.	PO1,PO2,PO3, PO4,PO12
CO-4	***Extend*** knowledge of microscopy for drug analysis.	PO1,PO2,PO3,PO4,PO12
CO-5	***Summarize*** the importance of physical parameters in drug quality.	PO1,PO2,PO3,PO4,PO12

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 paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books: (Latest Editions)

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

SEMESTER-V

BP501T.MEDICINAL CHEMISTRY– II (Theory)

45 Hours

Course Objective:

- Understand the mechanisms, uses, and effects of major drug classes.
- Develop skills to analyze and differentiate pharmacological properties for disease treatment.
- Apply SAR principles to evaluate and select effective drug therapies.

Course Outcomes: On completion of this course, students should be able to:

CO	Statements	**Cos & POs Mapping**
CO-1	***Analyze*** pharmacodynamics and uses of antihistaminics, anti-anginals, and anti-diabetics.	PO1,PO2,PO3,PO12
CO-2	***Compare*** H1 and H2 antagonists, and ***differentiate*** proton pump inhibitors for allergy and gastric treatments.	PO1,PO2,PO3,PO12
CO-3	***Classify*** anti-neoplastic agents and ***examine*** their cancer-fighting mechanisms.	PO1,PO2,PO3,PO12
CO-4	***Categorize*** endocrine drugs like sex hormones and corticosteroids, identifying therapeutic uses.	PO1,PO2,PO3,PO9,PO12
CO-5	***Contrast*** antidiabetic classes, and ***examine*** the structure-activity relationships in local anesthetics.	PO1,PO2,PO3,PO12

Course Content:

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

UNIT- I **10 Hours**

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

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidine.

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

Anti-neoplastic agents:

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

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

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

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

Dipyridamole.
Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.
Diuretics:
Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.
Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,
Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.
Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.
Osmotic Diuretics: Mannitol
Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III **10 Hours**
Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.
Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol
Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel
Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT- IV **08 Hours**
Drugs acting on Endocrine system
Nomenclature, Stereochemistry and metabolism of steroids
Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
Drugs for erectile dysfunction: Sildenafil, Tadalafil.
Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol
Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone
Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V **07 Hours**
Antidiabetic agents:
Insulin and its preparations
Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.
Biguanides: Metformin.
Thiazolidinediones: Pioglitazone, Rosiglitazone.
Meglitinides: Repaglinide, Nateglinide.
Glucosidase inhibitors: Acrabose, 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. 1to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry-A.I.Vogel

BP502T.Industrial Pharmacy I (Theory)

45 Hours

Course Objective:

- Understand the impact of drug properties on formulation.
- Learn formulation and quality control of key dosage forms.
- Ensure compliance in quality testing and packaging selection.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	**Cos & POs Mapping**
CO-1	***Extend*** knowledge of preformulation to assess drug properties affecting stability.	PO1,PO2,PO3,PO9,PO11,PO12
CO-2	***Relate*** formulation techniques to the quality of tablets, capsules, and liquid orals.	PO1,PO2,PO3,PO9,PO11,PO12
CO-3	***Distinguish*** capsule types and ***explain*** their applications and quality controls.	PO1,PO2,PO3,PO9,PO11,PO12
CO-4	***Compare*** requirements for parenteral and ophthalmic formulations, focusing on aseptic processes.	PO1,PO2,PO3,PO9,PO11,PO12
CO-5	***Summarize*** principles for cosmetics, aerosols, and ***explain*** packaging material selection and quality control.	PO1,PO2,PO3,PO9,PO11,PO12

Course content:

UNIT-I **07 Hours**

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

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

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemization, polymerization BCS classification of drugs

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

UNIT-II **10 Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling.
b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.
c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of solutions, suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-III **08 Hours**

Capsules:

a. ***Hard gelatin capsules:*** Introduction, Extraction of gelatin and production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules. 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 minimum/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules

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

UNIT-IV **10 Hours**

Parenteral Products:

a. Definition, types, advantages, and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity
b. Production procedure, production facilities and controls.
c. Formulation of injections, sterile powders, emulsions, suspensions, large volume parenterals and lyophilized products, Sterilization.
d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests.

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

BP506P.Industrial Pharmacy-I (Practical)

Course Objective:

- Understand drug properties' impact on formulation.
- Develop skills in making tablets, capsules, and injections.
- Ensure quality and packaging compliance.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	**Cos & POs Mapping**
CO-1	***Apply*** preformulation studies for assessing drug properties.	PO1,PO2,PO3,PO4,PO11,PO12
CO-2	***Prepare*** and evaluate tablets, capsules, injections, and eye preparations.	PO1,PO2,PO3,PO4,PO11,PO12
CO-3	***Classify*** coating techniques for tablets and granules.	PO1,PO2,PO3,PO4,PO11,PO12
CO-4	***Collect*** quality control data for tablets, capsules, and containers as per IP standards.	PO1,PO2,PO3,PO4,PO11,PO12
CO-5	***Show*** competency in formulating and assessing creams and cosmetics.	PO1,PO2,PO3,PO4,PO11,PO12

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 tables/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, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz

2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman

3. Pharmaceutical dosage form disperses system VOL-1 by Liberman & Lachman

4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition

5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)

6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman

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

Latest edition

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

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

BP503T.PHARMACOLOGY-II (Theory)

45 Hours

Course Objective:

- Understand drugs for heart, blood pressure, and renal conditions.
- Explore drugs for inflammation and hormonal regulation.
- Evaluate drug efficacy using bioassays.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Combine*** cardiovascular pharmacology knowledge for treating heart and blood pressure issues.	PO1,PO2,PO12
CO-2	***Develop*** strategies for managing shock and blood disorders.	PO1,PO2,PO12
CO-3	***Construct*** treatments using autacoids for inflammation control.	PO1,PO2,PO12
CO-4	***Formulate*** drug plans for hormonal and metabolic conditions.	PO1,PO2,PO3,PO12
CO-5	***Design*** bioassays to assess drug potency and efficacy.	PO1,PO2,PO3,PO12

Course Content:

UNIT-I **10hours**

1. **Pharmacology of drugs acting on cardio vascular system**
    a. Introduction to hemodynamic and electrophysiology of heart.
    b. Drugs used in congestive heart failure
    c. Anti-hypertensive drugs.
    d. Anti-anginal drugs.
    e. Anti-arrhythmic drugs.
    f. Anti-hyperlipidemic drugs.

UNIT-II

10hours

1. **Pharmacology of drugs acting on cardio vascular system**
    a. Drug used in the therapy of shock.
    b. Hematinics, coagulants and anticoagulants.
    c. Fibrinolytics and anti-platelet drugs
    d. Plasma volume expanders

2. **Pharmacology of drugs acting on urinary system**
    a. Diuretics
    b. Anti-diuretics.

UNIT-III **10hours**

3. **Autocoids and related drugs**
    a. Introduction to autacoids and classification
    b. Histamine, 5-HT and their antagonists.
    c. Prostaglandins, Thromboxanes and Leukotrienes.

d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

UNIT-IV **08hours**

4. Pharmacology of drugs acting on endocrine system

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

UNIT-V **07hours**

5. Pharmacology of drugs acting on endocrine system

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

6. Bioassay

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

BP507P.PHARMACOLOGY-II (Practical)

Course Objective:

- Learn techniques for drug testing on tissues.
- Conduct bioassays to evaluate drug potency.
- Assess drug activity in animal models.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** in-vitro pharmacological experiments to study drug effects on tissues.	PO1,PO2,PO3,PO4,PO12
CO-2	***Develop*** bioassay techniques to measure drug potency.	PO1,PO2,PO3,PO4,PO12
CO-3	***Combine*** physiology and pharmacology to assess drug actions on blood pressure and heart rate.	PO1,PO2,PO3,PO4,PO12
CO-4	***Formulate*** methods to test anti-inflammatory and analgesic drug activity.	PO1,PO2,PO3,PO4,PO12
CO-5	***Plan*** and analyze data from pharmacological studies to evaluate drug efficacy.	PO1,PO2,PO3,PO4,PO12

4Hrs/Week

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

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

Recommended Books (Latest Editions)

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

BP504T. PHARMACOGNOSY AND PHYTOCHEMISTRY-II (Theory)

45 Hours

Course Objective:

- Study secondary metabolite formation in plants.
- Learn about their uses and applications.
- Use modern methods for phytochemical isolation.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** methods to isolate and identify phytoconstituents.	PO1,PO2,PO3,PO4,PO9,PO12
CO-2	***Develop*** understanding of metabolic pathways and biogenetic studies.	PO1,PO2,PO3,PO4,PO9,PO12
CO-3	***Combine*** plant chemistry with therapeutic and commercial applications.	PO1,PO2,PO3,PO4,PO9,PO11,PO12
CO-4	***Formulate*** strategies for industrial production and estimation of phytoconstituents.	PO1,PO2,PO3,PO4,PO9,PO11,PO12
CO-5	***Apply*** modern techniques for extraction, purification, and identification of crude drugs.	PO1,PO2,PO3,PO9,PO12

Course Content:

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

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

UNIT-II **14 Hours**

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

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,
Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents
a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid & Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

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

UNIT V **8 Hours**

Basics of Phytochemistry

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

BP508P.PHARMACOGNOSY AND PHYTOCHEMISTRY-II (Practical)

Course Objective:

- Learn techniques for isolating compounds from plants.
- Gain skills in paper chromatography and TLC.
- Identify and analyze drugs using chemical tests.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** methods for isolating active principles from plants.	PO1,PO2,PO3,PO4 PO12
CO-2	***Combine*** chromatographic techniques for phytochemical analysis.	PO1,PO2,PO3,PO4,PO12
CO-3	***Develop*** skills in distilling volatile oils and detecting phytoconstituents.	PO1,PO2,PO3,PO4,PO12
CO-4	***Formulate*** chemical tests to analyze crude drugs.	PO1,PO2,PO3,PO4,PO12
CO-5	***Plan*** exercises in plant morphology and drug identification.	PO1,PO2,PO3, PO4,PO12

4 Hours/Week

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

Recommended Books: (Latest Editions)

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

BP505T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

Course Objective:

- Understand key pharmaceutical legislations.
- Master drug licensing and compliance.
- Study pharmacists' ethical responsibilities.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** legal frameworks for drug manufacturing and sale.	PO1,PO2,PO3,PO6,PO7,PO12
CO-2	***Combine*** pharmaceutical laws with licensing and labeling practices.	PO1,PO2,PO3,PO6,PO7,PO12
CO-3	***Develop*** understanding of pharmacy ethics and the pharmacist's role.	PO1,PO2,PO3,PO6,PO7,PO12
CO-4	***Formulate*** strategies for compliance with drug pricing and regulatory bodies.	PO1,PO2,PO3,PO6,PO7,PO12
CO-5	***Role play*** drug legislation enforcement scenarios.	PO1,PO2,PO3,PO6,PO7,PO12

Course Content:

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the act and rules

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

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

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

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

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

Administration of the act and rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

- **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; its 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, 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** D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath
- **Medical Termination of pregnancy act**
- **Right to information Act**
- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)

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

SEMESTER-VI

BP601T. MEDICINAL CHEMISTRY– III (Theory)

45 Hours

Course Objective:

- Understand SAR and classification of antimicrobial agents.
- Analyze mechanisms and therapeutic uses of antibiotics and antivirals.
- Apply drug design concepts like QSAR and pharmacophore modeling.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Evaluate*** the structure-activity relationships and products of antibiotics and antimicrobial agents.	PO1,PO2,PO3,PO12
CO-2	***Contrast*** mechanisms of antibiotics, antivirals, antifungals, and antiprotozoal drugs.	PO1,PO2,PO3,PO12
CO-3	***Analyze*** QSAR, pharmacophore modeling, and combinatorial chemistry approaches.	PO1,PO2,PO3,PO12
CO-4	***Link*** drug properties to treatment effectiveness for diseases like malaria and tuberculosis.	PO1,PO2,PO3,PO12
CO-5	***Suggest*** appropriate drug formulations based on pharmacological profiles.	PO1,PO2,PO3,PO12

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.

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II **10 Hours**

Antibiotics

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

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

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, 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 Streptomycine, Capreomycin sulphate.

Urinary tract anti-infective agents

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

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

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

UNIT – IV **08 Hours**

Antifungal agents:

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

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

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

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

Sulphonamides and Sulfones

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

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **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 applicationsof combinatorial chemistry: solid phase and solution phase synthesis.

BP607P. MEDICINAL CHEMISTRY- III (Practical)

Course Objective:

- Design medicinal compounds using laboratory techniques.
- Assess drug properties using design software.
- Compare methods for drug preparation and assay.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** drug synthesis methods and assays for evaluating drug efficacy.	PO1,PO2,PO3,PO4,PO12
CO-2	***Assess*** physicochemical properties and drug-likeness using design software.	PO1,PO2,PO3,PO4 PO12
CO-3	***Compare*** different drug preparation techniques, including microwave irradiation.	PO1,PO2,PO3,PO4 PO12
CO-4	***Critique*** drug design based on Lipinski's Rule of Five for drug development.	PO1,PO2,PO3,PO4 PO12
CO-5	***Summarize*** key methods in preparing and analyzing medicinal compounds.	PO1,PO2,PO3,PO4 PO12

4 Hours / week

I. **Preparation of drugs and intermediates**
1. Sulphanilamide
2. 7-Hydroxy, 4-methyl coumarin
3. Chlorobutanol
4. Triphenyl imidazole
5. Tolbutamide
6. Hexamine

II. **Assay of drugs**
1. Isonicotinic acid hydrazide
2. Chloroquine
3. Metronidazole
4. Dapsone
5. Chlorpheniramine maleate
6. Benzyl penicillin

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

IV. Drawing structures and reactions using chem draw®

V. Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design

software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

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

BP602T.PHARMACOLOGY-III (Theory)

45 Hours

Course Objective:

- To understand the pharmacology of drugs acting on the respiratory and gastrointestinal systems.
- To examine the principles and applications of chemotherapy and immunopharmacology.
- To compare the efficacy and mechanisms of various chemotherapy agents.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** students of pharmacology related to respiratory and gastrointestinal drugs.	PO1,PO2,PO3,PO12
CO-2	***Assess*** the efficacy of chemotherapy agents and their applications.	PO1,PO2,PO3,PO12
CO-3	***Compare*** treatments for infectious diseases and cancer.	PO1,PO2,PO3,PO12
CO-4	***Criticize*** the role of immunopharmacology in therapy.	PO1,PO2,PO3,PO12
CO-5	***Weigh*** the impact of chronopharmacology on drug administration.	PO1,PO2,PO3,PO12

Course Content:

UNIT-I **10hours**

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

Pharmacology of drugs acting on the Gastrointestinal Tract

f. Antiulcer agents.
g. Drugs for constipation and diarrhoea.
h. Appetite stimulants and suppressants.
i. Digestants and carminatives.
j. Emetics and anti-emetics.

UNIT-II **10hours**

Chemotherapy

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

UNIT-III **10hours**

Chemotherapy

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

UNIT-IV **08hours**

Chemotherapy

1. Urinary tract infections and sexually transmitted diseases.
2. Chemotherapy of malignancy.

Immunopharmacology

1. Immunostimulants
2. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07hours**

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, organophosphosphorus compound and lead, mercury, and arsenic poisoning.

Chronopharmacology

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

BP608P. PHARMACOLOGY-III (Practical)

Course Objective:

- Learn pharmacological experiment techniques and dose calculation.
- Apply animal models to assess drug efficacy and safety.
- Analyze experimental data using biostatistics and pharmacokinetics.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** students on pharmacological testing techniques such as dose calculation and toxicity studies.	PO1,PO2,PO3,PO4,PO12
CO-2	***Assess*** the efficacy of drugs through experiments like anti-ulcer and gastrointestinal motility testing.	PO1,PO2,PO3,PO4,PO12
CO-3	***Critique*** methodologies in drug testing, focusing on skin, eye irritation, and pyrogen testing.	PO1,PO2,PO3,PO4,PO12
CO-4	***Compare*** pharmacokinetic parameters and biostatistical analysis in experimental pharmacology.	PO1,PO2,PO3,PO4,PO12
CO-5	***Solve*** pharmacological problems using biostatistics methods like ANOVA and t-tests.	PO1,PO2,PO3,PO4,PO12

4Hrs/Week

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

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

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

BP603T. HERBAL DRUG TECHNOLOGY (Theory)

45 Hours

Course Objective:

- Understand the preparation and standardization of herbal medicines.
- Analyze the role of nutraceuticals in health management.
- Explore the regulatory and GMP standards in the herbal industry.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** and ***formulate*** herbal medicines and nutraceuticals, focusing on raw materials and interactions.	PO1,PO2,PO3,PO9,PO11,PO12
CO-2	***Develop*** understanding of Ayurvedic systems, formulations, and standardization.	PO1,PO2,PO3,PO9,PO11,PO12
CO-3	***Combine*** herbal drug evaluation with regulatory and patenting knowledge.	PO1,PO2,PO3,PO9,PO11,PO12
CO-4	***Create*** herbal cosmetics and excipients using natural substances.	PO1,PO2,PO3,PO9,PO11,PO12
CO-5	***Organize*** and ***plan*** for the future of the herbal drug industry, emphasizing GMP practices.	PO1,PO2,PO3,PO9,PO11,PO12

Course content

UNIT-I **6 Hours**

Herbs as raw materials

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

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

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.

Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

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

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

UNIT-II **05 Hours**

Nutraceuticals

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

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

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

UNIT-III **7 Hours**

Herbal Cosmetics

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

Herbal excipients:

Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations:

Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes.

UNIT-IV **10 Hours**

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

Patenting and Regulatory requirements of natural products:

a. Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy
b. Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

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

UNIT- V **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.

S**chedule 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

BP609P. HERBAL DRUG TECHNOLOGY (Practical)

Course Objective:

- Understand phytochemical screening of herbal drugs.
- Analyze herbal formulations for cosmetics and pharmaceuticals.
- Evaluate quality control and regulatory aspects of herbal products.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** students of phytochemical screening techniques for crude drugs.	PO1,PO2,PO3,PO4,PO11,PO12
CO-2	***Assess*** the quality of herbal formulations by testing alcohol content in Asava and Arista.	PO1,PO2,PO3,PO4,PO11,PO12
CO-3	***Compare*** natural excipients for use in cosmetic and pharmaceutical formulations.	PO1,PO2,PO3,PO4,PO11,PO12
CO-4	***Evaluate*** herbal extracts in cosmetic and pharmaceutical formulations based on pharmacopoeial standards.	PO1,PO2,PO3,PO4,PO11,PO12
CO-5	***Summarize*** herbal drug monograph analysis from recent pharmacopoeias.	PO1,PO2,PO3,PO4,PO11,PO12

4 hours/ week

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

Recommended Books: (Latest Editions)

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

BP604T.BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

45 Hours

Course Objective:

- To understand drug absorption, distribution, and elimination processes.
- To evaluate pharmacokinetic models and parameters.
- To apply nonlinear pharmacokinetics in drug dosage and treatment.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Assess*** factors affecting drug absorption, distribution, and protein binding.	PO1,PO2,PO3,PO12
CO-2	***Compare*** metabolic pathways, excretion routes, and their effect on bioavailability.	PO1,PO2,PO3,PO12
CO-3	***Analyze*** pharmacokinetic models and parameters for drug behavior.	PO1,PO2,PO3,PO12
CO-4	**E*valuate*** multicompartment and nonlinear models in clinical settings.	PO1,PO2,PO3,PO12
CO-5	***Summarize*** pharmacokinetic principles and bioequivalence study methods.	PO1,PO2,PO3,PO12

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, protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT-II **10 Hours**

Elimination renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Objectives of bioavailability studies, 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 mainetnance doses and their significance in clinical settins.

UNIT- V **07 Hours**

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

Recommended Books: (Latest Editions)

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

BP605T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

45 Hours

Course Objective:

- Explore biotechnology's role in pharmaceuticals.
- Examine recombinant DNA technology applications.
- Design microbial fermentation processes.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Combine*** biotechnological methods for pharmaceutical applications.	PO1,PO2,PO3,PO12
CO-2	***Design*** recombinant DNA-based therapeutics.	PO1,PO2,PO3,PO12
CO-3	***Formulate*** strategies for vaccine production using hybridoma technology.	PO1,PO2,PO3,PO12
CO-4	***Create*** solutions for large-scale fermentation and biotransformation.	PO1,PO2,PO3,PO12
CO-5	***Hypothesize*** methods for blood product production and storage.	PO1,PO2,PO3,PO12

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 products:
   i) Interferon ii) Vaccines- hepatitis- B iii) Hormones- Insulin.
d. Brief introduction to PCR

Unit III

Types of immunity- humoral immunity, cellular immunity **10 Hours**

a. Structure of Immunoglobulins
b. Structure and Function of MHC
c. Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e. Storage conditions and stability of official vaccines
f. Hybridoma technology- Production, Purification and Applications

g. Blood products and Plasma Substituties.

Unit IV **08Hours**

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

Unit V **07 Hours**

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

Recommended Books (Latest edition):

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

BP606T. PHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Course Objective:

- Assess Quality Assurance, GMP, and TQM practices in the pharmaceutical industry.
- Critique Good Laboratory Practices (GLP) and document maintenance.
- Summarize calibration and validation processes for product quality.
-

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** students of the key concepts in Quality Assurance, GMP, and TQM.	PO1,PO2,PO3,PO11,PO12
CO-2	***Assess*** the benefits and procedures of ISO 9000, ISO 14000, and NABL accreditation.	PO1,PO2,PO3,PO11,PO12
CO-3	***Critique*** pharmaceutical document maintenance for effective quality control.	PO1,PO2,PO3,PO11,PO12
CO-4	***Weigh*** the impact of Quality by Design (QbD) tools on product quality.	PO1,PO2,PO3,PO11,PO12
CO-5	***Summarize*** the principles and importance of calibration and validation in the industry.	PO1,PO2,PO3,PO11,PO12

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 procedure

UNIT – II **10 Hours**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipments selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT – III **10 Hours**

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

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

UNIT – IV **08 Hours**

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

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula

Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT – V **07 Hours**

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

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

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

SEMESTER-VII

BP701T.INSTRUMENTAL METHODS OF ANALYSIS (Theory)

45 Hours

Course Objective:

- Understand key principles of spectroscopy and chromatography.
- Develop skills in selecting appropriate analytical instrumentation.
- Apply chromatographic and spectroscopic methods to real-world sample analyses.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** principles and applications of UV-Visible, IR, and atomic absorption spectroscopies.	PO1,PO2,PO3,PO11,PO12
CO-2	***Assess*** the role of instrumental components on spectroscopic accuracy.	PO1,PO2,PO3,PO11,PO12
CO-3	***Compare*** chromatographic techniques for their principles, instrumentation, and uses.	PO1,PO2,PO3,PO11,PO12
CO-4	***Judge*** the suitability of fluorimetry and flame photometry for specific analyses.	PO1,PO2,PO3,PO11,PO12
CO-5	***Recommend*** appropriate analytical techniques based on sample and analysis needs.	PO1,PO2,PO3,PO11,PO12

Course Content:

UNIT –I **10 Hours**

UV Visible spectroscopy

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

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

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation, and applications

UNIT –II **10 Hours**

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry-Principle, interferences, instrumentation, and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation, and applications

Nepheloturbidometry- Principle, instrumentation, and applications

UNIT –III **10 Hours**

Introduction to chromatography

Adsorption and partition column chromatography- Methodology, advantages, disadvantages, and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages, and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages, and applications

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

UNIT –IV **08 Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages, and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages, and applications.

UNIT –V **07 Hours**

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

Gel chromatography- Introduction, theory, instrumentation, and applications

Affinity chromatography- Introduction, theory, instrumentation, and applications

BP705P.INSTRUMENTAL METHODS OF ANALYSIS (Practical)

Course Objective:

- Learn analytical techniques for compound analysis.
- Build skills in colorimetry, spectroscopy, and chromatography.
- Apply methods for compound assessment and separation.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	**Assess** solvent effects on absorption maxima in organic compounds.	PO1,PO2,PO3,PO4,PO11,PO12
CO-2	**Compare** colorimetric methods for compound estimation.	PO1,PO2,PO3,PO4,PO11,PO12
CO-3	**Judge** UV spectroscopy's utility in drug estimation.	PO1,PO2,PO3,PO4,PO11,PO12
CO-4	**Relate** flame photometry and nepheloturbidometry to ion analysis.	PO1,PO2,PO3,PO4,PO11,PO12
CO-5	**Critique** chromatographic techniques for compound separation and identification.	PO1,PO2,PO3,PO4,PO11,PO12

4 Hours/Week

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

Recommended Books (Latest Editions)

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

BP702T.INDUSTRIAL PHARMACY-II (Theory)

45 Hours

Course Objective:

- Learn pilot plant scale-up and technology transfer.
- Understand regulatory affairs and quality management in drug development.
- Apply regulatory requirements for drug approval and commercialization.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** key considerations for pilot plant scale-up in manufacturing.	PO1,PO2,PO3,PO11,PO12
CO-2	***Assess*** WHO technology transfer guidelines and documentation needs.	PO1,PO2,PO3,PO11,PO12
CO-3	***Critique*** the role of regulatory affairs in the drug development process.	PO1,PO2,PO3,PO11,PO12
CO-4	***Compare*** quality management systems like QbD, TQM, and ISO standards.	PO1,PO2,PO3,PO11,PO12
CO-5	***Summarize*** Indian regulatory requirements for new drug approval.	PO1,PO2,PO3,PO11,PO12

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

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

UNIT-III **10 Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT-IV **08 Hours**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by design, 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, Common Technical Document (CTD), Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

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

BP703T. PHARMACY PRACTICE (Theory)

45 Hours

Course Objective:

- Learn pharmacy organization and drug distribution systems.
- Manage adverse drug reactions and therapeutic drug monitoring.
- Apply patient counseling and drug information services.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** a hospital pharmacy structure and drug dispensing system.	PO1,PO2,PO3,PO9,PO12
CO-2	***Develop*** strategies for managing drug reactions, interactions, and adherence.	PO1,PO2,PO3,PO9,PO12
CO-3	***Construct*** a hospital formulary and therapeutic drug monitoring system.	PO1,PO2,PO3,PO9,PO12
C0-4	***Organize*** drug distribution protocols for hospital and ambulatory patients.	PO1,PO2,PO3,PO9,PO12
C0-5	***Create*** patient counseling programs and drug information services.	PO1,PO2,PO3,PO9,PO12

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 pharmacists.

c Adverse drug reaction
Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

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

Unit II: **10 Hours**

a Drug distribution system in a hospital
Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, dispensing of drugs to ambulatory patients, and dispensing of controlled drugs.

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

c Therapeutic drug monitoring
Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

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

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

f **Community pharmacy management**
Financial, materials, staff, and infrastructure requirements.

Unit III: 10 Hours

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

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

c **Patient counseling**
Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

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

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

Unit IV 8 Hours

a 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.

c Over the counter (OTC) sales
Introduction and sale of over the counter, and Rational use of common over the counter medications.

Unit V 7 Hours

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

b Investigational use of drugs
Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

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

Journals:

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

BP704T. NOVEL DRUG DELIVERY SYSTEMS (Theory)

45 Hours

Course Objective:

- Understand controlled drug delivery system designs.
- Explore polymers and targeted drug delivery methods.
- Apply advanced drug delivery techniques in practice.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** design principles of controlled drug delivery systems.	PO1,PO2, PO3,PO12
CO-2	***Assess*** polymers and microencapsulation in drug formulations.	PO1,PO2, PO3,PO12
CO-3	***Compare*** transdermal, gastroretentive, and nasopulmonary drug delivery systems.	PO1,PO2, PO3,PO12
CO-4	***Critique*** targeted drug delivery methods like liposomes and nanoparticles.	PO1,PO2, PO3,PO12
CO-5	***Summarize*** ocular and intrauterine drug delivery systems and their challenges.	PO1,PO2, PO3,PO12

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 implantsand osmotic pump

Unit-III **10 Hours**

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

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

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

Unit-IV **08 Hours**

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

Unit-V **07 Hours**

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

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

Recommended Books: (Latest Editions)

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

Journals

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

SEMESTER-VIII

BP801T.BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Course Objectives:

- Understand statistical methods in pharmaceutical research.
- Explore research designs and clinical trial statistics.
- Apply statistical tools for pharmaceutical data analysis.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** statistical methods in pharmaceutical research.	PO1,PO2,PO3,PO11,PO12
CO-2	***Assess*** regression, probability, and hypothesis testing in studies.	PO1,PO2,PO3,PO11,PO12
CO-3	***Compare*** parametric and non-parametric tests for data analysis.	PO1,PO2,PO3,PO11,PO12
CO-4	***Critique*** clinical trial design and statistical analysis methods.	PO1,PO2,PO3,PO11,PO12
CO-5	***Summarize*** factorial design and response surface methodology in experiments.	PO1,PO2,PO3,PO11,PO12

Course content:

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

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

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

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

Unit-II **10 Hours**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples

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

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

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

Unit-III **10 Hours**

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

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

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

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

Unit-IV **8 Hours**

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regression models

Introduction to Practical components of Industrial and Clinical Trials Problems:

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

Unit-V **7Hours**

Design and Analysis of experiments:

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

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

Recommended Books (Latest edition):

1 Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. 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. Montg

BP802T. SOCIAL AND PREVENTIVE PHARMACY (Theory)

45 Hours

Course Objective:

- Understand the concepts of health, disease prevention, and social determinants of health.
- Examine the effectiveness of national health programs and their impact on public health.
- Apply strategies for health education and disease prevention in community health settings.

Course Outcomes: On completion of this course, the students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** health concepts and social factors in public health.	PO1,PO2,PO3,PO9,PO12
CO-2	***Assess*** national health programs and disease prevention strategies.	PO1,PO2,PO3,PO9,PO12
CO-3	***Compare*** preventive medicine approaches for various diseases.	PO1,PO2,PO3,PO9,PO12
CO-4	***Critique*** the role of nutrition and education in health.	PO1,PO2,PO3,PO9,PO12
CO-5	***Summarize*** national health intervention programs for vulnerable groups.	PO1,PO2,PO3,PO9,PO12

Course content:

Unit I: **10 Hours**

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

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

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

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

Unit II: **10 Hours**

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

Unit III: **10 Hours**

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV: **08 Hours**

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

Unit V: **07 Hours**

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

Recommended Books (Latest edition)*:*

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

Recommended Journals:

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

ELECTIVES

BP803ET. PHARMACEUTICAL MARKETING MANAGEMENT (Theory)

45 Hours

Course Objectives:

- To analyze pharmaceutical market dynamics and consumer behavior.
- To examine product development, branding, and lifecycle management in the pharmaceutical industry.
- To evaluate promotional strategies and pricing models, focusing on regulatory frameworks.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Analyze*** pharmaceutical market segmentation and consumer behavior.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-2	***Compare*** pharmaceutical product management strategies.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-3	***Differentiate*** promotional methods in pharmaceutical marketing.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-4	***Examine*** pharmaceutical marketing channels and sales representative roles.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-5	***Investigate*** pricing strategies and regulatory impact in the pharmaceutical industry.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12

Course Contents

Unit I **10 Hours**

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

Pharmaceutical market:

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

Unit II **10 Hours**

Product decision:

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

Unit III **10 Hours**

Promotion:

Meaning and methods, determinants of promotional mix, promotional budget; An overview of

personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **07 Hours**

Pharmaceutical marketing channels:

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

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **08 Hours**

Pricing:

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

Emerging concepts in marketing:

Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

BP804ET. PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45Hours

Course Objective:

- Understand the drug discovery and development process.
- Learn regulatory approval processes for drug products.
- Design clinical trial protocols and pharmacovigilance practices.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Formulate*** drug development strategies from discovery to clinical trials.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-2	***Design*** regulatory submission processes for IND, NDA, and ANDA.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-3	***Create*** technical documents for international drug registration.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-4	***Develop*** clinical trial protocols and apply GCP standards.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-5	***Combine*** regulatory concepts to navigate global pharmaceutical regulations.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12

Course content:

Unit I **10Hours**

New Drug Discovery and development

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

Unit II **10Hours**

Regulatory Approval Process

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

Regulatory authorities and agencies

Overview of regulatory authorities of United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

Unit III **10Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

Unit IV **08Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of

Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **07Hours**

Regulatory Concepts

Basic terminologies, guidance, guidelines, regulations, laws and acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng

BP805ET. PHARMACOVIGILANCE (Theory)

45 hours

Course Objectives:

- Design pharmacovigilance programs for ADR monitoring.
- Analyze drug safety reporting methods.
- Develop strategies for drug safety across phases.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Design*** a pharmacovigilance program for a healthcare setting.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-2	***Develop*** methods for assessing and managing adverse drug reactions.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-3	***Create*** communication strategies for drug safety crises.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-4	***Construc*t** a plan for vaccine safety and post-marketing surveillance.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12
CO-5	***Analyze*** drug safety in special populations like pediatrics and geriatrics.	PO1,PO2,PO3,PO5,PO6,PO9,PO11,PO12

Course Content

Unit I **10 Hours**

Introduction to Pharmacovigilance

- History and development of Pharmacovigilance
- Importance of safety monitoring of Medicine
- WHO international drug monitoring programme
- Pharmacovigilance Program of India (PvPI)

Introduction to adverse drug reactions

- Definitions and classification of ADRs
- Detection and reporting
- Methods in Causality assessment
- Severity and seriousness assessment
- Predictability and preventability assessment
- Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication related events
- Regulatory terminologies

Unit II **10 hours**

Drug and disease classification

- Anatomical, therapeutic and chemical classification of drugs
- International classification of diseases
- Daily defined doses
- International Non-proprietary Names for drugs

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and Standardised MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

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

Unit III **10 Hours**

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross sectional study, case control study and cohort study
- Targeted clinical investigations

Communication in pharmacovigilance

- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Unit IV **8 Hours**

Safety data generation

- Pre clinical phase
- Clinical phase
- Post approval phase (PMS)

ICH Guidelines for Pharmacovigilance

- Organization and objectives of ICH
- Expedited reporting
- Individual case safety reports

- Periodic safety update reports
- Post approval expedited reporting
- Pharmacovigilance planning
- Good clinical practice in pharmacovigilance studies

Unit V **7 hours**

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

- Paediatrics
- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and Schedule Y
- Differences in Indian and global pharmacovigilance requirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiology edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy, Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen, Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org
14. http://www.cioms.ch
15. http://cdsco.nic.in
16. http://www.who.int/vaccine_safety/en
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP806ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

45 Hours

Course Objectives:

- Assess quality control and regulatory guidelines for herbal medicines.
- Compare quality assurance practices in herbal drug industry.
- Evaluate chromatographic techniques and stability testing in herbal product standardization.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Assess*** the quality control and WHO guidelines for herbal medicines.	PO1,PO2,PO3,PO6,PO11,PO12
CO-2	***Compare*** international regulatory frameworks for herbal drug manufacturing.	PO1,PO2,PO3,PO6,PO11,PO12
CO-3	***Consider*** the role of chemical and biological markers in herbal product standardization.	PO1,PO2,PO3,PO6,PO11,PO12
CO-4	***Critique*** stability testing and safety evaluation methods for herbal medicines.	PO1,PO2,PO3,PO6,PO11,PO12
CO-5	***Recommend*** improvements in regulatory and safety monitoring systems for herbal products.	PO1,PO2,PO3,PO6,PO11,PO12

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 of cGMP, GAP, GMP and GLP in traditional system of medicine.
WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants

Unit III **10 hours**

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

Unit IV **08 hours**

Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products.
Preparation of documents for new drug application and export registration
GMP requirements and Drugs & Cosmetics Act provisions.

Unit V **07 hours**

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems
Comparison of various Herbal Pharmacopoeias.
Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions)

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

BP807ET. COMPUTER AIDED DRUG DESIGN (Theory)

45 Hours

Course Objectives:

- Understand drug discovery stages and methods like lead discovery and analog-based drug design.
- Evaluate QSAR and molecular modeling techniques in drug development.
- Compare bioinformatics and virtual screening in drug design.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Assess*** stages and approaches in drug discovery and development.	PO1,PO2,PO3,PO4,PO6,PO11,PO12
CO-2	***Compare*** QSAR methods for drug optimization.	PO1,PO2,PO3,PO4,PO6,PO11,PO12
CO-3	***Critique*** virtual screening and molecular docking techniques.	PO1,PO2,PO3PO4,,PO6,PO11,PO12
CO-4	***Evaluate*** the role of informatics in drug design.	PO1,PO2,PO3,PO4,PO6,PO11,PO12
CO-5	***Solve*** molecular modeling challenges using energy minimization.	PO1,PO2,PO3,PO4,PO6,PO11,PO12

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, ed., "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 Text Book 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, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York

BP808ET. CELL AND MOLECULAR BIOLOGY (Elective subject)

45 Hours

Course Objectives:

- Understand fundamental cell and molecular biology concepts.
- Explore genetic information flow and protein synthesis.
- Analyze cell signaling and regulatory mechanisms in health.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** basic cell biology concepts and differences between prokaryotic and eukaryotic cells.	PO1,PO2,PO3,PO12
CO-2	***Assess*** DNA/RNA functions and the transcription-translation process.	PO1,PO2,PO3,PO12
CO-3	***Compare*** protein structures and their roles in cell processes.	PO1,PO2,PO3,PO12
CO-4	***Critique*** cell cycle stages and regulatory checkpoints.	PO1,PO2,PO3,PO12
CO-5	***Evaluate*** cell signaling pathways and the effects of pathway misregulation.	PO1,PO2,PO3,PO12

Course content:

Unit I **10Hours**

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

Unit II **10 Hours**

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

Unit III **10 Hours**

a Proteins: Defined **and** Amino Acids
b Protein Structure
c Regularities in Protein Pathways
d Cellular Processes
e Positive Control and significance of Protein Synthesis

Unit IV **08 Hours**

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

Unit V **07 Hours**

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

Recommended Books (latest edition):

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

BP809ET - COSMETIC SCIENCE (Theory)

45 Hours

Course Objectives:

- Introduce the classification and formulation principles of cosmetic and cosmeceutical products.
- Explore the role of active ingredients and herbs in personal care formulations.
- Equip students with skills to assess and analyze cosmetic products.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Formulate*** cosmetic products using regulatory guidelines and ingredient functions.	PO1,PO2,PO3,PO4,PO11,PO12
CO-2	***Design*** skin, hair, and oral care products with targeted active ingredients.	PO1,PO2,PO3,PO4,PO11,PO12
CO-3	***Develop*** sun protection and herbal-based formulations for enhanced benefits.	PO1,PO2,PO3,PO4,PO11,PO12
CO-4	***Apply*** analytical methods to assess cosmetic product quality.	PO1,PO2,PO3,PO4,PO11,PO12
CO-5	***Address*** common cosmetic concerns with specialized product formulations.	PO1,PO2,PO3,PO4,PO11,PO12

Course content:

UNIT I

10Hours

Classification of cosmetic and cosmeceutical products

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 their relative skin sensory, advantages and disadvantages.Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioners, antidandruff shampoo.

Hair oils.

Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric

Hair care: Henna and amla.

Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste**.**

UNIT IV **08 Hours**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin 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.

References

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

BP810 ET. PHARMACOLOGICAL SCREENING METHOD (Theory)

45 Hours

Course Objectives:

- Understand laboratory animal care guidelines and drug testing models.
- Evaluate preclinical screening models for drug activity.
- Apply statistical methods to analyze preclinical data.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** guidelines for animal care and drug administration techniques in preclinical studies.	PO1,PO2,PO3,PO12
CO-2	***Assess*** preclinical screening models for evaluating drug activities in various systems.	PO1,PO2,PO3,PO12
CO-3	***Compare*** animal models used in preclinical testing and their applications.	PO1,PO2,PO3,PO12
CO-4	***Critique*** research methods and statistical tools in preclinical studies.	PO1,PO2,PO3,PO12
CO-5	***Recommend*** suitable screening models and data analysis approaches for preclinical testing.	PO1,PO2,PO3,PO12

Course Content

Unit –I **08 Hours**

Laboratory Animals:

Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Unit –II **10 Hours**

Preclinical screening models

a. **Introduction:** Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study.
b. **Study of screening animal models for**
   Diuretics, nootropics, anti-Parkinson's,antiasthmatics,

Preclinical screening models: for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease

Unit –III **10 Hours**

Preclinical screening models: for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics

Unit –IV **07 Hours**

Preclinical screening models: for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti-aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.

Unit –V **10 Hours**

Research methodology and Bio-statistics

Selection of research topic, review of literature, research hypothesis and study design

Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data.

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

BP811ET. ADVANCED INSTRUMENTATION TECHNIQUES (Theory)

45 Hours

Course Objectives:

- Understand NMR, Mass Spectrometry, and X-ray Diffraction techniques.
- Develop calibration methods for analytical instruments.
- Apply advanced extraction and hyphenated techniques in analysis.

Course Outcomes: **On completion of this course, students should be able to:**

CO	Statement	Cos & POs Mapping
CO-1	***Evaluate*** analytical techniques like NMR and Mass Spectrometry for structural analysis.	PO1,PO2,PO3,PO4,PO11,PO12
CO-2	***Design*** calibration protocols for instruments as per ICH and USFDA guidelines.	PO1,PO2,PO3,PO4,PO11,PO12
CO-3	***Combine*** extraction and radioimmunoassay techniques in pharmaceutical research.	PO1,PO2,PO3,PO4,PO11,PO12
CO-4	***Create*** reports on hyphenated techniques like LC-MS/MS and GC-MS/MS.	PO1,PO2,PO3,PO4,PO11,PO12
CO-5	***Organize*** thermal analysis methods (TGA, DSC, DTA) for material characterization.	PO1,PO2,PO3,PO4,PO11,PO12

Course Content:

Unit –I **10 Hours**

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

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

UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

UNIT-III **10 Hours**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV **08 Hours**

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V **07 Hours**

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

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

BP812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS (Theory)

45 Hours

Course Objectives:

- Evaluate nutraceutical classifications and health benefits.
- Analyze the role of phytochemicals and antioxidants in health.
- Understand regulations and safety standards for nutraceuticals.

Course Outcomes: On completion of this course, students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	***Apprise*** the benefits of nutraceuticals in disease prevention.	PO1,PO2,PO12
CO-2	***Assess*** the role of phytochemicals and antioxidants in chronic diseases.	PO1,PO2,PO12
CO-3	***Compare*** different types of nutraceuticals and their health benefits.	PO1,PO2,PO12
CO-4	***Critique*** the impact of free radicals on health and aging.	PO1,PO2,PO3,PO12
CO-5	***Recommend*** strategies for optimizing nutraceutical efficacy and safety.	PO1,PO2,PO3,PO12

Course Content:

UNIT I **07 hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.

b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.

c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits
of following used as nutraceuticals/functional foods: Spirulina,
Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II **15 hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin
b) Sulfides: Diallyl sulfides, Allyl trisulfide.
c) Polyphenolics: Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans
g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III **07 hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins,

Carbohydrates, nucleic acids.b) Dietary fibres and complex carbohydrates as functional food ingredients..

UNIT IV **10 hours**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Functional foods for chronic disease prevention

UNIT V **06 hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

BP813ET. Pharmaceutical Product Development (Theory)

45 Hours

Course Objective:

- To understand the fundamentals of pharmaceutical product development
- To examine regulatory requirements and guidelines related to the development of pharmaceutical products
- To explore the principles and processes of pharmaceutical formulation for different dosage forms

Course Outcomes: On completion of this course, the successful students should be able to:

CO	Statements	Cos & POs Mapping
CO-1	***Explain*** the key stages of pharmaceutical product development, including preformulation, formulation development, stability assessment, and quality control testing	PO1,PO2,PO3,PO6,PO11,PO12
CO-2	**Describe** regulatory framework governing pharmaceutical product development	PO1,PO2,PO3,PO6,PO11,PO12
CO-3	***Summarize*** formulation strategies for various types of pharmaceutical dosage forms, such as tablets, capsules, injectable, and topicals.	PO1,PO2,PO3,PO6,PO11,PO12
CO-4	***Describe*** the techniques and methods used in stability assessment,	PO1,PO2,PO3,PO6,PO11,PO12
CO-5	***Develop*** a critical understanding of the importance of quality control in pharmaceutical manufacturing	PO1,PO2,PO3,PO6,PO11,PO12

Unit-I **10 Hours**

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

Unit-II **10 Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Solvents and solubilizers
ii. Cyclodextrins and their applications
iii. Non - ionic surfactants and their applications
iv. Polyethylene glycols and sorbitols
v. Suspending and emulsifying agents
vi. Semi solid excipients

Unit-III **10 Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Tablet and capsule excipients
ii. Directly compressible vehicles
iii. Coat materials
iv. Excipients in parenteral and aerosols products

v. Excipients for formulation of NDDS
Selection and application of excipients in pharmaceutical formulations with specific industrial applications

Unit-IV **08 Hours**

Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.

Unit-V **07 Hours**

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

BPHL4102- POJECT WORK

Course Objectives:

- Use knowledge across all B. Pharm subjects to solve pharmaceutical challenges.
- Develop abilities in research, analysis, and regulatory compliance.
- Enhance documentation, presentation, and teamwork skills.

Outcome: On completion of this course, the successful students should be able to:

CO	Statement	Cos & POs Mapping
CO-1	Ability to ***develop*** leadership quality and team work.	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO10,PO11,PO12
CO-2	***Learn*** how to collect literature and develop road map for project.	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO10,PO11,PO12
CO-3	To ***design*** the new research projects.	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO10,PO11,PO12
CO-4	***Learn*** to evaluate the obtained experimental data and draw conclusions.	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO10,PO11,PO12
CO-5	***Communicat***e research findings effectively.	PO1,PO2,PO3,PO4,PO5,PO6,PO9,PO10,PO11,PO12

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