ACADEMIC PROGRAMME GUIDE

of

BACHELOR OF PHARMACY

Batch 2020

Based on Choice Based Credit System (CBCS) / Elective Course System

CHITKARA UNIVERSITY
HIMACHAL PRADESH
NAAC ACCREDITED

w.e.f
Academic Year: 2020-2021

Approved by the 25th Academic Council vide agenda item no. 25.7 dated on 03/07/2020

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1. General Information

Pharmacy as academic discipline makes for an enriching learning experience as it perfectly combines technology and health care system. The profession of pharmacy has transformed into acrucial domain in health care management and evolved as a multidisciplinary, multifaceted curriculum. Learning and working in harmony with other members of health care are the immediate needs for the ideal role and social relevance of pharmacist in the health care system of our country. So, the academic system at School of Pharmacy has been framed taking into consideration the responsibility of undergraduate students to meet the demands of hi-tech pharmaceutical industry, at the same time ensuring that they confidently serve the requirements of patient care and pharmacy practice. Conscious efforts to inculcate research aptitude in the students through elective research projects to keep them abreast of the requirements of the industry.

1.1 Program Objectives:

1. To provide exemplary education in a stimulating environment where delivery of superb pharmaceutical knowledge is integrated with nationally and internationally recognized research data to enable students to conduct and publish cutting-edge multidisciplinary research in the discovery, utilization and evaluation of therapeutic agents.
2. To prepare competent pharmacists at various levels for India.
3. To prepare globally capable pharmaceutical scientists.
4. To become efficient leaders in various stages of pharmaceutical production, marketing and distribution.

The Programme Educational Objectives (PEOs) and Programme Outcomes (POs) of B. Pharmacy Programme are summarized as below:

1.2 Programme Educational Objectives (PEOs):

PEO1: To prepare competent professionals capable of providing excellence in Pharmaceutical services to patients.

PEO2: To prepare professionals with expertise in developing and managing medication distribution and control systems.

PEO3: To prepare competent Pharmacists and Pharmaceutical scientists.

PEO4: To prepare efficient leaders in various stages of Pharmaceutical planning, operation, production, marketing and distribution.

PEO5: To prepare professionals with excellence in promoting public health providing drug information and education services.

1.3 Program Outcomes (POs):

The proposed outcomes for the B. Pharmacy program focus on the ability of a graduating student to develop himself/herself as a competent professional with appropriate scientific innovative skills in pharmaceutical sciences.

The program outcomes of B. Pharmacy program are as following:

PO1: The Pharmacy graduates are required to learn and acquire adequate knowledge, necessary skills to practice the profession of pharmacy with

adequate knowledge and scientific information regarding basic principles of Pharmaceutical & Medicinal Chemistry, Pharmaceutics including Cosmeticology, Pharmacology, Pharmacognosy and Pharmaceutical analysis.

PO2: The graduate should have adequate knowledge of synthesis & analysis of medicinal agents, their mode and mechanism of action, drug interactions, patient counselling and adequate technical information to be exchanged with the physician and other health professionals.

PO 3: Adequate knowledge of practical aspects of synthesis of Active Pharmaceutical Ingerdients (APIs) & its intermediates and analysis of various pharmaceutical dosage forms Formulation developments &quality assurance of various pharmaceutical dosage forms including those of herbalorigin as per standards of official books, WHO and other regulatory agencies like CDSCO USFDA, MHRA etc., pharmacological screening and biological standardization and in-vivo drug interactions, preparation & analysis of suitable plants material/extracts of medicinal importance for various herbal formulations, clinical studies, patient counseling leading to physical and social well-being of the patients, product detailing, marketing, distribution and selling of pharmaceutical products.

PO 4: A graduate should be able to demonstrate skills necessary for practice of a Pharmacy viz. able to synthesize, purify, identify and analyze medicinal agents, able to formulate, store, dispense, manufacture the pharmaceutical products and analyze the prescriptions, able to learn and apply the quality assurance principles in regulatory and ethical aspects, able to extract, purify, identify and understand the therapeutic value of herbal/crude/natural products, able to screen various medicinal agents using animal models for pharmacological activity.

PO 5: A graduate should develop the attitudes during the course which including willingness to apply the current knowledge of pharmacy in the best interest of the patients and the community, maintain high standards of professional ethics in discharging professional obligations, continuously upgrade professional information and be conversant with latest advances in the field of pharmacy to serve community better, willingness to participate in continuing education programs of PCI/AICTE/Chitkara University to upgrade the knowledge and professional skills, to help and participate in the implementation of National Health Programs.

PO6: The graduates are required to acquire in depth knowledge of formulation, quality assurance and storage of various pharmaceutical dosage forms including herbal medicines.

PO 7: The graduates should also understand the concept of community pharmacy and be able to participate in clinical pharmacy and research.

PO8: To understand industry relevant operations in drug discovery, development, pharmaceutical operations, quality assurance, business, market development, corporate affairs and clinical practices.

PO9: Technology Competence: The program aims to prepare competent professionals with advanced knowledge in pharmaceutical technology for process development and industry operations.

PO 10: To develop research aptitude to acquire advanced skills in development, conduct & outcome management of research projects in optimized formulation development & standardization in time bound manner.

PO 11: To develop capacity for undertaking regulatory compliance responsibilities & entrepreneurship skills.

1.4 University Vision and Mission:

University Vision

To be globally recognized organization promoting academic excellence through interdisciplinary applied research and to expand realms of knowledge through innovation.

University Mission:

M1: To carry out the academic processes in accordance with global standards through active teacher-student-industry participation.

M2: To promote research, innovation and entrepreneurship in collaboration with industry, research laboratories and academic institutions of global repute.

M3: To inculcate high moral, ethical and professional values amongst our students, faculty & staff.

M4: To contribute in building skillful society

The programme educational objectives (PEOs) in Bachelor of Pharmacy are well-designed based on the mission of providing the graduating students with knowledge and for expertise required for professional practices in health and pharmaceutical services. The graduating students are prepared for demonstrating knowledge and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative sciences, health policy and legal issues in the practice of pharmacy. Each year, from different universities and pharmaceutical industry across the globe visits School of Pharmacy, Chitkara University, Himachal Pradesh to provide international exposure to the students.

Aiming at developing student's personality through community service, NSS activities are offered to students to instill the idea of social welfare and to provide service to society without bias. To enrich student’s interpersonal skills, variety of extracurricular activities have been inculcated in the course curriculum in the form of national level technical and cultural festivals such as Pharma-fest, International Pharmacist Day and National Pharmacy Week respectively on a yearly basis. A vital role is played by the institutional technical cell for overall progress & grooming of the student through organizing industrial visits, workshops, debate, technical quizzes and research project

paper presentation competitions in various events and conferences. The students are motivated to participate or organize such events. These value-added activities have been designed taken into account various Programme Objectives (POs) such as PO3, PO8, PO9, PO10 and PO11, and have been in accordance with all the mentioned Programme Educational Objectives (PEOs).

The main aim of service training with focus on good health and well-being is accomplished by delivering sport-related events, NSS and NCC. The programme also aims to develop professional with awareness of international standards as of global health has transcended beyond the idea of confining the pharmacist's work to a specific geographical location and broadened it to the global level. PO1, PO2, PO4, PO5 and PO6 promote development of skills in graduates for pharmaceutical formulations, analytical experts, regulatory and dispensing skills for good practices in global health system.

Pharmacists have the opportunity to play an important role in both public health and global health. In particular, pharmacists can look at the varied global health practices established in medicine and use this as a framework to understand the potential role of the pharmacist with in global health practice and program delivery, research, and policy. According to the "Consortium of Universities for Global Health", global health should refer to the scope of a wider problem rather than a geographical location. The scope of work of pharmacists in diverse settings faces challenges of global health such as self-care & self-medication, management of diseases through medication therapy management, resistance to existing drugs or recreational drugs being abused, medicines supplied through unregistered online pharmacies, online advertising of prescription drugs, direct-to-consumer websites and the distribution of substandard & spurious, falsely-labeled, falsified or counterfeit medicines. PEOs and POs are designed and oriented to meet the mission of university in professional ethics. The PEOs ensure that the graduating students are well equipped with pharmaceutical technical knowledge, to promote the development of trained human resource in pharmaceutical sciences for dissemination of quality education with highly professional and ethical attitude, strong communication and effective skills to work in a team with multidisciplinary approach. Thus, the objective of the programme is to produce pharmacy graduates with strong fundamental concepts and high technical competence in pharmaceutical sciences and technology, who shall be able to use these tools in pharmaceutical industry and/or institutes where ever necessary for success.

1.5 Placement Opportunities:

The bachelor program in pharmacy provides ample opportunity to a graduate to join various areas in pharmaceutical industry set up as well as in a hospital pharmacy support. The level of appointment and compensation there upon may depend upon the job profile and need for further additional postgraduate specialization in specific areas. The possible positions are:

a. Research and Formulation Development Executive: Development of new formulations

b. Production Executive: Managing and supervising production of formulations
c. Project Executive (New Products): Coordinating the research, production and marketing activities in a pharmaceutical organization, deciding as to what and how to develop a new product and plan production and marketing activity as per available capacity.
d. Project Executive (New Plant): coordinating and erection, installation commissioning of production in a new plant / facility and ensuring that all installation and procedures are as per compliance norms laid out by regulatory agencies.
e. Executive (Administration and Finance)/management Trainee: in a pharmaceutical organization.
f. Executive /Astt Manager, Regulatory Affairs: Helping the research team to compile drugmaster files for new drug products for registration and approval with the food and drug authority of different countries.
g. Hospital Pharmacist: He may further diversify into clinical pharmacist and then specialize into geriatric, pediatric or other specific area in a govt or private setup in India or in other countries including USA, UK, UAE and others.
h. Sales and Marketing: He/She may take up a career in marketing starting as a sales person and then diversifying into product management, training and market research.

2. Eligibility for Admission

First year B. Pharmacy:

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.

Pharmacy 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. Programme Duration

The course of study for B. Pharmacy 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.

Medium of instruction and examination

Medium of instruction and examination shall be in English.

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.

4. Pedagogical Aspects

Each course will be taught for 39-65 hrs. Everyday there will be three to four lecture sessions of three to four courses of 1 hours each and three-to-four-hour practical (pre-lunch and post-lunch). Activity and project hours will be other than these lecture hours depending upon the subject and relevance of the project. At least one week prior to the commencement of a particular course, the concerned faculty member or the course coordinator will circulate among the students the following pertaining to the course:

a. The course outlines containing the syllabus along with text books, reference books and other study material.
b. Day- to- day schedule to be followed- detailing the pace, coverage, prior reading assignments, case studies, home assignments to be perused by the students etc.
c. Various components of evaluation, such as quizzes (announced or unannounced), assignment, open book test, field work, group discussion, seminar, assignments, tests/examinations, class participation, mid-term and end term grading with relative weightage etc.
d. Other matters found desirable and relevant.

5. Program 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.

Credit assignment

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.

Minimum credit requirements

The minimum credit points required for award of a B. Pharmacy 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.

Academic work

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

Course of study

The course of study for B. Pharmacy shall include Semester Wise Theory and 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.

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 ChemistryI–Theory	3	1	4
BP203T	Biochemistry- Theory	3	1	4
BP204T	Pathophysiology - Theory	3	1	4
BP205T	Computer Applicationsin 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

List of courses offered in as per UGC guidelines:			
Course Code	**Course Name**	**L+T+P**	**Credits**
-	National Service Scheme (NSS)	-	2
-	National Cadets Corps (NCC)	-	2

Table-III: Course of Study for Semester III

Course Code	Name of the Course	No. of Hours	Tutorial	Credit Points
BP301T	Pharmaceutical Organic ChemistryII–Theory	3	1	4
BP302T	Physical PharmaceuticsI–Theory	3	1	4
BP303T	Pharmaceutical Microbiology–Theory	3	1	4
BP304T	Pharmaceutical Engineering–Theory	3	1	4
BP305P	Pharmaceutical Organic ChemistryII–Practical	4	-	2
BP306P	Physical PharmaceuticsI–Practical	4	-	2
BP307P	Pharmaceutical Microbiology–Practical	4	-	2
BP308P	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–	4	-	2
CS501	Cyber Security	3	-	-
Total		34	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
DM101	Disaster Management	2	-	-
Total		29	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	4	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 –Theory	3	1	4
BP802T	Socialand Preventive Pharmacy –Theory	3	1	4
BP803ET	Pharma Marketing Management –Theory	3+3=6	1+1=2	4+4=8
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			
BP813PW	Project Work	12	-	6
HR101	Human Rights and Values	3	-	-
Total		27	4	22

Value Added Course				
Course Code	**Name of the Course**	**No. of Hours**	**Tutorial**	**Credit Points**
--	Health Education	30	--	--
--	Prevention and Management of Drug Abuse	30	--	--

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 extra curricular and/or co-curricular activities shall be given by the Principal of the college and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

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

#Applicable ONLY for the students studied Mathematics/Physics/Chemistry at HSC

and appearing for Remedial Biology course.

Program Committee

I. 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.

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

III. 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.

6. Assessment and Evaluation

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

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 symbols (*) in Table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

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

Semester I

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

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

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

* Non University Examination (NUE)

Semester II

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

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– T	10	15	1 Hr	25	75	3 Hrs	100
BP302T	Physical Pharmaceutics I– T	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology– T	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering–T	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II– P	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I– P	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology– P	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering– P	5	10	4 Hr	15	35	4 Hrs	50
Total		60	100	20	160	440	28 Hrs	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 –T	10	15	1 Hr	25	75	3 Hrs	100

BP402T	Medicinal Chemistry I–T	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II– T	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I– T	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I– T	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal ChemistryI–P	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II– P	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I– P	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I– P	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–T	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Industrial Pharmacy I –T	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II– T	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II–T	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence– T	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Industrial Pharmacy I –P	5	10	4 Hrs	15	35	4 Hrs	50
BP507P	Pharmacology II– P	5	10	4 Hrs	15	35	4 Hrs	50

BP508P	Pharmacognosy II– P	5	10	4 Hrs	15	35	4 Hrs	50
Total		65	105	17 Hrs	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 – T	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III– T	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology– T	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics– T	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology– T	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– T	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal Chemistry III– P	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III– P	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology– P	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	10	15	1 Hr	25	75	3 Hrs	100

BP702T	Industrial Pharmacy– T	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice–T	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System– T	10	15	1 Hr	25	75	3 Hrs	100
BP705P	Instrumental Methods of Analysis	5	10	4 Hrs	15	35	4 Hrs	50
BP706PS	Practice School*	25	-	-	25	125	5 Hrs	150
Total		70	70	8 Hrs	140	460	21 Hrs	600

Semester VIII

Course Code	**Nameofthe course**	**Internal Assessment**				**End SemesterExams**		**Total Marks**
		Continuous Mode	**Sessional Exams**		**Total**	**Marks**	**Duration**	
			Marks	**Duration**				
BP801T	Biostatistics and Research Methodology– T	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing– T	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–							
BP805ET	Pharmacovigilance–							
BP806ET	Quality Control and Standardization of Herbals– T							
BP807ET	Computer Aided Drug Design– T							
BP808ET	Cell and Molecular Biology– T							
BP809ET	Cosmetic Science– T							
BP810ET	Experimental Pharmacology– T							
BP811ET	Advanced Instrumentation Techniques– T							

BP812ET	Dietary Supplements and Nutraceuticals – T							
BP813PW	Project Work	-	-	-	-	150	4 Hrs	150
Total		40	60	4 Hrs	100	450	16 Hrs	550

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	2.0
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	5.0
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

Sessional Exams

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

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

Question paper pattern for theory Sessional examinations

For subjects having University examination

I	Multiple Choice Questions (MCQs) OR Objective Type Questions (5x2) (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)	02 x 5 = 10
	Total	30 marks

For subjects having Non-University Examination

I	Long Answers (Answer 1 out of 2)	1 x 10 = 10
II	Short Answers (Answer 4 out of 6)	4 x 05 = 20
	Total	30 marks

Question paper pattern for practical sessional examinations

I	Synopsis	10
II	Experiments	25
III	Viva voce	05
	Total	40 marks

7. Rules for Attendance

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.

8. Grading System

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.

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.

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.

Re-examination of end semester examinations

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

Table-XIII: Tentative schedule of end semester examinations

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

Question paper pattern for end semester theory examinations

For 75 marks paper

I	Multiple Choice Questions (MCQs) OR Objective Type Questions (10x2) (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 x 05 = 35
	Total	75 marks

For 50 marks paper

I	Long Answers (Answer 2 out of 3)	2 x 10 = 20
II	Short Answers (Answer 6 out of 8)	5 x 05 = 30
	Total	50 marks

For 35 marks paper

I	Long Answers (Answer 1 out of 2)	1 x 10 = 10
II	Short Answers (Answer 5 out of 7)	5 x 05 = 25
	Total	35 marks

Question paper pattern for end semester practical examinations

I	Synopsis	05
II	Experiments	25
III	Viva voce	05
	Total	35 mzarks

Grading of performances

Letter grades and grade points allocations:

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

Table–XII: Letter grades and grade points equivalent to Percentage of marks and performances.

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00–100	O	10	Outstanding
80.00–89.99	A	9	Excellent
70.00–79.99	B	8	Good
60.00–69.99	C	7	Fair
50.00–59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

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 student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then student's SGPA is equal to:

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

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

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

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:

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

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

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

9. Promotion and Registration

No student shall be admitted to any examination unless he/she fulfills the norms given in 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 run till 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.

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 and bound copy not less than 25 pages).

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

Evaluation of Dissertation Book:

Objective(s) of the workdone	15Marks
Methodology adopted	20Marks
Resultsand Discussions	20Marks
Conclusions and Outcomes	20Marks
Total	75Marks

Evaluation of Presentation:

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

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.

Industrial training (Desirable)

Every candidate shall be required to work for atleast 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.

Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time. At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college level and grade point shall be awarded.

10. Migration/Credit Transfer Policy

The following procedures will be followed for credit transfer for student under migration, studied in other Universities in India and Abroad:

"The credits earned by the student from the other universities in India or abroad shall be transferred as such. The Degree shall only be awarded to candidate subject to the condition that student earned the minimum no. of credit defined by Academic Regulation/APG of the Programme run by the Chitkara University."

In case a student undergoes international exchange programme or internship for 1 semester/1year, then the courses, credits and grades earned by the student in abroad during that period should be reflected on the grade card issued by the Chitkara University. The courses will be marked as (*) on the grade

card/transcript. The description of the (*) will be "credits and grades as adopted university/institute name…….during international exchange programme. The minimum credits requirement for being eligible for B.Pharmacy degree will be 211/213$/214# credits. If consolidated credits are less than 211 credits, then the student has to earn extra credits to attain minimum credits requirement for B. Pharmacy degree. The instructions regarding this will be informed to the students by the department from time to time.

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

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

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

11. Eligibility to Award the Degree

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.

Award of degree

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

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.

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 breakup period and he/she has to rejoin the program by paying the required fees.

12. Programme Overview

CHAPTER-II: SYLLABUS

SEMESTER I

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP101T	Human Anatomy and Physiology I– Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: learn about the gross morphology, structure and functions of cell, skeletal, muscular, cardiovascular system of the human body.

CLO 02: study and understand the various homeostatic mechanisms and their imbalances.

CLO 03: identify the different types of bones in human body.

CLO 04: identify the various tissues of different systems of human body.

CLO 05: learn about the various experimental techniques related to physiology.

CLO 06: learn various techniques like blood group determination, blood pressure measurement, blood cells counting which will give them employability in clinical sector.

Course Content:

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.

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

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

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP107P	Human Anatomy and Physiology– Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the construction, working, care and handling of instruments, glassware's and equipment's required for practical.

CLO 02: understand the significance of Bleeding time, Blotting time, Blood group detection, Haemoglobin detection and measurement of blood pressure.

CLO 03: gain knowledge of mechanism of White Blood Cell Count and Red Blood Cell Count of blood sample.

CLO 04: develop skills by demonstrating the human cardiovascular system and digestive system with the help of Charts and models.

CLO 05: examine different types of human bones, heart rate and pulse rate.

Course Content:

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 skills and insights 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. K. Sembulingam and Prema Sembulingam, "Essentials of Medical Physiology", Jaypee brother's medical publishers, New Delhi, 8th edition.

2. Kathleen J. W. Wilson, "Anatomy and Physiology in Health and Illness", Churchill Livingstone, NewYork, 13th edition.
3. Physiological basis of Medical Practice-Best and Tailor. Williams and Wilkins Co, Riverview, MI USA
4. Arthur C, Guyton and John. E. Hall, "Textbook of Medical Physiology", Miamisburg, OH, U.S.A, 12th edition.
5. Tortora Grabowski, "Principles of Anatomy and Physiology", Palmetto, GA, U.S.A, 16th edition.
6. Inderbir Singh, "Textbook of Human Histology", Jaypee brother's medical publishers, New Delhi, 9th edition.
7. C.L.Ghai, "Textbook of Practical Physiology", Jaypee brother's medical publishers, New Delhi.
8. K.Srinageswari and Rajeev Sharma, "Practical work book of Human Physiology", Jaypee brother's medical publishers, New Delhi, 2nd edition.

Reference Books (Latest Editions)

1. Best and Tailor, "Physiological basis of Medical Practice", Williams and Wilkins Co, Riverview, MI USA
2. Arthur C, Guyton and John. E. Hall, "Textbook of Medical Physiology", Miamisburg, OH, U.S.A.
3. Dr. C.C. Chatterrje, "Human Physiology", Academic Publishers Kolkata, Vol. 1 and 2.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP102T	Pharmaceutical Analysis I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: develop ideas with the fundamental of analytical chemistry among the pupil.

CLO 02: construct the fundamental methodology to prepare different strength of solutions.

CLO 03: facilitate the fellow pupil to predict the sources of mistakes and errors.

CLO 04: develop the fundamentals of volumetric analytical skills.

CLO 05: peculate the basic knowledge in the principles of electrochemical analytical techniques which will make them employable in quality control unit.

CLO 06: develop skills by the course content in terms of choice of analytical

Course Content:

Pharmaceutical analysis: Definition and scope; Different techniques of analysis; Methods of expressing concentration; Primary and secondary standards; 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. Errors: Sources, types, and methods of minimizing errors, accuracy, precision and significant figures. Pharmacopoeia, sources of impurities in medicinal agents, limit tests.

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.

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajan's 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.

Diazotisation titration: Basic Principles, methods and application of diazotisation titration.

Redox titrations: Concepts of oxidation and reduction; types of redox titrations (principles and applications); Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate.

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, applications. Polarography- Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, and applications.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP108P	Pharmaceutical Analysis I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the apparatus and glassware used in analytical chemistry.

CLO 02: know the importance of calibration in analysis of compound

CLO 03: understand the principle, reaction condition and factor calculation for data analysis for various volumetric methods of analysis.

CLO 04: develop skills by studying the interpretation of data and computing the results.

CLO 05: apply conductometric and potentiometric titration of acid and base

Course Content:

1. Limit Test of Chloride
2. Limit Test of Sulphate
3. Limit Test of Iron
4. Limit Test of Arsenic
5. Preparation and standardization of Sodium hydroxide
6. Preparation and standardization of Sulphuric acid
7. Preparation and standardization of Sodium thiosulfate
8. Preparation and standardization of Potassium permanganate
9. Preparation and standardization of Ceric ammonium sulphate
10. Assay of Ammonium chloride by acid base titration
11. Assay of Ferrous sulphate by Cerimetry
12. Assay of Copper sulphate by Iodometry
13. Assay of Calcium gluconate by complexometry
14. Assay of Hydrogen peroxide by Permanganometry
15. Assay of Sodium benzoate by non-aqueous titration
16. Assay of Sodium Chloride by precipitation titration
17. Conductometric titration of strong acid against strong base
18. Conductometric titration of strong acid and weak acid against strong base
19. 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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP103T	Pharmaceutics I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: gain fundamental knowledge in preparing conventional dosage forms.

CLO 02: learn about basics of pharmacopoeias available.

CLO 03: gain knowledge about various pharmaceutical dosage calculations.

CLO 04: understand various techniques for the formulation and evaluation of powders and liquid dosage forms which will give them employability in pharmaceutical industries.

CLO 05: identify various pharmaceutical incompatibilities.

CLO 06: gain knowledge about various semisolid dosage forms and their evaluation will enhace the skills to perform work accordingly.

Course Content:

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, prescription handling, errors in prescription.

Posology: Definition, factors affecting posology; pediatric dose calculations based on age, body weight, body surface area.

Pharmaceutical calculations: Weights and measures – imperial and metric system, calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and dis-advantages, 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.

Monophasic liquids: Definitions and preparations of gargles, mouthwashes, throat paint, eardrops, nasal drops, enemas, syrups, elixirs, liniments and lotions.

Biphasic liquids: Suspensions: Definition, advantages, disadvantages, classification, and preparation of suspensions; flocculated and deflocculated suspension and 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.

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP109P	Pharmaceutics I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: explain formulation, evaluation and labeling of aromatic water, glycerides, syrups, elixirsand powder preparations.

CLO 02: develop skills by performing pharmaceutical calculations to determine evaluation parameters like density, viscosity, specific gravity, angle of repose, Carr's index, Hausner ratio of preparations.

CLO 03: describe use of ingredients in formulation and category of formulation.

CLO 04: compare various mono phasic preparations depending upon their formulation.

CLO 05: select suitable packaging material (container-CO sure) for the preparation.

Course Content:

1. **Syrups:** (a) Syrup IP'66; (b) Compound syrup of ferrous phosphate BPC'68.
2. **Elixirs:** (a) Piperazine citrate elixir; (b) Paracetamol pediatric elixir.
3. **Linctus:** (a) Terpin hydrate linctus IP'66; (b) Iodine throat paint (Mandles paint).
4. **Solutions:** (a) Strong solution of ammonium acetate; (b) Cresol with soap solution; (c) Lugol's solution.
5. **Suspensions:** (a) Calamine lotion; (b) Magnesium hydroxide mixture; (c) Aluminimum hydroxide gel.
6. **Emulsions**: (a) Turpentine liniment; (b) Liquid paraffin emulsion.
7. **Powders and granules:** (a) ORS powder (WHO); (b) Effervescent granules; (c) Dusting powder; (d) Divded powders.
8. **Suppositories:** (a) Glycero gelatin suppository; (b) Coca butter suppository; (c) Zinc oxide suppository.
9. **Semisolids:** (a) Sulphur ointment; (b) Non staining-iodine ointment with methyl salicylate; (c) Carbopal gel.
10. **Gargles and mouthwashes:** (a) Iodine gargle; (b) Chlorhexidine mouthwash.

Recommended Books (Latest Editions):

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone.
1. Indian pharmacopoeia.

2. British pharmacopoeia.
3. Lachmann. Theory and Practice of Industrial Pharmacy, Lea& Febiger Publisher.
4. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott.
5. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
6. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, Elsevier Health Sciences, USA.
7. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker.
8. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP104T	Pharmaceutical Inorganic Chemistry– Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the principles of limit tests.

CLO 02: analyze different classes of inorganic pharmaceuticals

CLO 03: Identify different anions, cations and different inorganic pharmaceuticals.

CLO 04: gain knowledge about the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals which will help students to get employability in quality control department.

CLO 05: understand and develop skills related to medicinal and pharmaceutical importance of inorganic compounds

CLO 06: introduce to a variety of inorganic drug classes.

Course Content:

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.

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*, 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.

Gastrointestinal agents: *Acidifiers*: Ammonium chloride*, Dil. HCl. *Antacid*: Ideal properties of antacids, combinations of antacids, sodium bicarbonate*, aluminum hydroxide gel, magnesium hydroxide. *Cathartics*: Magnesium sulphate, sodium orthophosphate, kaolin and bentonite. *Antimicrobials*: Mechanism, classification, potassium permanganate, boric acid, hydrogen peroxide*, chlorinated lime*, iodine and its preparations.

Miscellaneous compounds: *Expectorants:* Potassium iodide, ammonium chloride*. *Emetics*: Copper sulphate*, sodium potassium tartarate. *Haematinics*: Ferrous sulphate*, ferrous gluconate. *Poison and Antidote*: Sodium thiosulphate*, activated charcoal, sodium nitrite. *Astringents*: Zinc sulphate, potash alum.

Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of

α, β, γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions and pharmaceutical application of radioactive substances.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP110P	Pharmaceutical Inorganic Chemistry– Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: analyze different inorganic mixtures.

CLO 02: develop skills in carrying out identification test of given inorganic compounds

CLO 03: perform limit test For chlorides, sulphates etc.

CLO 04: prepare inorganic compounds

CLO 05: identify different limit tests

Course Content:

1. Limit test for Chlorides and Sulphates
2. Modified limit test for Chlorides and Sulphates
3. Limit test for Iron
4. Limit test for Heavy metals
5. Limit test for Lead
6. Limit test for Arsenic
7. Identification test for Magnesium hydroxide
8. Identification test for Ferrous sulphate
9. Identification test for Sodium bicarbonate
10. Identification test for Calcium gluconate
11. Identification test for Copper sulphate
12. Swelling power of Bentonite
13. Neutralizing capacity of aluminum hydroxide gel
14. Determination of potassium iodate and iodine in potassium Iodide
15. Preparation of Boric acid
16. Preparation of Potash alum
17. Preparation of 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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP105T	Communication skills–Theory	2	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation

CLO 02: communicate effectively (Verbal and Non-Verbal)

CLO 03: effectively manage the team as a team player

CLO 04: develop interview skills

CLO 05: develop leadership qualities and essentials

Course Content:

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.

Elements of Communication: Introduction, face to face communication - tone of voice, body language (non-verbal communication), verbal and physical communication.

Communication Styles: Introduction, the communication styles matrix with example for each-direct communication style, spirited communication style, systematic communication style, and considerate communication style.

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.

Interview Skills: Purpose of an interview, do's and don'ts of an interview.

Giving Presentations: Dealing with fears, planning your presentation, structuring your presentation, delivering your presentation, techniques of delivery.

Group Discussion: Introduction, communication skills in group discussion, do's and don'ts of group discussion.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP111P	Communication skills–Practical	2	1

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation

CLO 02: communicate effectively (Verbal and Non-Verbal)

CLO 03: effectively manage the teams team player

CLO 04: develop presentation, writing and interview skills

CLO 05: develop leadership qualities and essentials

CLO 06: develop E-Mail etiquette

Course Content:

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

1. Basic communication covering the following topics
2. Meeting People
3. Asking Questions
4. Making Friends
5. What did you do?
6. Do's and Dont's
7. Pronunciations covering the following topics
8. Pronunciation (Consonant Sounds)
9. Pronunciation and Nouns
10. Pronunciation (Vowel Sounds)
11. Advanced Learning
12. Listening Comprehension / Direct and Indirect Speech
13. Figures of Speech
14. Effective Communication
15. Writing Skills
16. Effective Writing
17. Interview Handling Skills
18. E-Mail etiquette
19. Presentation Skills

Recommended Books (Latest Editions):

1. Andreja. J. Ruther Ford, Basic communication skills for Technology, 2nd Edition, Pearson Education, 2011
2. Sanjay Kumar, Pushpalata, Communication skills, 1st Edition, Oxford Press, 2011

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP106RBT	Remedial Biology- Theory	2	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: learn and understand about cell biology (Basic Nature of Plant cell and Animal cell) which will develop skills and make them employable in various pharmaceutical sectors.

CLO 02: understand the classification system of both Plants and Animals

CLO 03: gain knowlwdge about various tissue system and organ system in plant and animals

CLO 04: understand the theory of evolution

CLO 05: remember the anatomy and physiology of plants and animals.

CLO 06: remember various phases in the development of plant growth.

CLO 07: learn about respiration techniques in plants.

Course Content:

Living world: Definition and characters of living organisms. Diversity in the living world. Binomial nomenclature. Five kingdoms of life and basis of classification. Salient features of monera, potista, fungi, animalia and plantae, virus.

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

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 & its regulation, exchange of gases, transport of gases and regulation of respiration, respiratory volumes.

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.

Plants and mineral nutrition: Essential mineral, macro and micronutrients, nitrogen metabolism, nitrogen cycle, biological nitrogen fixation.

Photosynthesis: Autotrophic nutrition, photosynthesis, photo-synthetic pigments, factors affecting photosynthesis.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP112RBP	Remedial Biology–Practical	2	1

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: develop skills and make aware the students to understand and learn about cell biology (Basic Nature of Plant cell and Animal cell)

CLO 02: understand the classification system of both Plants and Animals

CLO 03: gain knowlwdge about various tissue system and organ system in plant and animals

CLO 04: study the modification of stems, roots, leaf, seeds

CLO 05: remember the anatomy and physiology of plants and animals.

CLO 06: remember various phases in the development of plant growth.

CLO 07: learn about respiration techniques in plants.

Course Content:

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

Recommended Books (Latest Editions):

1. S. B. Gokhale, Text book of Biology, Nirali Prakashan, 2nd Edition, 2016
2. Dr. Thulajappa and Dr. Seetaram, A Text book of Biology, Expert Education Publisher, 1st Edition, 1995.
3. B.V. Sreenivasa Naidu, A Text book of Biology, Bangalore Prakasha Sahithya, 1998.
4. A.C. Dutta, Botany for Degree students, OUP India, 1st Edition, 1997.
5. M. Ekambaranatha ayyer and T. N. Ananthakrishnan, Outlines of Zoology, S.Viswanathan Printers & Publishers, 3rd Edition, 2011.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP106RMT	Remedial Mathematics–Theory	2	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.

CLO 02: create, use and analyze mathematical representations and mathematical relationships

CLO 03: communicate mathematical knowledge and understanding to get employability in the field of Clinical Pharmacy.

CLO 04: perform abstract mathematical reasoning.

CLO 05: learn about analytical geometry.

Course Content:

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 (definition),

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

Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.

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.tx, where n is any rational number, Derivative of e^x, Derivative of loge 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.

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.

Differential Equations: Some basic definitions, order and degree, equations in separable form, homogeneous equations, linear differential equations, exact equations, application in solving pharmacokinetic equations.

Laplace Transform: Introduction, definition, properties of Laplace transform, Laplace transforms of elementary functions, inverse Laplace transforms, Laplace transform of derivatives, application to solve linear differential equations, application in solving chemical kinetics and pharmacokinetics equations.

Recommended Books (Latest Editions):

1. Shanthinarayan, Differential Calculus, Ryerson Publisher, 1996.
2. Panchaksharappa Gowda D.H., Pharmaceutical Mathematics with application to Pharmacy, BS Publications, 1st Edition, 2014.
3. Shanthinarayan, Integral Calculus, S Chand & Co Ltd., 11th Edition, 2018.
4. Dr. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2018.

SEMESTER II

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP201T	Human Anatomy and Physiology II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: study about the grossmorphology, structure and functions of nervous, respiratory, urinary and reproductive systems in the human body.

CLO 02: study in detailed about energy and metabolism.

CLO 03: identify the various organs of different systems of human body.

CLO 04: perform and learn about the experiments like neurological reflex, body temperature measurement

CLO 05: study and elaborate on interlinked mechanisms in the maintenance of normal functioning of human body.

CLO 06: learn and perform the experiments like Olfaction, gustation reflex and eye Sight and it would groom them for better employability.

Course Content:

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).

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.

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.

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.

Reproductive system: Anatomy of male and female reproductive system, functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermato-genesis, oogenesis, pregnancy and parturition.

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP207P	Human Anatomy and Physiology II–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the construction, working, care and handling of instruments, glassware's and equipment's required for practical for developing skills.

CLO 02: gain knowledge of mechanism of Differential Blood Cell Count and Reticulocyte Count of Blood sample.

CLO 03: demonstrate human axial and appendicular skeleton system with the help of bones.

CLO 04: gain knowledge of construction and working of Spirometer for the measurement of lung volume and capacities.

CLO 05: study various family planning devices.

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 skills and an insight on the subject.

Course Content:

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP202T	Pharmaceutical Organic ChemistryI–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: write the structure, name of the organic compound.

CLO 02: gain knowledge about the type of isomerism.

CLO 03: write the reaction, name there action and orientation of reactions.

CLO 04: remember the account for reactivity/stability of compounds,

CLO 05: identify/confirm the unknown organic compound

CLO 06: gain knowledge about the naming reactions of carbonyl compounds

CLO 07: to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, etc and these skills maid our students better employable in medical arena.

Course Content:

General methods of preparation and reactions of compounds superscripted with a asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.

Classification, nomenclature and isomerism: Classification of organic compounds; Common and IUPAC systems of nomenclature (up to 10-C open chain and carbocyclic compounds); Structural isomerism in organic compounds.

Alkanes*, alkenes* and conjugated dienes*: SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes; E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

Alkyl halides*: SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols*: Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP208P	Pharmaceutical Organic Chemistry I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: explain correct use of various equipment's & Safety measures in Pharmaceutical Chemistry laboratory.

CLO 02: develop skills by calibrating thermometer & understand the simple laboratory techniques.

CLO 03: understand the significance and able to analyze organic compounds qualitatively, synthesis of derivatives.

CLO 04: understand the synthesis of different organic compounds along with reaction & mechanism.

CLO 05: prepare suitable solid derivatives from organic compounds

Course Content:

1. Systematic qualitative analysis of unknown organic compounds like:
   a Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
   b Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test.
   c Solubility test.
   d Functional group test like phenols, amides/ urea, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons, nitro compounds and anilides.
   e Melting point/Boiling point of organic compounds.
   f Identification of the unknown compound from the literature using melting point/ boiling point.
   g Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
   h Minimum 5 unknown organic compounds to be analysed systematically.
2. Preparation of suitable solid derivatives from organic compounds.
3. Construction of molecular models.

Recommended Books (Latest Editions)

1. Morrison and Boyd, "Organic Chemistry", Pearson Paperback, 7th edition.
2. I.L. Finar, "Organic Chemistry", Pearson Education India, Vol. 1, 5th edition.
3. B.S. Bahl and Arun Bahl, "Textbook of Organic Chemistry," S. Chand Publishing, 22nd edition.
4. P.L. Soni, "Organic Chemistry", Sultan Chand & Sons, 4th edition

5. Mann and Saunders, “Practical Organic Chemistry”, Longman, 4th edition.
6. Brian S. Furniss, “Vogel’s textbook of Practical Organic Chemistry”, Pearson India, 5th edition
7. N.K.Vishnoi, “Advanced Practical organic chemistry”, Vikas Publishing House Pvt Ltd., 3rd edition.
8. Pavia, Lampman and Kriz, “Introduction to Organic Laboratory techniques”, 2nd edition.
9. Ahluwaliah/Chatwal, “Reaction and reaction mechanism”, 3rd edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP203T	Biochemistry- Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the importance of metabolism of substrates.

CLO 02: remember chemistry and biological importance of biological macromolecules.

CLO 03: gain knowledge and employability in qualitative and quantitative estimation of the biological macromolecules.

CLO 04: know the interpretation of data emanating froma Clinical Test Lab, this will equip our students with better employable opportunities

CLO 05: know how physiological conditions influence the structures and re-activities of biomolecules.

CLO 06: understand the basic principles of protein and polysaccharide structure.

Course Content:

Biomolecules: Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics: Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP.

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 phosphorylation; Inhibitors ETC and oxidative phosphorylation/uncouplers.

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

Amino acid metabolism: General reactions of amino acid metabolism: Transamination, deamination and 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.

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP209P	Biochemistry- Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: detect and identify proteins, amino acids and carbohydrates by various qualitative as well as quantitative tests.

CLO 02: separate, identify and characterize proteins from various samples like egg, milk, etc and understand principle and develop skills behind the technique.

CLO 03: isolate starch from potato and understand techniques as well as mechanism involved.

CLO 04: analyze stimate quantity of as corbicacidina given sample.

CLO 05: demonstrate action of salivary amylase on starch.

Course Content:

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. Gupta RC, Bhargavan S., “Practical Biochemistry”, CBS Publishers and Distributors, 5th edition.
2. Plummer DT., “Introduction to Practical Biochemistry”, Tata McGraw-Hill Education, 3rd edition.
3. Rajagopal G, Ramakrishnan S., “Practical Biochemistry for Medical Students”, Orient Longman, 3rd edition.
4. Satyanarayana U, Chakrapani U., “Biochemistry”, Elsevier India, 4th edition.
5. Robert K.Murry, Dary lK. Granner and Victor W. Rodwell, “Harper’s Biochemistry”, 24th edition.

6. Rama Rao, "Textbook of Biochemistry", John willey & Sons Inc., 7th edition.
7. R.C. Gupta and S. Bhargavan, "Practical Biochemistry", WB Saunders, 12th edition.
8. David T. Plummer, "Introduction of Practical Biochemistry",3rd Edition.
9. Rajagopal and Ramakrishna, "Practical Biochemistry for Medical students", Ahuja publishing House, 4th edition.
10. Harold Varley, "Practical Biochemistry", CBS Publishers & Distributors, 4th edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP204T	Pathophysiology - Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: describe the etiology and pathogenesis of the selected disease states

CLO 02: gain knowledge of signs and symptoms of the diseases

CLO 03: identify the complications of the diseases.

CLO 04: know most commonly encountered pathophysiological state(s) and/or disease mechanism(s), as well as any clinical testing requirements and it would convert our student's better employable assets.

CLO 05: understand various diseases of bones and joints.

Course Content:

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 and 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.

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.

Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, haemophilia.

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.

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.

Infectious diseases: Meningitis, typhoid, leprosy, and 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. Laurence B, Bruce C, Bjorn K; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
3. 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.
4. William and Wilkins, Baltimore; 1991 [1990 printing].
5. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
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.
2. The American Journal of Pathology. ISSN: 0002-9440.
3. Pathology. ISSN: 1465-3931.
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171.
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP205T	Computer Applications in Pharmacy–Theory	3	3

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: apply the knowledge and skills of mathematics and computing fundamentals to pharmaceutical applications for any given requirement

CLO 02: design and develop solutions to analyze pharmaceutical problems using computers.

CLO 03: integrate and apply efficiently the contemporary IT tools to all Pharmaceutical related activities.

CLO 04: solve and work with a professional context pertaining to skill development, ethics, social, cultural and regulations with regard to Pharmacy.

CLO 05: understand equal or ahead with existing market contestants in this fast pace modern digitalized scientific environment.

Course Content:

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

Concept of information systems and software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project.

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.

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.

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases.

Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery.

Computers as data analysis in preclinical development: Chromatographic dada analysis (CDS), Laboratory information management system (LIMS), Text information management system (TIMS).

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP210P	Computer Applications in Pharmacy–Practical	2	1

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: apply the knowledge of mathematics and computing fundamentals to pharmaceutical applications for any given requirement

CLO 02: design and develop solutions to analyze pharmaceutical problems using computers skills

CLO 03: integrate and apply efficiently the contemporary IT tools to all Pharmaceutical related activities

CLO 04: solve and work with a professional context pertaining to ethics, social, cultural and regulations with regard to Pharmacy

CLO 05: create and work with MS access

Course Content:

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 Editions):

1. William E.Fassett, Computer Application in Pharmacy, Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Sean Ekins, Computer Application in Pharmaceutical Research and Development, Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. S.C. Rastogi, Bioinformatics (Concept, Skills and Applications), CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP206T	Environmental Sciences–Theory	3	3

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: create awareness about environmental problems; develop an attitude towards of concern for the environment.

CLO 02: learn about concept of ecosystem its structure and functions.

CLO 03: understand the concept of ecosystems.

CLO 04: gain knowledge about different types of ecosystems.

CLO 05: gain knowledge about environmental pollution.

CLO 06: gain knowledge about combination of environment and become entrepreneur.

Course Content:

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.

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).

Environmental Pollution: Air pollution; Water pollution; Soil pollution.

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP301T	Pharmaceutical Organic Chemistry II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: gain basic knowledge regarding general methods of preparation of organic compounds.

CLO 02: understand the reactions of some organic compounds.

CLO 03: understand Reactivity of organic compounds.

CLO 04: understand mechanisms and orientation of chemical reactions

CLO 05: gain knowledge and develop skills in heterocyclic compounds

CLO 06: gain knowledge and develop skills about the electrophilic and nucleophilic reactions.

Course Content:

General methods of preparation and reactions of compounds superscripted with an asterisk (*) to be explained. To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

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

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.

Fats and Oils: Fatty acids – reactions; hydrolysis, hydrogenation, saponification and rancidity of oils, drying oils; analytical constants – acid value, saponification value, ester value, iodine value, acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

Polynuclear hydrocarbons: Synthesis, reactions; Structure and medicinal uses of naphthalene, phenanthrene, anthracene, diphenylmethane, triphenylmethane and their derivatives.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP305P	Pharmaceutical Organic ChemistryII–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: explain and understand the principal behind various ualitative tests and analyze the given unknown organic compound having different functional groups.

CLO 02: explain and understand the principal, reaction mechanism and illustrate application of every experiment in the pharmacy.

CLO 03: understand, apply and develop skills in various laboratory techniques for the synthesis of organic compounds, various techniques of purification of the synthesized compounds using Precipitation or recrystallization.

CLO 04: prepare compounds of different substances

CLO 05: analyze reactions performed while preparing compounds

Course Content:

Experiments involving laboratory techniques

1. Recrystallization
2. Steam distillation

Determination of following oil values (including standardization of reagents)

3. Acid value
4. Saponification value
5. Iodine value

Preparation of compounds

6. Benzanilide/Phenyl benzoate/Acetanilide from Aniline / Phenol /Aniline by acylation reaction.
7. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction.
8. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
9. Benzoic acid from Benzyl chloride by oxidation reaction.
10. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
11. 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions.

12. Benzil from Benzoin by oxidation reaction.
13. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
14. Cinnamic acid from Benzaldehyde by Perkin reaction
15. P-Iodo benzoic acid from P-amino benzoic acid

Recommended Books (Latest Editions)

1. Morrison and Boyd, "Organic Chemistry", Pearson Paperback, 7th edition.
2. I.L.Finar, "Organic Chemistry", Pearson Education India, Vol. 1, 5th edition.
3. B.S.Bahl and Arun Bahl, "Textbook of Organic Chemistry," S. Chand Publishing, 22nd edition.
4. P.L.Soni, "Organic Chemistry", Sultan Chand & Sons, 4th edition
5. Mann and Saunders, "Practical Organic Chemistry", Longman, 4th edition.
6. Brian S. Furniss, "Vogel's textbook of Practical Organic Chemistry", Pearson India, 5th edition
7. N.K.Vishnoi, "Advanced Practical organic chemistry", Vikas Publishing House Pvt Ltd., 3rd edition.
8. Pavia,Lampman and Kriz, "Introduction to Organic Laboratory techniques", 2nd edition.
9. Ahluwaliah/Chatwal, "Reaction and reaction mechanism", 3rd edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP302T	Physical PharmaceuticsI–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: state the physicochemical properties of drug molecules, pH, and solubility

CLO 02: explain the role of surfactants, interfacial phenomenon and thermodynamics

CLO 03: describe the flow behavior of fluids and concept of complexation

CLO 04: analyze the chemical stability tests of various drug products

CLO 05: Understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology.

CLO 06: understanding of physicochemical properties of drugs including solubility, distribution, adsorption, and stability.

CLO 07: gain basic knowledge of pharmaceutical suspensions and colloids.

CLO 08: gain basic understanding of the pharmaceutical applications of various physical and chemical properties of system which will enhance the employability to work in pharma sector

CLO 09: underatand principles such as lyophilization, aerosols, condensed systems, and phase diagram.

Course Content:

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

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.

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.

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 the stability constants.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP306P	Physical PharmaceuticsI–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: explain formulation, evaluation and labeling of aromatic water, glycerides, syrups, elixirs and powder preparations.

CLO 02: develop skills in performing pharmaceutical calculations to determine evaluation parameters like density, viscosity, specific gravity, angle of repose, Carr's index, Hausner ratio of preparations.

CLO 03: describe use of ingredients in formulation and category of formulation.

CLO 04: compare various monophasic preparations depending upon their formulation.

CLO 05: select suitable packaging material (container-Closure) for the preparation.

Course Content:

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbatch 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. Alfred Martin, "Physical Pharmacy", Lippincott Williams & Wilkins, 4th edition.
2. Eugene, Parott, "Experimental Pharmaceutics", Minneapolis, Minnesota : Burgess Publishing, 2nd edition,
3. Cooper and Gunn, "Tutorial Pharmacy",London: Pitman Medical, 6th edition.

4. Stocklosam J. Pharmaceutical Calculations, Lea and 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, volume1,2,3. Marcel Dekkar Inc.
7. Ramasamy C and Manavalan R, "Physical Pharmaceutics", 4th edition.
8. C.V.S. Subramanyam, J. Thimmasettee, "Laboratory Manual of Physical Pharmaceutics", Vallabh Prakashan, 8th edition.
9. C.V.S. Subramanyam, "Physical Pharmaceutics", Vallabh Prakashan, 8th edition.
10. Gaurav Jain and Roop K.Khar, "Testbook of Physical Pharmacy", Elsevier India, 1st edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP303T	Pharmaceutical Microbiology–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology.

CLO 02: acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

CLO 03: communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.

CLO 04: demonstrate isolation and identification of microbes.

CLO 05: design microbiology laboratory considering all the aspects of safety

CLO 06: gain knowledge about validating the microbiological equipment and reporting the observations

Course Content:

Introduction, history of microbiology, its branches, scope and its importance. Introduction to the Prokaryotes and Eukaryotes. Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for the 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 and viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Identification of bacteria using staining techniques (simple, Gram's & Acid-fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.

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

Designing of aseptic area, laminar flow 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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP307P	Pharmaceutical Microbiology–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: know the principle, construction and working of various instruments and perform their operations and Skill to handle microscope for observation of microbes.

CLO 02: learn and develop skills on how to prepare and sterilize nutrient broth, nutrientagar, slants, stabs and plates and adopt the skills required for maintaining strictly aseptic condition & handling inoculating loop, its sterilization and Inoculation procedure.

CLO 03: develop skill of isolating microorganism by streak plate technique & count them by pour plate technique.

CLO 04: adopt the technique involved to see motility of bactericide by hanging drop technique.

CLO 05: develop skill to execute morphology of bacteria by simple staining, negative staining & gram staining

CLO 06: understand the direction culation method and to do sterility testing of WFI

CLO 07: perform the broth dilution method to determine minimum in hibitory concentration and learn how to perform Assay of antibiotic.

Course Content:

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP304T	Pharmaceutical Engineering–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: know various unit operations and understand the basic concept of industrial entrepreneurship.

CLO 02: understand the material handling techniques.

CLO 03: perform various processes involved in pharmaceutical manufacturing process.

CLO 04: carryout various test to prevent environmental pollution.

CLO 05: appreciate and comprehend significance of plant layout design for optimum use of resources.

CLO 06: appreciate the various preventive methods used for corrosion control in Pharmaceutical industries

Course Content:

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

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

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

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

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

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

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 and 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 and Silverson emulsifier.

Filtration: Objectives, applications, theories and factors influencing filtration, filter aids, filter medias. Principle, construction, working, uses, merits and demerits of plate filter and frame filter, filter leaf, rotary drum filter, meta filter and cartridge filter, membrane filters and Seidtz filter.

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

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 their prevention. Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handling systems.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP308P	Pharmaceutical Engineering–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: know various unit operation used in Pharmaceutical industries.

CLO 02: understand develop skills in the material handling techniques.

CLO 03: perform various processes involved in pharmaceutical manufacturing process.

CLO 04: carryout various test to prevent environmental pollution.

CLO 05: appreciate and comprehend significance of Plant layout design for optimum use of resources.

CLO 06: appreciate the various preventive methods used for corrosion control in Pharmaceutical Industries

Course Content:

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

Recommended Books: (Latest Editions)

1. Walter L Badger and Julius Banchero, "Introduction to chemical engineering",

1st edition.
2. Nigel J.K. Simpson, "Solid phase extraction, Principles, techniques and applications", Mcabe Smith, "Unit operation of chemical engineering", 4th edition.
3. C.V.S Subrahmanyam et al., "Pharmaceutical engineering principles and practices", 4th edition.
4. Martin, "Remington practice of pharmacy", Mack Publishing Co., 12th edition.
5. Lachmann, "Theory and practice of industrial pharmacy", CBS Publishers & Distributors Pvt. Ltd., 4th edition.

SEMESTER IV

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP401T	Pharmaceutical Organic Chemistry III–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: acquire the knowledge and understanding of the basic experimental principles of heterocyclic chemistry.

CLO 02: draw the structures and synthesize simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.

CLO 03: describe detailed mechanisms for common naming reactions.

CLO 04: run experimental techniques, procedures and safe laboratory practices for developing entrepreneurship qualities.

CLO 05: understand stereo-chemical features including conformation and stereoelectronic effects; Geometrical isomers

Course Content:

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

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.

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.

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

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.

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. Finar I.L., "Organic chemistry" 5th edition.
2. Arun Bahl, B.S. Bahl "A text book of organic chemistry", S.Chand Publishing.
3. Raj Kumar Bansal, "Heterocyclic Chemistry", New Age International, 2008.
4. Morrison and Boyd "Organic Chemistry", 7th edition.
5. Thomas L. Gilchrist "Heterocyclic Chemistry", 3rd edition

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP402T	Medicinal Chemistry I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: helps in correlating between pharmacology of a disease and its mitigation or cure.

CLO 02: understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

CLO 03: know the structural activity relationship of different class of drugs.

CLO 04: understand synthesis of some important class of drugs.

CLO 05: gain knowledge and skill about the mechanism pathways of different class of medicinal compounds.

CLO 06: understand the chemistry of drugs with respect to their pharmacological activity.

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 super scripted (*)

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, Bio-isosterism, Optical and Geometrical isomerism.

Drug metabolism: Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.

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.

Drugs acting on Autonomic Nervous System: *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.

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.

Drugs acting on Central Nervous System: A. *General anesthetics*: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. Ultra-short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium. Dissociative anesthetics: Ketamine hydrochloride*. B. *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. C. *Narcotic antagonists*: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. D. *Anti-inflammatory agents*: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP406P	Medicinal Chemistry I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: helps in correlating between pharmacology of a disease and its mitigation or cure.

CLO 02: understand the drug metabolic pathways, adverse effect and therapeutic value of drugs

CLO 03: know the structural activity Relationship of different class of drugs.

CLO 04: acquainted with the synthesis of some important class of drugs.

CLO 05: gain knowledge about the mechanism pathways of different class of medicinal compounds.

CLO 06: understand the chemistry of drugs with respect to their Pharmacological activity

Course Content:

1. Preparation of drugs/ intermediates

a 1,3-Pyrazole
b 1,3-Oxazole
c Benzimidazole
d Benzotriazole
e 2,3-Diphenyl quinoxaline
f Benzocaine
g Phenytoin
h Phenothiazine
i Barbiturate

2. Assay of drugs

a Chlorpromazine
b Phenobarbitone
c Atropine
d Ibuprofen
e Aspirin
f Furosemide

Recommended Books (Latest Editions)

1. Wilson and Giswold's "Organic medicinal and Pharmaceutical Chemistry".
2. Foye's "Principles of Medicinal Chemistry" 6th edition.

3. Burger's "Medicinal Chemistry", 8th edition.
4. Smith and Williams, "Introduction to principles of drug design", 4th edition
5. Remington's "Pharmaceutical Sciences", 23rd edition.
6. Martindale's "extra pharmacopoeia", 31st edition.
7. Lednicer "The Organic Chemistry of Drug Synthesis" Johan willey & Sons
8. Indian Pharmacopoeia.
9. Vogel, Arthur Israel, "A text-book of practical organic chemistry including qualitative organic analysis", Longmans, Green,, 1956.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP403T	Physical Pharmaceutics II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: state the physicochemical properties of drug molecules, pH, and solubility

CLO 02: explain the role of surfactants, interfacial phenomenon and thermodynamics

CLO 03: describe the flow behavior of fluids and concept of complexation

CLO 04: analyze the chemical stability tests of various drug products

CLO 05: understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology.

CLO 06: understand of physicochemical properties of drugs including solubility, distribution, adsorption, and stability.

CLO 07: develop skills and knowledge of pharmaceutical suspensions and colloids.

CLO 08: understand pharmaceutical applications of various physical

CLO 09: understand Principles such as lyophilization, aerosols, condensed systems, and phase diagram.

Course Content:

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.

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

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

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.

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of

powders, porosity, packing arrangement, densities, bulkiness & flow properties.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP407P	Physical Pharmaceutics II–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: develop practical skill by evaluating surface tension, viscosity, specific surface area, particle size distribution of given material.

CLO 02: calculate Cloud point, critical micelle Concentration and HLB Value of given surfactant.

CLO 03: calculate energy of activation of acid hydrolysis, order of given reaction, relative strength of two acids

CLO 04: find outcome position of binary mixture by viscosity method.

CLO 05: understand an accelerated stability studies

Course Content:

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. Alfred Martin "Physical Pharmacy", 6th edition. Lea & Febiger.
2. Eugene, Parott, "Experimental pharmaceutics".
3. Cooper and Gunn "Tutorial pharmacy", CBS Publisher & Distributor.
4. Stocklosam J. "Pharmaceutical calculations", Lea and Febiger, Philadelphi
5. Liberman H.A, Lachman C., "Pharmaceutical Dosage forms", Tablets, Marcel Dekkar Inc. 2nd edition
6. Liberman H.A, Lachman C, "Pharmaceutical dosage forms". Disper. Marcel Dekkar Inc.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP404T	Pharmacology I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the pharmacological actions of different categories of drugs

CLO 02: study in detailed about mechanism of drug action at organ system/subcellular/macro molecular levels.

CLO 03: understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases.

CLO 04: observe the effect of drugs on animals by simulated experiments

CLO 05: get an idea and skills about correlation of pharmacology with other biomedical sciences.

CLO 06: understand the signal transduction mechanism of various receptors

Course Content:

General Pharmacology: *Introduction to Pharmacology*: Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy; *Pharmacokinetics*: Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination.

General Pharmacology: *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; *Adverse drug reactions*; *Drug interactions (pharmacokinetic and pharmacodynamic)*; *Drug discovery and clinical evaluation of new drugs* -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

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, para-sympatholytics, sympathomimetics, sympatholytics; (d) Neuromuscular blocking agents and skeletal muscle relaxants (peripheral); (e) Local anesthetic agents; (f) Drugs used in myasthenia gravis and glaucoma.

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP408P	Pharmacology I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the pharmacological actions of different categories of Drugs

CLO 02: study in detailed about mechanism of drug action at organ system/sub cellular/ macro molecular levels.

CLO 03: understand the application of basic pharmacological knowledge and develop skills in the prevention and treatment of various diseases.

CLO 04: observe the effect of drugs on animals by simulated experiments

CLO 05: get an idea about correlation of pharmacology with other bio medical sciences.

CLO 06: understand signal transduction mechanism of Various receptors

Course Content:

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 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.

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 and Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. Tripathi K.D.. "Essentials of Medical Pharmacology", 5th edition JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Charles R.Craigand Robert, "Modern Pharmacology with clinical Applications",
9. Ghosh MN. "Fundamentals of Experimental Pharmacology". Hilton and Company, Kolkata.
10. Kulkarni SK, "Handbook of experimental pharmacology". Vallabh Prakashan.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP405T	Pharmacognosy and Phytochemistry I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand different herbs, and their Science.

CLO 02: classify medicinal Plants, Phytochemistry, Carbohydrates, Lipids,

CLO 03: understand terpenes, Polyphenols, Alkaloids, Pharmacology, Toxicity, Formulations and Preparations of Herbal Medicines.

CLO 04: influence our physiology and can be helpful against several disorders.

CLO 05: understand relations between Phyto-therapy and the Elderly, Phytotherapy and Children, Understanding Herbal Action, and Understanding the Material Medica for skill development and make them entrepreneaur.

CLO 06: gain knowledge regarding cognition of medicinal plants, identification of adulteration and Contamination.

CLO 07: understand ethnobotany and Ethno pharmacology in drug discovery process.

CLO 08: apply DNA Finger printing.

Course Content:

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

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

Quality control of drugs of natural origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

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.

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.

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.

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP409P	Pharmacognosy and Phytochemistry I– Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand and develop skills in the evolutionary significance of alkaloids from plants &other organisms & reduce their significance as medicinal molecules.

CLO 02: explain the classification, source, name, chemical structures of alkaloids, extraction, qualitative & quantitative analysis of alkaloids.

CLO 03: explain the historical significance & contribution of alkaloids in modern drug discovery.

CLO 04: explain the historical significance & contribution of terpenoids / resins in modern drug discovery.

CLO 05: analyze drugs through chemical tests

Course Content:

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,W.B. Sounders and Co., London, 2009, 16th edition.
2. Tyler,V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, Lea and Febiger, Philadelphia,1988, 9th edition.
3. T.E. Wallis, Text Book of Pharmacognosy, CBS Publishers and Distributors, 5th Edition.
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers and Distribution, New Delhi.

5. C.K. Kokate, Purohit, Gokhlae, Textbook of Pharmacognosy, Nirali Prakashan, New Delhi, 37th Edition, 2007,
6. R.D. Choudhary, Herbal drug industry, Eastern Publisher, New Delhi, Ist Edn, 1996.
7. Dr.SH. Ansari, Essentials of Pharmacognosy, Birla publications, New Delhi, IInd edition, 2007
8. M.A. Iyengar, Anatomy of Crude Drugs, Pharmamed Press, 12th Edition,

Course Code	Name of the Course	No. of Hours/week	Credit Points
CS501	Cyber Security	3	-

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: learn about the cyber security, cyber crime and type of cyber criminals.

CLO 02: understand the types of attacks on Individual, Property, Organization, Computer and Mobile network and safety measurement.

CLO 03: understand the perils as well as advantages of technology for skill development and entrepreneaurship.

CLO 04: explore the usage of internet, internet policy and safety computing.

CLO 06: understand social political, ethical and psychological dimensions in cyber crime

Course Content:

Introduction to Cyber Crime: Definition and origins of the world, cybercrime and information security, who are cyber criminals, classification of cyber crimes, cyber crime and ITA

Cyber Offense: Categories of Cybercrime, How criminals plans the attack, social engineering, cybers talking.

Cybercafé and cyber criminals, Botnet, Cloud computing.

Cloud Computing and Cyber Crime: Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and wireless computing era, Security challenges posed by mobile devices, Registry setting for Mobile Devices.

Authentication and Authorization: Authentication service security, Attacks on Mobile/CellPhones, Mobile Devices: Security Implications for organizations

Tools and Methods used in Cybercrime: Proxy Server and anonymizers, Phishing, Password cracking, Key loggers and spywares, Virus and Worms, Trojan Horse and Backdoors, Stegnography.

Attacks: DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on wireless network

Cyber security: Organizational Implications: Cost of cyber cimes and IPR issues, Web Threats for Organizations, Security and Privacy Implications from Cloud computing, Social Media Marketing, Social Computing and the Associated Challenges for Organizations

Organizational guidelines for Internet Usage: Safe Computing, Guidelines and Computer Usage Policy, Incident Handling: An essential component of cyber security. Forensic Best Practices for Organizations

Cybercrime and Cyber terrorism: Social Political, Ethical and Psychological

Dimensions: Intellectual Property in the Cyberspace, The ethical dimension of cybercrime, The psychology, mindset and skills of hackers and other cyber criminals, Ethical Hackers

Cybercrime: Illustrations, examples and mini-cases: Real Life examples, minicases

Instructional Strategies: Materials

Recommended Books: (Latest Editions)

1. Godbole N. and Belapur S., "Cyber Security", First Edition, Wiley-India, 2014.
2. Duggal P., "Cyber Frauds, Cyber crimes and Laws in India"; Kindle Edition, 2013.

Reference Books

1. Singer P.W. and Friedman A., 2014, "Cyber Security and Cyber War", Oxford Publication, 1st edition.

SEMESTER V

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP501T	Medicinal Chemistry II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: help in correlating between pharmacology of a disease and its mitigation or cure.

CLO 02: write chemical synthesis of some drugs.

CLO 03: know the structural activity relationship of different class of drugs.

CLO 04: gain knowledge about the mechanism pathways of different class of medicinal compounds.

CLO 05: acquire knowledge and skills about the chemotherapy for cancer.

CLO 06: understand the chemistry of drugs with respect to their pharmacological activity.

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 (*)

Antihistaminic agents: Histamine, receptors and their distribution in the human body. *H1-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. *H2-antagonists*: Cimetidine*, famotidine, ranitidin. *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, and mitotane.

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.

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 and Anticoagulants: Menadione, acetomenadione, warfarin*, anisindione, clopidogrel.

Drugs used in Congestive Heart Failure: digoxin, digitoxin, nesiritide, bosentan, and tezosentan.

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.

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, and dibucaine*.

Recommended Books (Latest sEditions)

1. Wilson and Giswold's, "Organic medicinal and Pharmaceutical Chemistry", Lippincott Williams and Wilkins, 13th edition.
2. Victoria F Roche, "Foye's Principles of Medicinal Chemistry", Wolters Kulwers publications, 8th edition.

3. Donald Abraham, "Burger's Medicinal Chemistry", Wiley publications, 7th edition.
4. John Smith, "Introduction to principles of drug design and action", CRC Press, 4th edition
5. Remington's Pharmaceutical Sciences, John Wiley & Son, 18th edition
6. James EF Reynolds, "Martindale's extra pharmacopoeia", Pharmaceutical Press; Facsimile, 1883 edition
7. IL Finar, "Organic Chemistry, Fifth edition
8. Daniel Lednicer, "The Organic Chemistry of Drug Synthesis", Wiley-Interscience; 1st edition
9. Indian Pharmacopoeia.
10. AI. Vogel, "Text book of practical organic chemistry" Pearson publications,5th edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP502T	Industrial Pharmacy I–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the basic concept of Preformulation studies and study of various physical and chemical characteristics of drugs.

CLO 02: know various types of tablets, granulation and formulation methods for skill development

CLO 03: analyze various In-process quality control tests.

CLO 04: study of liquids oral dosage forms and evaluation.

CLO 05: study of various parenteral and ophthalmic products.

CLO 06: formulate various cosmetic products and stability studies for entrepreneaurship.

Course Content:

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. Physical properties (physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism); Chemical Properties (hydrolysis, oxidation, reduction, racemisation, polymerization); BCS classification of drugs & its significant; Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

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

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

Capsules: *Hard gelatin capsules*: Introduction, Production of hard gelatin capsule shells. Size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. *Soft gelatin capsules*: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

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

Parenteral Products: Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity; Production procedure, production facilities and controls, aseptic processing; Formulation of injections, sterile powders, large volume parenterals and lyophilized products; Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

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

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP506P	Industrial Pharmacy I–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand correct use of various equipment in pharmaceutics laboratory relevant to Suspensions, Emulsions &semi-solids, prepare BMR.

CLO 02: develop practical skills by explaining & carrying out formulation of Suspensions like Calamine lotion, Milk of Magnesia, Paracetamol Suspension, Antacid Suspension & carryout Evaluation.

CLO 03: formulate emulsions: Liquid paraffin oral Emulsion, Turpentine Liniment Formulation of Emulsion with HLB Consideration & evaluation.

CLO 04: describe use of ingredients in formulation and category of Formulation.

CLO 05: prepare semisolids: Pain balm, Antifungal ointment/cream, Medicated Gel Anti-acne preparation, non-staining Iodine ointment with Methyl Salicylate & evaluation.

CLO 06: prepare the labels so as to suit the regulatory requirements.

Course Content:

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. HA Liberman, Leon Lachman, JB Schwartz “Pharmaceutical dosage forms: Tablets”, CRC Press,2nd edition
2. HA Liberman, Leon Lachman, JB Schwartz “Pharmaceutical dosage forms: Parentral medication”, CRC Press,3rd edition.
3. HA Liberman, Leon Lachman, JB Schwartz “Pharmaceutical dosage forms: disperse systems”, CRC Press,2nd edition.
4. Gilbert S Banker, “Modern Pharmaceutics”, Informa healthcare publications,

3rd Edition

5. HA Liberman, Leon Lachman, JB Schwartz, "Remington: The Science and Practice of Pharmacy, CRC Press, 20th edition
6. Liberman and Lachman,"Theory and Practice of Industrial Pharmacy",CBS Publishers.
7. ME Aulton, "Pharmaceutics- The science of dosage form design", Churchill livingstone, Latest edition
8. HC Ansel, "Introduction to Pharmaceutical Dosage Forms" by Lea and Febiger, Philadelphia, 5thedition.
9. Cartsen," Drug stability Principles and practice" ,Marcel Dekker Series 3rd Edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP503T	Pharmacology II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand and develop skills in the mechanism of drug action and its relevance in the treatment of different diseases

CLO 02: comprehend the principles of toxicology and treatment of various poisonings.

CLO 03: locate and isolate different organs/tissues from the laboratory animals used in pharmacological experiments

CLO 04: study in detail about various receptor actions using isolated tissue preparation

CLO 05: understand the correlation of pharmacology with related medical sciences

CLO 06: study about the various methods of toxicity studies and become employable in different toxicological research.

Course Content:

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.

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.

Pharmacology of drugs acting on urinary system: (a). Diuretics. (b). Anti-diuretics.

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.

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

Pharmacology of drugs acting on endocrine system: (a). Androgens and Anabolic steroids. (b). Estrogens, progesterone and oral contraceptives. (c). Drugs acting on the uterus.

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP507P	Pharmacology II–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: Develop skills by studying of commonly used instruments in experimental Pharmacology.

CLO 02: remember and understand CPCSEA guidelines and OECD guidelines.

CLO 03: understand animal physiology with their biochemical reference values in various animal species.

CLO 04: study various routes of drug administration, anesthetics agents used to anesthetize laboratory animals and Techniques of Euthanasia

CLO 05: study physiological salt solutions, drug solution and use in various animal experiments.

CLO 06: study methods for collection of blood, body fluids and urine from Experimental animals.

CLO 07: record the effect of drug on Concentration Response Curves (CRC) using suitable isolated tissue preparations (Synergism and Antagonism).

Course Content:

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 PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods.

Note: *All laboratory techniques and animal experiments are demonstrated by*

simulated experiments by softwares and videos.

Recommended Books (Latest Editions)

1. HP Rang, "Pharmacology", Churchil Livingstone Elsevier,4th edition.
2. BG Katzung B. G, "Basic and clinical pharmacology", Tata Mc Graw- Hill, 14th edition.
3. Goodman and Gilman's, "The Pharmacological Basis of Therapeutics" McGraw Hill / Medical,13th edition
4. KK Marry Anne, "Applied Therapeutics, The Clinical use of Drugs", The Point Lippincott Williams and Wilkins,10th edition.
5. MJ Mycek, "Lippincott's Illustrated Reviews- Pharmacology", Lippincott Williams & Wilkins,3rd edition.
6. KD Tripathi, "Essentials of Medical Pharmacology", JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi,7th edition.
7. HL Sharma , "Principles of Pharmacology", Paras medical publisher,3rd edition.
8. Charles R Craig and Robert, "Modern Pharmacology with clinical Applications", Lippincott Williams and Wilkins,6th edition
9. MN Ghosh, "Fundamentals of Experimental Pharmacology", Hilton and Company, Kolkata,sixth edition.
10. SK Kulkarni, "Handbook of experimental pharmacology", Vallabh Prakashan.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP504T	Pharmacognosy and Phytochemistry II– Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: study basic metabolic pathways and formation of different secondary metabolites through Shikimic acid pathway, Acetate pathways and Amino acid pathway.

CLO 02: understand composition, chemistry and chemical classes, biosources, therapeutic uses and commercial applications of secondary metabolites.

CLO 03: isolate, Identification and Analysis of Phytoconstituents: terpenoids and steroids;

CLO 04: determine the biological activities of several compounds belonging to polyketides, terpenoids and steroids; and their traditional use and application in pharmaceutical and/or nutraceutical field for employability.

CLO 05: study the basics of Phytochemistry.

Course Content:

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.

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites: *Alkaloids*: Vinca, Rauwolfia, Belladonna, Opium. *Phenylpropanoids and Flavonoids*: Lignans, Tea, Ruta. *Steroids, Cardiac Glycosides & Triterpenoids*: Liquorice, Dioscorea, Digitalis. *Volatile oils*: Mentha, Clove, Cinnamon, Fennel, Coriander. *Tannins*: Catechu, Pterocarpus. *Resins*: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony. *Glycosides*: Senna, Aloes, Bitter Almond. *Iridoids, Other terpenoids & Naphthaquinones*: Gentian, Artemisia, taxus, carotenoids.

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

Industrial production, estimation and utilization of the following

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

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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP508P	Pharmacognosy and Phytochemistry II– Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: demonstrate skills of plant material sectioning, staining, mounting & focusing ;decide on staining reagents required for specific part of plant.

CLO 02: Identify the parts of plants from its Morphological & microscopical features.

CLO 03: draw Morphological & microscopical diagrams & be able to label component/parts.

CLO 04: develop skills by conducting extractions/ isolations & explain significance of use of various chemicals & physical conditions.

CLO 05: Identify unorganized crude drugs using morphological, chemical, physical & microscopical Characteristics.

Course Content:

1. Morphology, histology and powder characteristics & extraction & detection of:
   a. Cinchona
   b. Cinnamon
   c. Senna
   d. Clove
   e. Ephedra
   f. Fennel
   g. 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:
   a. Asafoetida
   b. Benzoin
   c. Colophony
   d. Aloes
   e. Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, "Trease and Evans Pharmacognosy",W.B. Sounders and Co., London, 16th edition.
2. Ali Mohammad, "Pharmacognosy and Phytochemistry", CBS Publishers and Distribution,.
3. CK Kokate, "Text book of Pharmacognosy" by Nirali Prakashan, CBS publishers, 2nd edition.
4. RD Choudhary , "Herbal drug industry" Eastern Publisher, Ist edition.
5. SH Ansari, "Essentials of Pharmacognosy", Birla publications, 2nd edition
6. H pande, "Herbal Cosmetics" Asia Pacific Business press, 3rd revised edition.
7. AN Kalia, "Textbook of Industrial Pharmacognosy", CBS Publishers
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. James Bobbers, "Pharmacognosy and Pharmacobiotechnology", Anshan Ltd, 2nd edition
10. LouisAppell," The formulation and preparation of cosmetic, fragrances and flav ours", Micelle Press; 2nd edition
11. Remington's Pharmaceutical sciences. John Wiley & Sons; 18th edition
12. Vyas and Dixit," Text Book of Biotechnology" , CBS publishers and distributors
13. RC Dubey, "Text Book of Biotechnology" S Chand; 4th Rev. Edn. 2006 edition

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP505T	Pharmaceutical Jurisprudence–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: know the Pharmaceutical legislations and their implications in the development and marketing skills.

CLO 02: know various Indian pharmaceutical Acts, Laws and schedule

CLO 03: know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals

CLO 04: know code of ethics during the pharmaceutical practice

CLO 05: understand the objectives of D & C act, Pharmacy act etc.

Course Content:

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.

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. *Labelling & Packing of drugs*- General labelling 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.

Pharmacy Act 1948: Objectives, definitions, pharmacy council of india; its constitution and functions, education regulations, state and joint state pharmacy councils; constitution and functions, registration of pharmacists, offences and penalties.

Medicinal and Toilet Preparation Act 1955: Objectives, definitions, licensing, manufacture in bond and outside bond, export of alcoholic preparations, manufacture of ayurvedic, homeopathic, patent & proprietary preparations; offences and penalties.

Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, definitions, authorities and officers, constitution and functions of narcotic &

psychotropic consultative committee, national fund for controlling the drug abuse, prohibition, control and regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, offences and penalties.

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, definitions, prohibition of certain advertisements, classes of exempted advertisements, offences and penalties.

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

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

Pharmaceutical Legislations: A brief review, introduction, study of drugs enquiry committee, health survey and development committee, Hathi committee and Mudaliar committee.

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

Medical Termination of Pregnancy Act.

Right to Information Act.

Introduction to Intellectual Property Rights (IPR)

Recommended books: (Latest Edition)

1. B. Suresh, Forensic Pharmacy, Birla Publications, 1st Edition, 2010.
2. B.M. Mithal, Text book of Forensic Pharmacy, Nirali Prakashan, 2nd Edition, 1999.
3. M.L. Mehra, Hand book of drug law, Vallabh Prakashan, 1st Edition, 2004
4. N.K. Jain, A text book of Forensic Pharmacy, Vallabh Prakashan, 1st Edition, 2003
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)

Course Code	Name of the Course	No. of Hours/week	Credit Points
DM101	Disaster Management	2	-

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: provide students an exposure to disasters, their significance and types

CLO 02: gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)

CLO 03: enhance awareness of institutional processes in the country

CLO 04: ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction

CLO 05: develop skills and rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Content:

Disasters: Classification, Causes, Impacts

- Introduction to Disasters: Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks)
- Impacts (including social, economic, political, environmental, health, psychosocial, etc. Differential impacts-in terms of caste, class, gender, age, location, disability) Classification of hazards/disasters and causes

Principles of disaster management

- Approaches to Disaster Risk reduction: Disaster cycle-its analysis, Phases, Culture of safety, prevention, mitigation and preparedness,
- Community based DRR, Components of Disaster Relief: Water, Food, Sanitation, Shelter, and Health,
- Structural and non-structural measures.

Hazard Profile (India), Disaster Risk Management in India

- Hazard and Vulnerability profile of India
- Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation), Role of Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.

Disaster and Development

- Inter-relationship between Disasters and Development: Factors affecting

Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc. urban disasters, Waste Management

- Global trends in disasters and Adaptation: Global Trends, Complex emergencies, Pandemics Climate change and Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

Recommended books: (Latest Edition)

1. Larry R. Collins, Disaster Management and Preparedness, 2000.
2. Satish Modh, Introduction to Disaster Management, 2009.
3. W. Nick Carter, Disaster Management: A Disaster Manager's Handbook, 1992.
4. Damon P. Coppola, Introduction to International Disaster Management, 2010.

SEMESTER VI

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP601T	Medicinal Chemistry III –Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: develop an understanding of the physico-chemical properties of drugs.

CLO 02: understand how current drugs were developed by using pharmacophore modeling and docking technique.

CLO 03: acquire knowledge and skills in the chemotherapy for cancer and microbial diseases and different anti-viral agents.

CLO 04: acquire knowledge about the mechanism pathways of different class of medicinal compounds.

CLO 05: introduced a variety of drug classes and some pharmacological properties.

CLO 06: acquire knowledge on thrust areas for further research.

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 super scripted by(*)

Antibiotics: Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes: β-Lactamantibiotics (Penicillin, Cepholosporins, β-Lactamase inhibitors, Monobactams); Amino glycosides (Streptomycin, Neomycin, Kanamycin); Tetracyclines (Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline).

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, Quininesulphate, Chloroquine*, Amodiaquine, Primaquinephosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine; Biguanides and dihydrotriazines: Cycloguanilpamoate, Proguanil; Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone).

Anti-tubercular Agents: Synthetic anti-tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine, Streptomycine,

Capreomycinsulphate.

Urinarytractanti-infectiveagents: Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin; Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviralagents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridinetrifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

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-protozoalAgents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazinecitrate*, 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*.

Introduction to Drug Design: Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP607P	Medicinal Chemistry III–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand how to make correct use of various equipments & take safety measures while working in medicinal chemistry Laboratory to get employable in pharmaceutical industry.

CLO 02: develop skills involved in thin layer chromatography techniques and purification of synthesized compounds by Column chromatography.

CLO 03: synthesize, Re-crystallize and understand reaction mechanisms involved in synthesis of medicinally important organic Compounds.

CLO 04: interpret the spectral characterizations made by IR and 1H-NMRs of synthesized compounds.

CLO 05: Draw structures and reactions using softwares (Chemdraw)

Course Content:

1. Preparation of drugs and intermediates: Sulphanilamide; 7-Hydroxy,4-methylcoumarin; Chlorobutanol; Triphenylimidazole; Tolbutamide; Hexamine.
2. Assay of drugs: Isonicotinic acid hydrazide; Chloroquine; Metronidazole; Dapsone; Chlorpheniramine maleate; Benzyl penicillin.
3. Preparation of medicinally important compounds or intermediates by Microwave irradiation technique
4. Drawing structures and reactions using chemdraw®
5. Determination of physicochemical properties such as log P,Clog P, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

RecommendedBooks(LatestEditions)

1. John M. and Beale J. H. B., "Wilson and Giswold's Organic Medicinal and Pharmaceutical Chemistry." 12th edition.
2. Foye W.O., "Foye's Principles of Medicinal Chemistry" Lippincott Williams & wilkins, 8th edition.
3. Abraham D.J., "Burger's Medicinal Chemistry, Drug discovery", Vol I to IV. Wiley Interscience; a John Wiley and Sons Inc., 6th edition.
4. Smith H.J. and Williams, Introduction to principles of drug design. Elsevier, 3rd edition.

5. “Remington´s Pharmaceutical Sciences”, Mack publishing company.
6. Ferner R.E.,“Martindale's Extra Pharmacopoeia”, B.M.J.
7. Finar I.L, “Organic Chemistry -Vol 2- Stereochemistry and chemistry of natural products”, 5th ed.
8. Lednicer D. and Mitscher L.A., “The Organic Chemistry of Drug Synthesis, Volume 1-5, John Wiley & Sons.
9. Indian Pharmacopoeia. Ministry of Health & Family Welfare Government of India
10. Vogel A.I, “Practical Organic Chemistry”, Longmans.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP602T	Pharmacology III–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: Elaborate mechanism of drug action and its relevance in the treatment of different infectious diseases

CLO 02: comprehend the principles of toxicology and and skilled in the treatment of various poisoning symptoms

CLO 03: come across the methods of toxicity studies

CLO 04: study about symptoms of several poisonings

CLO 05: study about treatment of several poisonings

CLO 06: understand the toxicity profile of each drugs

Course Content:

Pharmacology of drugs acting on Respiratory system: Anti-asthmatic drugs; Drugs used in the management of COPD; Expectorants and antitussives; Nasal decongestants; and Respiratory stimulants.

Pharmacology of drugs acting on the Gastrointestinal Tract: Antiulcer agents; Drugs forconstipation and diarrhoea; Appetite stimulants and suppressants; Digestants and carminatives; Emetics and anti-emetics.

Chemotherapy: General principles of chemotherapy; Sulfonamides and cotrimoxazole; Antibiotics-Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides.

Chemotherapy: Antitubercular agents; Antileprotic agents; Antifungal agents; Antiviral drugs; Anthelmintics; Antimalarial drugs; Antiamoebic agents.

Chemotherapy: Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.

Immunopharmacology: Immuno stimulants; Immuno suppressant; Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars.

Principles of toxicology: Definition and basic knowledge of acute, subacute and chronic toxicity. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity.General principles of treatment of poisoning. Clinical symptoms and management of barbiturates, morphine, organo phosphosphorus compound and lead, mercury and arsenic poisoning.

Chronopharmacology: Definition of rhythm and cycles. Biological Clock and their significance leading to chronotherapy.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP608P	Pharmacology III–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the OECD guidelines (425) to develop skills for acute oral toxicity.

CLO 02: understand the introduction to principles of bioassay, its types including advantages and disadvantages

CLO 03: determin the unknown concentration of Acetylcholine and Histamine using suitable isolated tissue preparations (Matching bioassay method)

CLO 04: determin the unknown concentration of Acetylcholine and Histamine using suitable isolated tissue preparations (Bracketing bioassay method)

CLO 05: determin the unknown concentration of Acetylcholine and Histamine using suitable isolated tissue preparations (Interpolation bioassay method)

CLO 06: study the analgesic activity by using Eddy's hot plate Analgesiometer in Mice.

Course Content:

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi-auto analyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation/corrosion of a test substance
12. Determination of acute eye irritation/corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chisquaretest, Wilcoxon Signed Ranktest) *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 Pharmacolog", Churchil Livingstone Elsevier, 9th edition.
2. Katzung B. G., Masters S. B., Trevor A. J., "Basic and clinical pharmacology", Tata McGraw-Hill, 12th edition.
3. Gilman Alfred Goodman, Louis S. Goodman, Theodore W. Rall, Ferid Murad, "Goodman and Gilman's the Pharmacological Basis of Therapeutics, 13th edition.
4. Marry Anne K K, Lloyd Yee Y, Brian KA, Robbin LC, Joseph G B, Wayne A.K, Bradley RW. "Applied Therapeutics, The Clinical use of Drugs", The Point Lippincott Williams & Wilkins., 9th edition.
5. Howland, Richard D., Mary Julia Mycek, Richard A. Harvey, and Pamela C. Champe. Lippincott's illustrated reviews: Pharmacology. Philadelphia: Lippincott Williams & Wilkins.
6. Tripathi KD, "Essential of Medical Pharmacology", JAYPEE brothers and Medical Publishers (P) Ltd New Delhi, 7th edition.
7. Sharma HL, Sharma KK, "Principles of Pharmacology", Paras Medical Publisher,
8. Charles R. Craig, Stitzel E Robert, "Modern Pharmacology with clinical Applications", Lippincott Williams & Wilkins, 6th edition.
9. Ghosh M N, "Fundamentals of experimental pharmacology", Hilton & Company, Kolkata, 6th edition.
10. Kulkarni SK, Handbook of Experimental Pharmacology", Vallabh Prakashan, New Delhi, 3rd edition.
11. Udupa N and Gupta PD, "Concepts in Chronopharmacology", ShyamPrakashan, 1st edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP603T	Herbal Drug Technology–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: gain knowledge of the basic and applied know-how and professional skills in Herbal drug Science and Technology and the necessary training for admission to the postgraduate courses in this field.

CLO 02: acquire operative knowledge and able to carryout technical and management tasks and professional activities in the areas of transformation of medicinal herbs, management of the quality of the processes, marketing of medicinal plants and derivatives for use in herbal, food and cosmetic products, Guaranteeing conformity with the national and EU laws inforce.

CLO 03: acquired the recognition, collection and preservation of medicinal plants. Analyses and dosage of active ingredients. The biological effects of medicinal plants. The toxicological aspects of active ingredients and finished products.

CLO 04: study, design, management, control and conduction of the processing systems of medicinal plants and derivatives.

CLO 05: Manage quality of medicinal plant products and derivatives.

CLO 06: study medicinal plants and derivatives as health Products, including the food

Course content:

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.

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, Ginko biloba, Ginseng, Garlic, Pepper and Ephedra.

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 and perfumes.

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

Evaluation of Drugs WHO and 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 and Neem.

Regulatory Issues-Regulations in India (ASUDTAB, ASUDCC), Regulation of manufacture of ASU drugs-Schedule Z of Drugs and Cosmetics Act for ASU drugs.

General Introduction to Herbal Industry: Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine: Components of GMP (Schedule – T) and its objectives. Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP609P	Herbal Drug Technology–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: prepare, label& Evaluate herbal/ TSM formulations.

CLO 02: evaluate marketed cosmetic & nutraceutical Formulations for developing skills for entrepreneurship.

CLO 03: conduct pre-formulation parameters & Understand underlying rationale

CLO 04: conduct in vitro assays for correlation with Biological efficacy

CLO 05: analyze the monographs herbal drugs from recent Pharmacopoeias

Course Content:

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. In corporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. In corporation 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. Evans WC, “Trease and Evans' pharmacognosy”, Elsevier Health Sciences, 15th edition.
2. Tyler E Varro, Brady R. Lynn, Robbers E. James, Textbook of Pharmacognosy, Lea & Febiger ,7th edition.
3. Kokata CK, Purohit A.P, Gokhale SB, “Pharmacognosy”, Nirali Prakashan, 56th edition.
4. Ansari SH, “Essential of Pharmacognosy”, Birla Publications Pvt Ltd.
5. Rangari VD, “Pharmacognosy and Phytochemistry”-Vol 1-II.
6. Pharmacopoeal standards for Ayurvedic Formulation, Council of Research in

Indian Medicine and Homeopathy.

7. Mukherjee K. Pulok, "Qualuty Control of Herbal Drugs: An approach to evaluation of Botanicals", Business Horizons Publishers, New Delhi.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP604T	Biopharmaceutics and Pharmacokinetics– Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the concept and skills of ADME of drug in human body.

CLO 02: determine the various pharmacokinetic parameters from either plasma concentration or urinary excretion data for drug

CLO 03: apply various regulations related to developing BA-BE study protocol for the new drug molecule.

CLO 04: study the concept of pharmacokinetics parameters

CLO 05: understand the basics of multi compartment model

Course Content:

Introduction to Biopharmaceutics: Absorption; Mechanisms of drug absorption through GIT,factors influencing drug absorption though GIT, absorption of drug from Non peroral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume ofdrugdistribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs. Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs.

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute andrelative 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.

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

Multi compartment 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 settings.

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

of drugs.

Recommended Books: (Latest Editions)

1. Milo Gibaldi, "Biopharmaceutics and clinical pharmacokinetics", Lea and Febiger, 4th edition.
2. Robert F Notari, "Biopharmaceutics and Pharmacokinetics: An Introduction", M. Dekker, 4th edition.
3. Leon Shargel and Andrew B. C. Y. U., "Applied Biopharmaceutics & Pharmacokinetics", Prentice-Hall Inernational edition.USA, 4th edition.
4. Brahmankar D. M. and Sunil B.Jaiswal, "Bio pharmaceutics and Pharmacokinetics-A Treatise", Vallabh Prakashan Pitampura, Delhi.
5. Milo Glbaldi, DonaldPerier, "Pharmacokinetics": Marcel Dekker, Madison Avenue, 2nd edition.
6. Milo Gibaldi and Laurie Prescott, "Hand Book of Clinical Pharmacokinetics", Adis Health Science Press, New York, Sydney.
7. Malcolm Rowland and Thomas N. Tozen, "Clinical Pharmacokinetics, Concepts and Applications", Lea &Febrger, Philadelphia. 3rd edition.
8. Abdou H.M, "Dissolution, Bioavailability and Bioequivalence", Mack, Publishing Company, Pennsylvania.
9. Rebort F Notari, "Biopharmaceutics and Clinical Pharmacokinetics-An introduction", Marcel Dekker Inn, New York and Basel, 4th edition Revised and expanded.
10. Joseph P. Remington and Alfonso R Gennaro, "Remington'sPharmaceutical Sciences", Mack Publishing Company, Pennsylvnia.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP605T	Pharmaceutical Biotechnology–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the various techniques used in modern biotechnology.

CLO 02: design research strategy with step-by-step instructions to address a research problem

CLO 03: provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic

CLO 04: explain and study the concept and application of monoclonal antibody technology for employability

CLO 05: demonstrate and provide examples on how to use microbes and mammalian cells for the production of pharmaceutical products

CLO 06: explain the general principles of generating transgenic plants, animals and microbes

Course Content:

Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.

Study of Cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine. Application of rDNA technology and genetic engineering in the production of: i)Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR.

Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins. Structure and Function of MHC. Hypersensitivity reactions, Immune stimulation and Immunesuppressions. General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines. Hybridoma technology- Production, Purification and Applications. Blood products and Plasma Substituties.

Immuno blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes. Microbial genetics

including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation:Types of mutation/mutants.

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

Recommended Books (Latest edition):

1. Bernard R. Glick, Jack J. Pasternak, Cheryl L Patten, "Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press, Washington DC, 4th edition.
2. Richard A Goldsby, Kindt Thomas J, Osborne Barbara A, "Kuby's Immunology" 8th Edition.
3. James WGoding, "Monoclonal Antibodies: Principles and Practise", Elseveir, 3rd edition, reprint.
4. Walker JM., Gingold E.B, "Molecular Biology and Biotechnology", Royal Society of Chemistry, London.
5. Zaborsky Oskar, "Immobilized Enzymes", CRC Press, Cleveland, Ohio.
6. S.B. Primrose, "Molecular Biotechnology", Blackwell Scientific Publication, 2nd Edition.
7. Stanbury F Peter, Whitakar Allan, Stephen J Hall, "Principles of fermentation technology, Elsevier, 2nd edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP606T	Quality Assurance–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the importance of quality in pharmaceutical products.

CLO 02: explore the importance of Good practices such as GMP, GLP ect.

CLO 03: explore the factors affecting the quality of pharmaceutical products.

CLO 04: understand the regulatory aspects of pharmaceutical industries

CLO 05: learn the process involved in manufacturing of pharmaceuticals different section/department and activity for entrepreneaurship.

CLO 06: study various documentation processes

Course content:

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 andISO14000: Overview, Benefits, Elements, steps for registration NABL accreditation: Principles and procedures

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

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

Quality Control: Quality control test for containers, rubber Courses 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

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.

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

SEMESTER VII

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP701T	Instrumental Methods of Analysis–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the basic theoretical knowledge of the instrumentation techniques available.

CLO 02: theoretically understand the aspects of separation formulating components.

CLO 03: develop practical skills for the analysis of drugs and excipients using various instrumentation techniques.

CLO 04: make accurate analysis and report the results in defined formats.

CLO 05: learn documentation and express the observations with clarity.

CLO 06: understand the professional and safety responsibilities for working in the analysis laboratory.

Course Content:

UV Visible spectroscopy: Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications – Spectrophotometric titrations, Single component and multicomponent analysis

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

IRspectroscopy: Introduction, fundamental modes of vibrations in polyatomic molecules, sample handling, factors affecting vibrations. Instrumentation-Sources of radiation, wavelength selectors, detectors-Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications.

FlamePhotometry- Principle, interferences, instrumentation and applications.

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nephelo turbidometry- Principle, instrumentation and applications

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 techniqus, advantages, disadvantages and applications.

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

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

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

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

Gel chromatography- Introduction, theory, instrumentation and applications.

Affinity chromatography- Introduction, theory, instrumentation and applications.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP705P	Instrumental Methods of Analysis–Practical	4	2

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand the interaction of matter with electromagnetic radiations.

CLO 02: apply electromagnetic radiations in Drug analysis

CLO 03: understand and develop skills on the chromatographic separation and analysis of drugs and perform quantitative & qualitative analysis of Drugs using various analytical instruments.

CLO 04: determine the sodium and potassium by flame photometry

CLO 05: perform separation of sugar and amino acids by chromatographic technique.

Course Content:

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. Sharma, B. K. Instrumental methods of chemical analysis. Krishna Prakashan Media, 1981.
2. Sharma, Yog Raj. Elementary organic spectroscopy. S. Chand Publishing, 2007.
3. Kho, B. T. "A textbook of pharmaceutical analysis.: By Kenneth A. Connors. Wiley-Interscience, New York, 1975.
4. Vogel, Arthur Israel, and George Harold Jeffery. Vogel's textbook of quantitative

chemical analysis. Wiley, 1989.

5. Beckett, Arnold Heyworth, and John Bedford Stenlake, eds. Practical Pharmaceutical Chemistry: Part II Fourth Edition. Vol. 2. A&C Black, 1988.
6. Finar, I. L. "Organic Chemistry: The Fundamental Principles" (1967).
7. Kemp, William. Organic spectroscopy. Macmillan International Higher Education, 2017.
8. Donald Clarence Garrett, Quantitative Analysis of Drugs, 3rd edition, Science paperbooks
9. Sethi P.D. Quantitative Analysis of Drugs in Pharmaceutical Formulations, 3rd Edition.
10. Robert Silverstein, Spectrophotometric identification of Organic Compounds, Wiley, eighth edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP702T	Industrial Pharmacy II–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: understand pilot plant technique, its significance and basic requirements.

CLO 02: understand the pilot plant and scale up techniques for various dosage forms in pharmaceutical industry.

CLO 03: understand the concept of technology transfer and its utilization in commercial batch for employability

CLO 04: understand the regulatory requirements for drug product approvals and marketing.

CLO 05: remember the role of quality management system and its certification.

CLO 06: study various Indian regulatory commissions.

Course Content:

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

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

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.

Quality management systems: Quality management and Certifications: Concept

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

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

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http//en.wikipedia.org/wiki/Regulatory Affairs.
2. International Regulatory Affairs Updates, 2005. Available at http://www.iraup.com/about.php
3. Douglas JP and David SM. Textbook 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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP706PS	Practice School	12	6

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: prepare and formulated different dosage forms

CLO 02: sterilize formulated dosage forms

CLO 03: perform identification test of tincture of iodine

CLO 04: understand the clinical case studies

CLO 05: study the drug information based on industrial application for inculcating employability skills in pharmaceutical industries.

Course Content:

1. Preparation and Sterilization of 0.9% Normal Saline Injection.
2. Preparation and Sterilization of 5% Dextrose Injection.
3. Preparation and Sterilization of Isotonic Ringer Solution Injection.
4. Preparation and Identification of Tincture of Iodine.
5. Preparation of Mandl's Throat Paint.
6. Clinical Case Study 1
7. Clinical Case Study 2
8. Clinical Case Study 3
9. Clinical Case Study 4
10. Clinical Case Study 5
11. Drug Information Services 1
12. Drug Information Services 2
13. Drug Information Services 3
14. Drug Information Services 4
15. Drug Information Services 5

Recommended Books

1. Merchant S.H. and Dr. J.S.Quadry. A textbook of hospital pharmacy,4th ed. Ahmadabad: B.S. Shah Prakashan; 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 and 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 and Distributers; 2008.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP703T	Pharmacy Practice–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: demonstrate knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative aspects, health policy and legal issues in the practice of pharmacy.

CLO 02: gain knowledge of drug distribution methods in hospital and apply it in the practice of pharmacy.

CLO 03: effectively apply principles of drugs to remanagement and inventory control to medication use.

CLO 04: provide patient-centered care to diverse patients using the best available evidence and monitor drug therapy of patient through medication chart review, obtain medication history interview and counsel the patients, identify drug related problems.

CLO 05: engage in innovative activities by making use of the knowledge of clinical trials which will help them to become an entrepreneaur.

CLO 06: exhibit professional ethics by producing safe and appropriate medication use throughout society

Course Content:

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.

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

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.

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.

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.

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.

Therapeutic drug monitoring: Need for Therapeutic Drug Monitoring, Factors to be considered during the

Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

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

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

Community pharmacy management: Financial, materials, staff,and infrastructure requirements.

Pharmacy and therapeutic committee: Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs in to formulary, inpatient and outpatient prescription, automatics top order, and emergency drug list preparation.

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

Patient counseling: Definition of patient counseling; steps involved inpatient counseling, and Special cases that require the pharmacist.

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.

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

Budget preparation and implementation: Budget preparation and implementation

Clinical Pharmacy: Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

Dosing pattern and drug therapy based on Pharmacokinetic and disease pattern.

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

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.

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

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 Prakashan; 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 and 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 and Distributers; 2008.

Journals:

1. Therapeuticdrugmonitoring.ISSN:0163-4356
2. Journalofpharmacypractice.ISSN:0974-8326
3. Americanjournalofhealthsystempharmacy.ISSN:1535-2900(online)
4. Pharmacytimes(Monthlymagazine)

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP704T	Novel Drug Delivery System–Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: analyze various approaches for development of skills on novel drug delivery systems.

CLO 02: understand the criteria for selection of drugs and polymers for the development of NTDS

CLO 03: formulate and evaluate novel drug delivery systems.

CLO 04: apply approaches to design-controlled release formulations based on diffusion

CLO 05: apply approaches for transdermal drug delivery systems and permeation across the skin.

Course Content:

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.

Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications.

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion/ mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump.

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

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

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

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

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intrauterine 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 and 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 and Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

SEMESTER VIII

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP801T	Biostatistics and Research Methodology – Theory	4	4

Course Learning Outcomes:

Upon successful completion of the course, students will be able to:

CLO 01: learn and develop skills on how to create frequency distribution, apply correlation and regression tools on Pharmaceutical problems.

CLO 02: carryout different tests on the observations from clinical trials and surveys**.**

CLO 03: learn about factorial designs and Blocking and confounding system for Two-level factorials.

CLO 04: design and analysis of experiments by Response Surface methodology.

CLO 05: apply hypothesis testing in Simple and Multiple regression models

Course content:

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

Regression: Curve fitting by the method of least squares, fitting the line system , 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

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

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.

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

Design and Analysis of experiments:

Factorial Design: Definition, 22, 23 design. Advantage of factorial design

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

Recommended Books (Latest edition):

1. Sanford Bolton, "Pharmaceutical statistics-Practical and clinical applications", Marcel Dekker Inc. New York, 2nd edition.
2. S.C.Guptha, "Fundamental of Statistics", Himalaya Publishing House, 7th edition.
3. R.Pannerselvam, "Design and Analysis of Experiments", PHI Learning Private Limited, 8th edition.
4. Douglas and C.Montgomery, "Design and Analysis of Experiments", Wiley Students Edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP802T	Social and Preventive Pharmacy –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: Acquire high consciousness/realization of current issues related to health and pharmaceutical problems with in the country and worldwide.

CLO 02: Have a critical way of thinking based on current healthcare development to become an entrepreneaur

CLO 03: Evaluate alternative ways of solving problems related to health and pharmaceutical issues.

CLO 04: Study the National health intervention programme for mother and child.

CLO 05: Study the community services in rural, urban and school health.

Course content:

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 healthcare; avoidable habits

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

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

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.

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

Recommended Journals:

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP803ET	Pharma Marketing Management –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand the concept of marketing, selling and marketing environment.

CLO 02: analyze the competitive and consumer buying behavior.

CLO 03: study various qualitative and quantitative aspects related to size and composition of market.

CLO 04: study various pharmaceutical marketing channels to become an entrepreneaur.

CLO 05: understand Vertical and Horizontal Marketing concepts.

Course Content:

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

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

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

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

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, normsfor customer calls, motivating, evaluating, compensation and future prospects of the PSR.

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 and 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 GrawHill
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 and Nanakamari, S: Marketing Managemnt: Global Perspective, Indian Context, 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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP804ET	Pharmaceutical Regulatory Science –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand stages of drug discovery, development, preclinical, non-clinical and clinical studies to get employability

CLO 02: develop generic drug product development.

CLO 03: perform regulatory approval processes.

CLO 04: learn and study the procedure for export of pharmaceutical products and Registration of Indian drug product in overseas market.

CLO 05: develop skills in creating clinical trial protocols and guidelines of regulatory commissions.

Course content:

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.

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

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

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.

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

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

Recommended books (Latest edition):

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP805ET	Pharmacovigilance –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: analyze the importance of safety monitoring of Medicine and Pharmacovigilance Program of India.

CLO 02: Develop skills and methods in Causality assessment; Severity and seriousness assessment.

CLO 03: learn WHO adverse reaction terminologies.

CLO 04: establish pharmacovigilance programme in a hospital.

CLO 05: understand ICH Guidelines for Pharmacovigilance.

CLO 06: understand Drug safety evaluation in special population.

Course Content

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 andreporting; 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.

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 and operation of drug safety department in industry; Contract Research Organisations (CROs); Establishing a national programme.

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.

Communicationinpharmacovigilance: Effective communication in Pharmacovigilance; Communication in Drug Safety Crisis management; Communicating with Regulatory Agencies, Business Partners, Healthcare facilities and Media.

Safety data generation: Preclinical 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.

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 and C Act and ScheduleY; Differences in Indian and global pharmacovigilance requirements.

Recommended Books (Latest edition):

1. SK Gupta, “Textbook of Pharmacovigilance”,Jaypee Brothers, Medical Publishers.
2. Barton Cobert, Pierre Biron, “Practical Drug Safety from A to Z”, Jones and Bartlett Publishers.
3. Elizabeth B.Andrews, Nicholas, “Mann's Pharmacovigilance”, Wiley Publishers.
4. John Talbot, Patrick Walle Stephens,“ Detection of New Adverse Drug Reactions”, Wiley Publishers.
5. Patrick Waller, “An Introduction to Pharmacovigilance”, Wiley Publishers.
6. Barton Cobert, “Cobert's Manual of Drug Safety and Pharmacovigilance”, Jones and Bartlett Publishers.
7. Brian L. Strom, Stephen E Kimmel, Sean Hennessy, “Textbook of Pharmacoepidemiology” , Wiley Publisher.
8. G. Parthasarathi, K. Nyfort Hansen, M.C. Nahata, “A Textbook ofClinical Pharmacy Practice-Essential Concepts and Skills”.
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Textbook of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP806ET	Quality Control and Standardization of Herbals –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand skills related to various basic tests for drugs, Medicinal plants materials and dosage forms.

CLO 02: learn and understand the quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine.

CLO 03: learn EU and ICH guidelines for quality control of herbal drugs.

CLO 04: understand the regulatory requirements for herbal medicines

CLO 05: study WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems

Course Content:

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.

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.

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

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 and Cosmetics Act provisions.

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

Recommended Books: (Latest Editions)

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Textbook of Pharmacognosy and Phytochemistry Vol.I, 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 Phytomedicine1(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 RegionalPublications, 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. 2vol.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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP807ET	Computer Aided Drug Design –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand the stages of drug discovery and development for entrepreneaurship.

CLO 02: study the history and development of QSAR

CLO 03: learn and understand the molecular modeling and virtual screening techniques

CLO 04: understand the informatics and methods in drug design

CLO 05: perform and apply molecular docking techniques.

Course Content:

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.

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 Taftssteric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

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. Denovo drug design.

Informatics and Methods in drug design: Introduction to Bioinformatics, chemoinformatics.ADME databases, chemical, biochemical and pharmaceutical databases.

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. MartinYC. “Quantitative Drug Design ” Dekker, NewYork.
3. Delgado JN, Remers WA eds “Wilson and Gisvolds’s Text Book of Organic Medicinal and Pharmaceutical Chemistry” Lippincott, NewYork.
4. FoyeWO “Principles of Medicinal chemistry ‘Lea and Febiger.
5. Korolkovas A, Burckhalter JH. “Essentials of Medicinal Chemistry” Wiley Interscience.
6. WolfME, ed “The Basis of Medicinal Chemistry, Burger’s Medicinal Chemistry” John Wiley and Sons, NewYork.
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.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP808ET	Cell and Molecular Biology –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: learn theoretical basis and applications of cell and molecular biology.

CLO 02: study the flow of molecular information.

CLO 03: understand and learn the structure and functions of proteins and regularities in proteins.

CLO 04: remember the Genetics and cell signaling.

CLO 05: develop skills in positive control and significance of protein synthesis

Course content:

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

DNA and the Flow of Molecular Information: DNA Functioning; DNA and RNA; Types ofRNA;Transcription and Translation.

Proteins: Defined and Amino Acids; Protein Structure. Regularities in Protein Pathways. Cellular Processes. Positive Control and significance of Protein Synthesis.

Science of Genetics: Transgenics and Genomic Analysis. Cell Cycle analysis. Mitosis and Meiosis.Cellular Activities and Check points.

Cell Signals: Introduction, Receptors for Cell Signals, Signaling Pathways: Overview, Misregulation of Signaling Pathways, Protein-Kinases: Functioning.

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Black well scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers and Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology,Tata Mc Graw Hill edn.
4. Malcolm Harris, BalliereTindall 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, J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
13. RA Goldshy et.al., : Kuby Immunology.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP809ET	Cosmetic Science –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand principles of formulation and building blocks of skin care products.

CLO 02: learn various oily and dry skin, causes leading to dry skin, skin moisturization.

CLO 03: understands principle of cosmetic evaluation and get skilled in various cosmetiology techniques

CLO 04: study various principles of cosmetic evaluation.

CLO 05: understand building blocks for skin care products.

Course Content:

Classification of cosmetic and cosmeceutical products: Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs; Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application; Skin: Basic structure and function of skin. Hair: Basic structure ofhair. Hair growth cycle. Oral Cavity: Common problem associated with teeth and gums.

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals. Antiperspants and deodorants- Actives and mechanism of action. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hairoils. Chemistry and formulation of Para-phylene diamine based hairdye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums,sensitive teeth.Teeth whitening, Mouthwash.

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.

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties. Soaps, and syndet bars. Evolutionand skinbenfits.

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.Cosmetic problem sassociated with Hair and scalp: Dandruff, Hairfall causes Cosmetic problems

associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants-Actives and mechanism of action.

References

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

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP810ET	Experimental Pharmacology –Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals.

CLO 02: study various preclinical screening models.

CLO 03: develop skill in screening preclinical models for ANS activity, CVS activity.

CLO 04: gain knowledge and study research methodology and biostatics in the Selection of research topic, review of literature, research hypothesis and study design

CLO 05: interpretate pre-clinical data analysis using Students 't'test; and One-way ANOVA.

Course Content:

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.

Preclinical screening models: Dose selection, calculation and conversions, preparation of drugsolution/suspensions, grouping of animals and importanceof sham negative and positive control groups. Rationale for selection of animal species and sex for the study. Study of screening animal models for Diuretics, nootropics, anti-Parkinson's,antiasthmatics, Preclinical screeningmodels: for CNS activity- analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer'sdisease.

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

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

anticancer and antiasthmatics.

Research methodology and Bio-statistics: Selection of research topic, review of literature, research hypothesis and study design; Pre-clinical data analysis and interpretation using Students 't'test;and One-way ANOVA.Graphical representation of data.

Recommended Books (latest edition):

1. M.N.Ghosh, "Fundamentals of experimental Pharmacology", Hilton & Company, 7th edition.
2. S.K.Kulakarni, "Handbook of Experimental Pharmacology", Vallabh Prakashan, 3rd edition.
3. CPCSEA guidelines for laboratory animal facility.
4. Vogel H.G., "Drug discovery and Evaluation", Springer Ver Lag Berlin Heidelberg, New York, 2nd edition.
5. Suresh Kumar Gupta and S.K.Gupta, "Drug Screening Methods", Jaypee Brothers Medical Publishers.
6. PSS Sundar Rao and JRichard, "Introduction to biostatistics and research methods", PHI Learning, 5th edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP811ET	Advanced Instrumentation Techniques – Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: learn basic theoretical knowledge of NMR and mass spectrometry.

CLO 02: theoretically understand the aspects thermal methods of analysis and X-ray diffraction.

CLO 03: develop practical skills for the analysis of drugs and excipients using various instrumentation techniques.

CLO 04: make accurate analysis and report the results in defined formats.

CLO 05: learn calibration and validation-as per ICH and USFDA guidelines

CLO 06: understand the extraction techniques and hyphenated techniques.

Course Content:

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

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

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

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

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.

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

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

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

Recommended Books (Latest Editions)

1. B.K Sharma, “Instrumental Methods of Chemical Analysis”, Krishna Prakashan

Media, 1981, 3rd edition.
2. Y.R Sharma, "Organic spectroscopy", S. Chand & Co. Ltd.
3. Kenneth A.Connors, "Textbook of Pharmaceutical Analysis", Wiley, 3rd edition.
4. A.I.Vogel, "Vogel's Textbook of Quantitative Chemical Analysis", Longman Scientific & Technical, 5th edition.
5. A.H.Beckett and J.B.Stenlake, "Practical Pharmaceutical Chemistry", CBS Publisher, 3rd edition.
6. I.L.Finar, "Organic Chemistry", Pearson Education, 6th edition.
7. William Kemp, "Organic spectroscopy", Palgrave USA, 3rd edition.
8. D. C. Garrett, "Quantitative Analysis of Drugs", CBS PUBLICATION, 3rd edition.
9. P.D.Sethi, "Quantitative Analysis of Drugs in Pharmaceutical Formulations", CBS Publishers & Distributors, 3rd edition.
10. Silverstein, "Spectrophotometric identification of Organic Compounds", 7th edition.

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP812ET	Dietary Supplements and Nutraceuticals – Theory	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: understand the role of Functional foods, Nutraceuticals and Dietary supplements.

CLO 02: understand the chemical nature and medicinal benefits of Phytochemicals as nutraceuticals to become an entrepreneur

CLO 03: understand the role and damaging reactions of free radicals.

CLO 04: understand the role of free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage.

CLO 05: analyze the effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

Course Content:

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, osteo arthritis, hypertension etc. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. 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.

Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin, Sulfides: Diallyl sulfides, Allyl trisulfide, Polyphenolics: Reservetrol, Flavonoids-Rutin, Naringin, Quercitin, Anthocyanidins, catechins, Flavones, Prebiotics / Probiotics: Fructo oligosaccharides, Lactobacillum, Phytoestrogens:Isoflavones, daidzein, Geebustin, lignans, Tocopherols, Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, ricebran, seafoods, coffee, tea and the like.

Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicalsin cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleicacids; Dietary fibres and complex carbohydrates as functional food ingredients.

Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion

injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscledamage. Free radicals involvement in other disorders. Free radicals theory of ageing. 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.

Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

Reference Books:

1. K.T Agusti and P.Faizal, "Role of dietary fibres and neutraceuticals in preventing diseases", BS Publication.
2. Cooper K.A., "Advanced Nutritional Therapies".
3. Jean Carper, "The Food Pharmacy", Simon and Schuster, UK Ltd.,(1988).
4. James F. Balch and Phyllis A. Balch, "Prescription for Nutritional Healing", Avery Publishing Group, NY (1997), 2nd edition.
5. G. Gibson and C.williams Editors 2000 Functional foods Woodhead Publ. Co. London.
6. Goldberg, I. Functional Foods.1994.Chapman and Hall, NewYork.
7. 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. Labuzaeds. Aspen Press.
8. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
9. Shils ME, Olson JA, Shike M. 1994 Modern Nutrition in Health and Disease. Eighth edition. Lea and Febiger

Course Code	Name of the Course	No. of Hours/week	Credit Points
BP813PW	Project Work	4	4

Course Learning Outcomes:

After successful completion of the course student will be able to:

CLO 01: gain knowledge regarding regulations related to pre-formulation, formulation development, stability assessment, manufacturing and quality control testing.

CLO 02: study Pharmaceutical Excipients in pharmaceutical product development with a special reference to Tablet and capsule excipients, directly compressible vehicles, Coat materials, Excipients in parenteral and aerosols products

CLO 03: evaluate selection and quality control testing of packaging materials for pharmaceutical product development-regulatory considerations and understand the basic concept of industrial entreprenurship

CLO 04: develop skills by performing quality control testing of manufactured products

CLO 05: perform optimization techniques in pharmaceutical product development

Course Content:

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

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories: Solvents and solubilizers, Cylodextrins and their applications, Non-ionic surfactants and their applications, Polyethylene glycols and sorbitols, Suspending and emulsifying agents, Semisolid excipients.

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories: Tablet and capsule excipients, Directly compressible vehicles, Coat materials, Excipients in parenteral and aerosols products, Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications.

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.

Selection and quality control testing of packaging materials for

pharmaceutical product development-regulatory considerations.

Recommended Books (Latest editions)

1. Stanford Bolton, "Pharmaceutical Statistics Practical and Clinical Applications", Charles Bon;Marcel Dekker Inc., 2nd edition.
2. James swarbrick, "Encyclopedia of Pharmaceutical Technology", Informa Health care publishers, Third Edition
3. Herbert A. Lieberman and Leon Lachman, "Pharmaceutical Dosage Forms, Tablets", Marcel Dekker, Inc. Volume II.
4. Roop K Khar, SP Vyas, Farhan J Ahmad, Gaurav K Jain, "The Theory and Practice of Industrial Pharmacy", CBS Publishers and Distributors Pvt. Ltd. 2013, Fourth Edition.
5. Patrick J. Sinko, "Martin's Physical Pharmacy and Pharmaceutical Sciences, BI Publications Pvt. Ltd., 5th Edition.
6. S.P. Vyas and R.K. Khar, "Targeted and Controlled Drug Delivery, Novel Carrier Systems", CBS Publishers and Distributors Pvt. Ltd,1st Edition 2012.
7. Loyd V. Allen Jr, "Pharmaceutical Dosage Forms and Drug Delivery Systems", Nicholas B.Popovich, Howard C.Ansel, 9th Ed. 40.
8. Aulton's Pharmaceutics–The Design and Manufacture of Medicines, Michael E.Aulton, 3rd edition.
9. Remington–The Science and Practice of Pharmacy, 20th Ed.
10. Liberman, Leon Lachman and Joseph B. Schwartz, "Pharmaceutical Dosage Forms", Vol 1 to 3.
11. Liberman, Martin, M.R and Gilbert S. Banker, "Pharmaceutical Dosage Forms–Disperse Systems", Vol 1 to 3
12. Kenneth E. Avis and H.A. Libermann, "Pharmaceutical Dosage Forms–Parenteral Medication", Vol 1 and 2.
13. Advanced Review Articles related to the topics.

VALUE ADDED COURSES
SESSION 2020-21

Course Code	Name of the Course	No. of Hours/week	Credit Points
--	Health Education	30	-

Course Objective: The objective of this Value Addition Course is to create awareness among the students to improve health education and social health problems in the country as well as equip the students with workable knowledge to treat common illnesses at home.

Course Outcome: After completion of this course, students will be able to learn about environmental health, various communicable diseases, social health problems and complimentary system of Indian medicines.

Course Contents: Introductory Health Education: Physical, mental and emotional facets of health. This will prepare students to help patients maintain a balance in every aspect of their health. Environmental Health: An environmental health course helps future industry professionals teach clientele how to create and maintain a healthy home, work space and community. Communicable Diseases: Public health pathology, environmental influences on disease and the history of disease. Additionally, students will learn about treatments, prevention and the importance of health awareness. Social health problems: Smoking, alcoholism, drug abuse and AIDS Nutritional deficiencies: Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency Complimentary system of Medicine: Mind body therapies, Whole medical systems (AYUSH), Safety of CAM. Antibiotic resistance: Introduction to antimicrobial resistance, Mechanism of resistance to antibacterial NDM-1, Strategies and Treatment of bacterial infections.

Recommended Books:

- Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; 2012; New Age International Publishers
- Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill..
- Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing
- Khanna K et al. Textbook of Nutrition and Dietetics; 2013; Phoenix Publisher.
- Sharma S, Wadhwa A. Nutrition in the Community- A textbook; 2003; Elite Publishing House Pvt. Ltd.
- Srilakshmi B. Dietetics; 2012; New Age International (P) Ltd.

- Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford& IBH Publishing Co. Pvt Ltd.

Course Code	Name of the Course	No. of Hours/week	Credit Points
--	Prevention and Management of Drug Abuse	30	-

Course Objective: The objective of this Value Addition Course is to make the students understand the impact of misuse of drugs and substance use disorders on public health problems in the country.

Course Outcome: Drug prevention programs are designed to provide the education and support necessary to the students in order to diminish drug dependency in communities, schools and the workplace.

Course Contents: Drug Abuse: Introduction to Drug Abuse, Drug Dependence, Physical Dependence, Experimental Dependence, phases of drug dependence, Primary cause and factors to drug abuse, Signs and symptoms of drug abuse.
Important Terminologies: Drug seeking behavior, Misuse, Addiction, Habituation, Rebound, Relapse, Detoxification, Craving.
Drugs and substance of abuse: Recreational Drugs (Alcohol, Morphine, Cocaine, Heroin, Cannabis), Drug Dependence and Tolerance, Alcohol Dependence.
Treatment and Prevention: Treatment, Mechanism of Anti-abuse drugs, Strategies and Programs of Drug abuse..

Recommended Books:

- Blanco C, Alderson D, Ogburn E, et al. Changes in the prevalence of non-medical prescription drug use and drug use disorders in the United States: 1991-1992 and 2001-2002. Drug Alcohol Depend. 2007;90(2- 3):252-260. doi:10.1016/j.drugalcdep.2007.04.005
- Center for Behavioral Health Statistics and Quality. Treatment Episode Data Set (TEDS): 2003-2013. National Admissions to Substance Abuse Treatment Services. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2015. http://www.samhsa.gov/.../2013_Treatment_Episode_Data_Set_National.pdf.
- Center for Behavioral Health Statistics and Quality. Drug Abuse Warning Network: 2011: Selected Tables of National Estimates of Drug-Related Emergency Department Visits. Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Jones CM, McAninch JK. Emergency Department Visits and Overdose Deaths From Combined Use of Opioids and Benzodiazepines. Am J Prev Med. 2015;49(4):493-501. doi:10.1016/j.amepre.2015.03.040
- Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in Drug and Opioid Overdose Deaths—United States, 2000–2014. Centers for Disease Control and Prevention; 2016. https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6450a3.

htm

- ?s_cid=mm6450a3_w. Accessed November 7, 2017.
- CDC Wonder: Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2019 on CDC WONDER Online Database, released December 2020
- Center for Behavioral Health Statistics and Quality. Results from the 2017 National Survey on Drug Use and Health: Detailed Tables. Rockville (MD): SAMHSA;
  2018. https://www.samhsa.gov/data/report/2017-nsduh-detailed-tables. Accessed October 19, 2018.

13. Appendix A: Mapping of Programme Outcomes (POs) with Course Learning Outcomes (CLOs):

Sr. No.	Course Name	Course Code	Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
1.	Human Anatomy and Physiology I– Theory	BP101T	**CLO 01:** Students will learn about the gross morphology, structure and functions of cell, skeletal, muscular, cardiovascular system of the human body.	**H**		**M**					**L**			
			CLO 02: Students will study and understand the various homeostatic mechanisms and their imbalances.		**H**	**M**					**L**			
			CLO 03: Students will be able to identify the different types of bones in human body.	**H**										
			CLO 04: Students will be able to identify the various tissues of different systems of human body.	**H**										

			CLO 05: Students will learn about the various experimental techniques related to physiology.			**H**	**M**						**L**	
			CLO 06: Students will learn various techniques like blood group determination, blood pressure measurement, blood cells counting which will give them employability in clinical sector.	**M**						**H**		**L**		
2.	Pharmaceutical Analysis I – Theory	BP102T	**CLO 01:** Students will develop ideas with the fundamental of analytical chemistry among the pupil.				**H**						**L**	**M**
			CLO 02: Students will constructs the fundamental methodology to prepare different strength of solutions.		**M**	**H**							**L**	
			CLO 03: Students will facilitate the fellow			**H**			**M**			**L**		

			pupil to predict the sources of mistakes and errors.											
			CLO 04: Students will develop the fundamentals of volumetric analytical skills.			**H**								
			CLO 05: Students will peculates the basic knowledge in the principles of electrochemical analytical techniques which will make them employable in quality control unit.				**H**							
			CLO 06 Students interpretation skills will be improved by the course content in terms of choice of analytical					**M**						
3.	Pharmaceutics I – Theory	BP103T	**CLO 01:** Upon completion of this program the student will have fundamental						**M**			**H**		

			knowledge in preparing conventional dosage forms.											
			CLO 02: Upon completion of this program students learn about basics of pharmacopoeias available.			**H**			**M**			**L**		
			CLO 03: Knowledge about various pharmaceutical dosage calculations.				**H**		**L**			**M**		
			CLO 04: Understand various techniques for the formulation and evaluation of powders and liquid dosage forms which will give them employability in pharmaceutical industries.				**M**		**H**	**L**				
			CLO 05: Identification of various pharmaceutical				**H**		**L**	**M**				

			in compatibilities.											
			CLO 06: Knowledge about various semisolid dosage forms and their evaluation will enhance the skills to perform work accordingly.			**M**	**H**			**L**				
4.	Pharmaceutical Inorganic Chemistry – Theory	BP104T	**CLO 01:** Well acquainted with the principles of limit tests.		**H**		**M**							
			CLO 02: Familiar with different classes of inorganic pharmaceuticals and their analysis	**H**		**M**								
			CLO 03: Identification of different anions, cations and different inorganic pharmaceuticals.	**H**			**M**				**L**			

			CLO 04: Knowledge about the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals which will help students to get employability in quality control department.	**M**	**H**		**L**							
			CLO 05: Understand and develop skills related to medicinal and pharmaceutical importance of inorganic compounds	**H**			**M**		**L**					
			CLO 06: To have been Introduced to a variety of inorganic drug classes.	**H**										
5.	Communication skills–Theory	BP105T	**CLO 01:** Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation						**M**	**L**	**H**			

			CLO 02: Communicate effectively (Verbal and Non-Verbal)	**H**	**M**									
			CLO 03: Effectively manage the team as a team player		**L**	**H**					**M**			
			CLO 04: Develop interview skills	**H**		**M**					**L**			
			CLO 05: Develop Leadership qualities and essentials			**H**					**M**			
6.	Remedial Biology	BP106RBT	**CLO 01:** The main aim of this course is to make aware the students to understand and learn about cell biology (Basic Nature of Plant cell and Animal cell) which will develop skills and make them employable in various pharmaceutical sectors.	**M**		**H**					**L**			
			CLO 02: Classification System of both Plants & Animals	**H**		**M**			**L**					

			CLO 03: Various tissue system and organ system in Plant and animals	**H**		**M**			**L**					
			CLO 04: Theory of evolution	**H**		**M**			**L**					
			CLO 05: Anatomy and Physiology of plants and animals	**H**		**M**			**L**					
			CLO 06: Various phases in the development of plant growth.	**H**										
			CLO 07: Learn about respiration techniques in plants.	**H**										
7.	Remedial Mathematics – Theory	BP106RMT	**CLO 01:** Apply mathematical concepts and principles to perform Computations for Pharmaceutical Sciences.		**H**	**M**	**L**							
			CLO 02: Create,use and analyze mathematical representations and mathematical relationships			**M**								**H**

			CLO 03: Communicate mathematical knowledge and understanding to get employability in the field of Clinical Pharmacy.			**M**					**L**			**H**
			CLO 04: Perform abstract mathematical reasoning.			**M**								**H**
			CLO 05: Learn about analytical geometry.		**H**	**M**								
8.	Human Anatomy and Physiology – Practical	BP107P	**CLO 01**: Understand the construction, working, care and handling of instruments, glassware's and equipment's required for practical.			**H**	**M**			**L**				
			CLO 02: Understand the significance of Bleeding time, Blotting time, Blood group detection, Haemoglobin detection and measurement of blood pressure.	**H**				**M**						

			CLO 03: Knowledge of mechanism of White Blood Cell Count and Red Blood Cell Count of blood sample.	**H**			**M**							
			CLO 04: Develop skills by Demonstrating the human cardiovascular system and digestive system with the help of Charts and models.	**H**			**M**					**L**		
			CLO 05: examine different types of human bones, heart rate and pulse rate.	**H**			**M**							
9.	Pharmaceutical Analysis I – Practical	BP108P	**CLO 01:** Understand the apparatus and glassware used in analytical chemistry.	**H**			**M**							
			CLO 02: Know the importance of calibration in analysis of compound	**H**	**M**									

			CLO 03: Understand the principle, reaction condition and factor calculation for data analysis for various volumetric methods of analysis.	**H**	**M**				**L**					
			CLO 04: Students will develop skills by studying the Interpretation of data and computing the results.	**L**			**M**							**H**
			CLO 05: apply conductometric and potentiometric titration of acid and base	**H**	**M**				**L**					
10.	Pharmaceutics I – Practical	BP109P	**CLO 01:** Explain formulation, evaluation and labeling of aromatic water, glycerides, syrups, elixirsand powder preparations.	**M**			**H**	**L**						

			CLO 02: Develop skills by performing pharmaceutical calculations to determine evaluation parameters like density, viscosity, specific gravity, angle of repose, Carr's index, Hausner ratio of preparations.	**M**			**H**		**L**					
			CLO 03: Describeuse of ingredients in formulation and categoryof formulation.	**H**		**M**	**L**							
			CLO 04: Compare various mono phasic preparations depending upon their formulation.		**M**		**H**				**L**			
			CLO 05: Selection of suitable packaging material (container-CO sure) for the preparation.								**M**	**H**	**L**	
			CLO 01: Perform qualitative Analysis of given	**H**										

			inorganic mixtures.											
11.	Pharmaceutical Inorganic Chemistry – Practical	BP110P	**CLO 02:** Develop skills in carrying out identification test of given inorganic compounds	**M**			**H**							
			CLO 03: Perform limit test for chlorides, sulphates etc.	**H**										
			CLO 04: Prepare inorganic compounds			**H**	**M**							
			CLO 05: understand and develop skills related to medicinal and pharmaceutical importance of inorganic compounds	**M**			**H**							
12.	Communication skills–Practical	BP111P	**CLO 01:** Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation					**H**		**M**				**L**
			CLO 02: Communicate effectively (Verbal andNon-Verbal)	**H**				**M**					**L**	

			CLO 03: Effectively manage the teams team player	**L**							**H**			
			CLO 04: Develop interview skills	**H**							**M**			
			CLO 05: Develop Leadership qualities and essentials	**M**							**H**			
13.	Remedial Biology –Practical	BP112R BP	**CLO 01:** The main aim of this course is to develop skills and make aware the students to understand and learn about cell biology (Basic Nature of Plant cell and Animal cell)	**H**			**M**						**L**	
			CLO 02: Classification System of both Plants & Animals	**M**		**H**				**L**				
			CLO 03: Various tissue System and organ system in plant and animals	**M**		**H**			**L**					
			CLO 04: Theory of evolution	**M**		**H**								
			CLO 05: Anatomy and Physiology of plants and	**M**		**H**								

			animals											
			CLO 06: Various phases in the development of plant growth.	**H**		**M**								
			CLO 07: Learn about Respiration techniques in plants.	**M**		**H**			**L**					
14.	Human Anatomy and Physiology II –Theory	BP201T	**CLO 01:** Students will study about the grossmorphology, structure and functions of nervous, respiratory, urinary and reproductive systems in the human body.	**H**			**M**			**L**				
			CLO 02: Students will study in detailed about energy and metabolism.	**H**			**M**			**L**				
			CLO 03: Students will be able to identify the various organs of different systems of human body.	**H**			**M**			**L**				

			CLO 04: Students will perform and learn about the experiments like neurological reflex, body temperature measurement	**H**			**M**			**L**				
			CLO 05: Students will study and elaborate on interlinked mechanisms in the maintenance of normal functioning of human body.	**H**	**M**					**L**				
			CLO 06: Students will learn and perform the experiments like Olfaction, gustation reflex and eye Sight and it would groom them for better employability.	**M**			**H**							
15.	Pharmaceutical Organic Chemistry I –	BP202T	**CLO 01:** Write the structure, name of the organic compound.	**H**	**M**		**L**							
			CLO 02: Knowledge about the type of isomerism.	**H**	**M**			**L**						

	Theory		**CLO 03:** Write the reaction, name the reaction and Orientation of reactions.	**H**	**M**			**L**						
			CO 04: Account for reactivity/stability of compounds		**M**	**H**								
			CLO 05: Identify/ confirm the unknown organic compound	**H**	**L**	**M**								
			CLO 06: Knowledge about the naming reactions of carbonyl compounds	**H**	**M**		**L**							
			CLO 07: To perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, etc and these skills maid our students better employable in medical arena.	**H**	**M**		**L**							
16.	Biochemistry – Theory	BP203T	**CLO 01:** To understand the importance of	**H**			**M**			**L**				

			metabolism of substrates.											
			CLO 02: Will acquire chemistry and biological importance of biological macromolecules.	**M**	**H**		**L**							
			CLO 03: To acquire knowledge and employability in qualitative and quantitative estimation of the biological macromolecules.		**H**		**M**	**L**						
			CLO 04: To know the interpretation of data emanating from a Clinical Test Lab, this will equip our students with better employable opportunities			**H**		**M**			**L**			
			CLO 05: To knowhow physiological conditions influence the structures and re-activities of biomolecules.	**L**		**H**		**M**						

			CLO 06: To understand the basic principles of protein and polysaccharide structure.	**L**		**H**		**M**						
17.	Pathophysiology –Theory	BP204T	**CLO 01:** Describe the etiology and pathogenesis of the selected disease states			**H**		**L**						
			CLO 02: Knowledge of signs and symptoms of the diseases	**L**		**H**		**M**						
			CLO 03: Identify the complications of the diseases.	**H**			**M**		**L**					
			CLO 04: Know most commonly encountered path physiological state (s) and/or disease mechanism(s), as well as any clinical testing requirements and it would convert our students better employable assets.				**H**		**M**				**L**	

			CLO 05: To understand Various disease of bones and joints.	**H**										
18.	Computer Applications in Pharmacy – Theory	BP205T	**CLO 01:** Apply the knowledge and skills of mathematics and computing fundamentals to pharmaceutical applications for any given requirement	**M**				**L**						**H**
			CLO 02: Design and develop solutions to analyze pharmaceutical problems using computers.		**H**			**M**					**L**	
			CLO 03: Integrate and apply efficiently the Contemporary IT tools to all Pharmaceutical related activities.	**H**				**L**						**M**
			CLO 04: Solve and work with a professional context pertaining to ethics, social, cultural and regulations with regard					**H**				**L**		**M**

			to Pharmacy.											
			CLO 05: understand equal or ahead with existing market contestants in this fast pace modern digitalized scientific environment.	**H**				**L**						**M**
19.	Environmental sciences–Theory	BP206T	**CLO 01:** This program will create awareness about environmental problems, develop an attitude towards of concern for the environment.			**H**				**M**			**L**	
			CLO 02: Learn about concept of ecosystem its Structure and functions.			**H**				**M**			**L**	
			CLO 03: To understand the concept of ecosystems	**M**				**L**						**H**
			CLO 04: To gain knowledge about environmental pollution		**H**			**M**					**L**	
			CLO 05: To gain knowledge about environmental pollution	**H**				**L**						**M**

			CLO 06: To gain knowledge about combination of environment and become entrepreneur.					**H**				**L**		**M**
20.	Human Anatomy and Physiology II –Practical	BP207P	**CLO 01:**Understand the construction, working, care and handling of instruments, glassware's and equipment's required for practical for developing skills.	**H**	**M**								**L**	
			CLO 02: Knowledge of mechanism of Differential Blood Cell Count and Reticulocyte Count of Blood sample.	**H**	**M**	**L**								
			CLO 03: Demonstration of human axial and appendicular skeleton system with the help of bones.	**H**	**L**	**M**								

			CLO 04: Knowledge of construction and working of Spirometer for the measurement of lung volume and capacities.	**H**	**M**				**L**					
			CLO 05: Study of various family planning devices.				**H**			**L**		**M**		
21.	Pharmaceutical Organic Chemistry I– Practical	BP208P	**CLO 01:** Explain correct use of various equipment's & Safety measures in Pharmaceutical Chemistry laboratory.	**H**		**M**				**L**				
			CLO 02: Develop skills by calibrating thermometer & understand the simple laboratory techniques.	**H**	**M**			**L**						
			CLO 03: Understand the significance and able to analyze organic compounds qualitatively, synthesis of derivatives.	**M**	**H**			**L**						

			CLO 04: Understand the synthesis of different organic compounds along with reaction & mechanism.	**M**	**H**			**L**						
			CLO 05: prepare suitable solid derivatives from organic compounds	**M**	**H**			**L**						
22.	Biochemistry – Practical	BP209 P	**CLO 01:** Detect and identify proteins, amino acids and carbohydrates by various qualitative as well as quantitative tests.	**H**	**M**			**L**						
			CLO 02: Separate, identify and characterize proteins from various samples like egg, milk, etc and understand principle and develop skills behind the technique.	**H**	**M**			**L**						

			CLO 03: Isolate of starch from potato and understand techniques as well as mechanism involved.	**H**				**M**			**L**			
			CLO 04: Estimate quantity of as corbicacidina given sample.		**H**		**L**				**M**			
			CLO 05: Demonstrate action of salivary amylase on starch.	**H**				**L**				**M**		
23.	Computer Applications in Pharmacy – Practical	BP210P	**CLO 01:** Apply the knowledge of mathematics and computing fundamentals to pharmaceutical applications for any given requirement											
					H			**L**		**M**				
			CLO 02: Design and develop solutions to analyze pharmaceutical problems using computers skills			**L**			**M**					**H**

			CLO 03: Integrate and apply efficiently the contemporary IT tools to all Pharmaceutical related activities	**H**				**M**	**L**					
			CLO 04: Solve and work with a professional context pertaining to ethics, social, cultural and regulations with regard to Pharmacy		**H**			**M**			**L**			
			CLO 05: create and work with MS access	**H**				**M**	**L**					
24.	Pharmaceutical Organic Chemistry II – Theory	BP301T	**CLO 01:** Basic knowledge regarding general methods of preparation of organic compounds.	**H**			**L**					**M**		
			CLO 02: Understand the reactions of some organic compounds.	**H**				**M**				**L**		
			CLO 03: To understand Reactivity of organic compounds.		**H**			**M**			**L**			

			CLO 04: Special emphasis on mechanisms and orientation of chemical reactions		**H**			**M**				**L**		
			CLO 05: To acquire knowledge and develop skills in heterocyclic ccompounds	**M**				**L**			**H**			
			CLO 06: To acquire knowledge and develop skills about the electrophilic and nucleophilic reactions.	**H**				**L**				**M**		
	Physical	BPT302T	**CLO 01:**State the physicochemical properties of drug molecules, pH, and solubility	**H**				**L**			**M**			
			CLO 02: Explain the role of surfactants ,interfacial Phenomenon and thermodynamics	**L**				**M**			**H**			
			CLO 03: Describe the flow behavior of fluids and concept of	**H**				**M**				**L**		

25.	Pharmaceutics I – Theory		complexation											
			CLO 04: Analyze the chemical stability tests of various drug products		**H**				**M**				**L**	
			CLO 05: Understand the physical properties of solutions, buffers, isotonicity, disperse systems and rheology.	**H**				**M**			**L**			
			CLO 06: Understand of physicochemical properties of drugs including solubility, distribution ,adsorption, and stability.	**H**			**M**			**L**				
			CLO 07: Have basic knowledge of pharmaceutical suspensions and colloids.	**H**			**M**				**L**			
			CLO 08: Have basic understanding of the pharmaceutical applications of various physical and chemical	**H**			**M**			**L**				

			properties of system which will enhance the employability to work in pharma sector											
			CLO 09: Principles such as lyophilization, aerosols, condensed systems, and phase diagram.	**H**			**M**			**L**				
26.	Pharmaceutical Microbiology – Theory	BP303T	**CLO 01:** Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology.		**H**		**M**			**L**				
			CLO 02: Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical	**H**			**L**			**M**				

			methods, including accurately reporting observations and analysis.											
			CLO 03: Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.	**H**			**M**				**L**			
			CLO 04: Students will demonstrate isolation of and identification of microbes.	**H**				**M**					**L**	
			CLO 05: Students can able to design microbiology laboratory considering all the aspects of safety	**H**				**M**				**L**		
			CLO 06: Students will acquire knowledge about validating the Microbiological equipment and reporting the observations	**H**	**M**					**L**				

27.	Pharmaceutical Engineering – Theory	BP304T	**CLO 01:** To know various unit operations and understand the basic concept of industrial entrepreneurship.			**H**			**M**				**L**	
			CLO 02: To underst and the material handling techniques.	**H**			**M**				**L**			
			CLO 03: To perform various processes involved in pharmaceutical manufacturing process.	**H**		**M**			**L**					
			CLO 04: To carryout various test to prevent Environmental pollution.	**H**		**M**		**L**						
			CLO 05: To appreciate and comprehend significance of plant layout design for optimum	**H**			**M**				**L**			
			CLO 06: Use of resources.	**H**				**L**					**M**	

			CLO 07: To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries	**H**			**M**				**L**			
28.	Pharmaceutical Organic Chemistry II – Practical	BP305P	**CLO 01:** Explain and understand the principal behind various ualitative tests and analyze the given unknown organic compound having different functional groups.	**H**				**M**				**L**		
			CLO 02: Explain and understand the principal, reaction mechanism and illustrate application of every experiment in the pharmacy.	**H**		**M**			**L**					

			CLO 03: Understand, apply and develop skills in various laboratory techniques for the synthesis of organic compounds, various techniques of purification of the synthesized compounds using Precipitation or recrystallization.	**H**				**L**			**M**			
			CLO 04: prepare compounds of different substances	**H**				**M**				**L**		
			CLO 05: analyze reactions performed while preparing compounds	**H**		**M**			**L**					
29.	Physical Pharmaceutics I – Practical	BP306P	**CLO 01:** Explain formulation, evaluation and labeling of aromatic water, glycerides, syrups, elixirs and powder preparations.	**H**			**L**			**M**				

			CLO 02: Develop skills in performing pharmaceutical calculations to determine evaluation parameters like density, viscosity, specific gravity, angle of repose, Carr's index, Hausner ratio of preparations.	**H**			**L**					**M**		
			CLO 03: Describe use of ingredients in formulation and category of formulation.	**H**				**L**				**M**		
			CLO 04: Compare various monophasic preparations depending upon their formulation.	**H**			**M**			**L**				
			CLO 05: Selection of suitable packaging material (container-Closure) for the preparation.	**H**			**L**			**M**				

30.	Pharmaceutical Microbiology – Practical	BP307P	**CLO 01:** Know the principle, construction and working of various instruments and perform their operations and Skill to handle microscope for observation Of microbes.	**H**		**L**			**M**					
			CLO 02: Learn and develop skills on how to prepare and sterilize nutrient broth, nutrientagar, slants, stabs and plates and adopt the skills required for maintaining strictly aseptic condition & handling inoculating loop, its sterilization and Inoculation procedure.	**H**			**L**				**M**			
			CLO 03: Skill of Isolating microorganism by streak plate technique & count them by pour plate	**H**			**L**				**M**			

			technique.											
			CLO 04: Adopt the technique involved to see motility of bactericide. hanging drop technique.		**H**			**M**				**L**		
			CLO 05: Develop skill to execute morphology of bacteria by simple staining, negative staining & gram staining	**H**	**M**				**L**					
			CLO 06: Understand the direction culation method To do sterility testing of WFI by	**H**					**M**			**L**		
			CLO 07: Able to perform the broth dilution method to determine minimum in hibitory concentration and learn how to perform Assay of antibiotic.	**H**		**M**			**L**					

31.	Pharmaceutical Engineering – Practical	BP308P	**CLO 01:** To know various unit operation used in Pharmaceutical industries.	**H**			**L**				**M**			
			CLO 02: To understand develop skills in the material handling techniques.	**H**			**M**				**L**			
			CLO 03: To perform various processes involved in pharmaceutical manufacturing process.	**H**		**M**				**L**				
			CLO 04: To carryout various test to prevent environmental pollution.		**H**			**M**					**L**	
			CLO 05: To appreciate and comprehend significance of Plant layout design for optimum use of resources.	**H**			**L**			**M**				
			CLO 06: To appreciate the various preventive methods used for corrosion control in	**H**			**M**				**L**			

			Pharmaceutical industries											
32.	Pharmaceutical Organic Chemistry III– Theory	BP401T	**CLO 01:**To acquire the knowledge and understanding of the basic experimental principles of Heterocyclic chemistry.	**H**				**L**					**M**	
			CLO 02: To draw the structures and synthesize simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.	**H**			**M**			**L**				
			CLO 03: To describe detailed mechanisms for common naming reactions.	**H**			**M**				**L**			
			CLO 04: To be able to run experimental techniques, procedures and safe laboratory practices for		**H**			**M**				**L**		

			developing entrepreneurship qualities											
			CLO 05: Stereo-chemical features including conformation and stereoelectronic effects; Geometrical isomers	**H**				**L**			**M**			
33.	Medicinal Chemistry I– Theory	BP402T	**CLO 01:** Helps in correlating between pharmacology of a disease and its mitigation or cure.	**H**		**M**		**L**						
			CLO 02: To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs		**H**				**M**				**L**	
			CLO 03: To know the structural activity relationship of different Class of drugs.	**H**		**M**			**L**					
			CLO 04: Well acquainted with the synthesis of some		**H**			**M**				**L**		

			important class of drugs.											
			CLO 05: Knowledge and skill about the mechanism pathways of different class of medicinal compounds.	**H**			**M**				**L**			
			CLO 06: To understand the chemistry of drugs with respect to their pharmacological activity.	**H**			**L**				**M**			
34.	Physical Pharmaceutics –Theory	BP403T	**CLO 01:** State the physicochemical properties of drug molecules, pH, and solubility		**H**				**M**					**L**
			CLO 02: Explain the role of surfactants, interfacial phenomenon and thermodynamics		**H**			**M**			**L**			
			CLO 03: Describe the flow behavior of fluids and concept of complexation		**H**				**M**				**L**	

			CLO 04: Analyze the chemical stability tests of various drug products		**H**				**L**				**M**	
			CLO 05: Understand the physical properties of solutions, buffers, Isotonicity disperse systems and rheology.		**H**			**M**					**L**	
			CLO 06: Understand of physicochemical properties of drugs including solubility, distribution, adsorption, and stability.		**H**		**M**		**L**					
			CLO 07: Have basic skills and knowledge of pharmaceutical suspensions and colloids		**H**		**M**		**L**					
			CLO 08: Have basic understanding of the pharmaceutical applications of various physical		**H**			**M**				**L**		

			CLO 09: Principles such as lyophilization, aerosols, condensed systems, and phase diagram.		**H**			**L**			**M**			
35.	Pharmacology I– Theory	BP404T	**CLO 01:** Students will understand the pharmacological actions of different categories of drugs		**H**			**M**				**L**		
			CLO 02: Students will study in detailed about mechanism of drug action at organ system/subcellular/macro molecular levels		**H**			**M**			**L**			
			CLO 03: Students will understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases.		**H**			**M**			**L**			

			CLO 04: Students will observe the effect of drugs on animals by simulated experiments		**M**		**H**			**L**				
			CLO 05: Students will get an idea and skills about correlation of pharmacology with other biomedical sciences.		**H**			**M**			**L**			
			CLO 06: Students will understand the signal transduction mechanism of various receptors		**H**		**M**	**L**						
	Pharmacognosy and	BP405T	**CLO 01:** Herbs,and their Science.		**H**		**M**		**L**					
			CLO 02: Classification of Medicinal Plants, Phytochemistry, Carbohydrates, Lipids		**H**		**L**		**M**					
			CLO 03: Terpenes, Polyphenols, Alkaloids, Pharmacology, Toxicity, Formulation and Preparations of Herbal Medicines.			**H**		**L**		**M**				

36.	Phytochemistry I–Theory		**CLO 04:** How herbs influence our physiology and can be helpful against several disorders.		**H**			**M**			**L**			
			CLO 05: Relations between Phyto-therapy and the Elderly, Phytotherapy and Children, Understanding Herbal Action, and Understanding the Material Medica for skill development and make them entrepreneur.		**H**			**L**			**M**			
			CLO 06: The recognition of medicinal plants, identification of Adulteration and Contamination.	**H**			**M**			**L**				
			CLO 07: Ethnobotany & Ethnopharmacology in drug discovery process.	**H**			**L**			**M**				
			CLO 08: DNA Finger Printing.		**H**			**L**		**M**				

37.	Medicinal Chemistry I– Practical	BP406P	**CLO 01:** Helps in correlating between pharmacology of a disease and its mitigation or cure.	**H**			**M**			**L**				
			CLO 02: To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs	**H**		**L**		**M**						
			CLO 03: To know the structural activity Relationship of different class of drugs.	**M**		**H**		**L**						
			CLO 04: Well acquainted with the synthesis of some important class of drugs.	**M**		**H**			**L**					
			CLO 05: Knowledge about the mechanism pathways of different class of medicinal compounds.	**H**		**M**			**L**					
			CLO 06: To understand the chemistry of drugs with respect to their	**M**		**H**		**L**						

			Pharmacological activity.											
38.	Physical Pharmaceutics II –Practical	BP407P	**CLO 01:** Develop practical skill by evaluating surface tension, viscosity, specific surface area, particle size distribution of given material.	**M**		**L**			**H**					
			CLO 02: Calculate Cloud point, critical micelle Concentration and HLB Value of given surfactant.	**H**			**L**			**M**				
			CLO 03: Calculate energy of activation of acid hydrolysis, order of given reaction, relative strength Of two acids	**L**		**M**		**H**						
			CLO 04: Find outcome position of binary mixture by	**H**		**L**		**M**						

			viscosity method.										
			CLO 05: understand an accelerated stability studies	**L**		**M**		**H**					
39.	Pharmacology I– Practical	BP408P	**CLO 01:**Students will understand the pharmacological actions of different categories of Drugs		**H**				**M**				**L**
			CLO 02: Students will study in detailed about mechanism of drug action at organ system/sub cellular/ macro molecular levels.		**H**		**M**			**L**			
			CLO 03: Students will understand the application of basic pharmacological knowledge and develop skills in the prevention and treatment Of various diseases.		**H**		**M**			**L**			
			CLO 04: They will		**M**			**L**			**M**		

			observe the effect of drugs on animals by simulated experiments											
			CLO 05: They will get an idea about correlation of pharmacology with other bio medical sciences.	**H**		**L**				**M**				
			CLO 06: Understanding of the signal transduction mechanism of Various receptors		**H**		**L**			**M**				
40.	Pharmacognosy and Phytochemistry I –Practical	BP409P	**CLO 01:** Understand and develop skills in the evolutionary significance of alkaloids from plants &other organisms & reduce their significance as medicinal molecules.		**H**					**M**				
			CLO 02: Explain the classification, source, name, chemical structures of alkaloids,		**H**		**L**			**M**				

			extraction, qualitative & quantitative analysis of alkaloids.											
			CLO 03: Explain the historical significance & contribution of alkaloids in modern drug discovery.		**L**		**M**		**H**					
			CLO 04: Explain the historical significance & contribution of terpenoids / resins in modern drug discovery.		**L**		**H**			**M**				
			CLO 05: analyze drugs through chemical tests		**L**		**H**			**M**				
41.	Medicinal Chemistry II – Theory	BP501T	**CLO 01:** Helps in correlating between pharmacology of a disease and its mitigation or cure.		**L**		**M**			**H**				
			CLO 02: To write the Chemical synthesis of some drugs.		**M**		**L**					**H**		

			CLO 03: To know the structural activity relationship of different class of drugs.			**H**				**L**			**M**	
			CLO 04: Knowledge about the mechanism pathways of different class of medicinal Compounds.		**H**			**L**				**M**		
			CLO 05: To acquire knowledge and skills about the chemotherapy for cancer		**H**			**L**			**M**			
			CLO 06: To understand the chemistry of drugs with respect to their pharmacological activity.		**H**			**M**					**L**	
42.	Industrial Pharmacy I– Theory	BP502T	**CLO 01:** The basic concept of Reformulation studies and study of various physical and chemical characteristics of drugs.		**M**			**H**				**L**		
			CLO 02: Various types of tablets, granulation		**H**			**M**						**L**

			and formulation methods for skill development											
			CLO 03: Various In-process quality control tests.					**H**			**M**			**L**
			CLO 04: Study of liquids oral dosage forms and Evaluation.		**H**			**M**			**L**			
			CLO 05: Study of various parenteral and ophthalmic products.		**H**			**L**			**M**			
			CLO 06: Formulation of various cosmetic products and stability studies for entrepreneurship	**H**			**M**				**L**			
43.	Pharmacology II –Theory	BP503T	**CLO 01:** Students will understand and develop skills in the mechanism of drug action and its relevance in the treatment of different diseases	**H**			**M**						**L**	

			CLO 02: Students will comprehend the principles of toxicology and treatment of various poisonings.		**H**			**M**				**L**		
			CLO 03: Students will be able to locate and isolate different organs/tissues from the laboratory animals used in pharmacological experiments		**H**			**L**				**M**		
			CLO 04: Students will study in detail about various receptor actions using isolated tissue preparation		**H**		**M**							**L**
			CLO 05: Students will understand the correlation of pharmacology with related medical sciences			**H**			**L**				**M**	
			CLO 06: Students will study about the various methods of toxicity studies and become			**H**			**L**			**M**		

			employable in different toxicological research.											
44.	Pharmacognosy and Photochemistry II–Theory	BP504T	**CLO 01:** Study of basic metabolic pathways and formation of different secondary metabolites through Shikimic acid pathway, and Amino acid pathway.			**M**		**H**					**L**	
			CLO 02: General introduction, composition, chemistry & chemical classes, bio sources, therapeutic uses and commercial applications of secondary metabolites.		**M**			**H**				**L**		
			CLO 03: Isolation, Identification and Analysis of Phytoconstituents: Terpenoids and steroids;		**M**		**H**				**L**			

			CLO 04: The biological activities of several compounds belonging to polypeptides, terpenoids and steroids; and their traditional use and application in pharmaceutical and/ or nutraceutical field for employability.		**H**		**M**		**L**					
			CLO 05: Basics of Phytochemistry.	**H**									**L**	
45.	Pharmaceutical Jurisprudence – Theory	BP505T	**CLO 01:** Know the Pharmaceutical legislations and their implications in the development and marketing skills.			**H**			**L**			**M**		
			CLO 02: Know various Indian pharmaceutical Acts, Laws and schedule		**H**			**L**			**M**			
			CLO 03: Know the regulatory authorities and agencies governing		**L**			**M**				**H**		

			the Manufacture and sale of pharmaceuticals											
			CLO 04: Know code of ethics during the Pharmaceutical practice						**H**		**M**		**L**	
			CLO 05: understand the objectives of D & C act, Pharmacy act etc.						**H**		**M**		**L**	
46.	Industrial Pharmacy I Practical	BP506P	**CLO 01:** State the correct use of various equipment in pharmaceutics laboratory relevant to Suspensions, Emulsions &semi-solids, prepare BMR.			**M**				**H**			**L**	
			CLO 02: Develop practical skills by explaining & carrying out formulation of Suspensions like Calamine lotion, Milk of Magnesia, Paracetamol Suspension, Antacid		**H**				**M**				**L**	

			Suspension & carryout Evaluation.											
			CLO 03: Formulate emulsions: Liquid paraffin oral Emulsion, Turpentine Liniment Formulation of Emulsion with HLB Consideration & evaluation.		**H**			**M**					**L**	
			CLO 04: Describe use of ingredients in formulation and categoryof Formulation.		**M**				**H**			**L**		
			CLO 05: Prepare semisolids: Pain balm, Antifungal ointment/cream, Medicated Gel Anti-acne preparation, non-staining Iodine ointment with Methyl Salicylate & evaluation.		**H**				**M**			**L**		

			CLO 06: Prepare the labels so as to suit the regulatory requirements.		**H**			**M**			**L**			
47.	Pharmacology II –Practical	BP507P	**CLO 01:** Develop skills by studying of commonly used instruments in experimental Pharmacology.		**M**		**H**			**L**				
			CLO 02: Introduction to CPCSEA guidelines and OECD guidelines.		**H**			**L**		**M**				
			CLO 03: Introduction to animal physiology with their biochemical reference values in various animal species.		**H**			**M**		**L**				
			CLO 04: Study of various routes of drug administration, anesthetics agents used to anesthetize laboratory animals and			**H**		**L**		**M**				

			Techniques of Euthanasia											
			CLO 05: Study of physiological salt solutions, drug solution and use in various animal experiments.	**M**			**H**			**L**				
			CLO 06: Study of methods for collection of blood, body fluids and urine from Experimental animals.	**H**			**L**				**M**			
			CLO 07: Record the effect of drug on Concentration Response Curves (CRC) using suitable isolated tissue preparations (Synergism and Antagonism).				**H**			**M**				
48.	Pharmacognosy and Phytochemistry II –Practical	BP508P	**CLO 01:** Demonstrate skills of plant material sectioning, staining, mounting & focusing ;decide on			**H**			**L**			**M**		

			staining reagents required for specific part of plant.											
			CLO 02: Identify the parts of plants from its Morphological & microscopical features.		**H**			**L**			**M**			
			CLO 03: Draw Morphological & microscopical diagrams & be able to label component/parts.		**L**			**M**			**H**			
			CLO 04: Develop skills by conducting extractions/ isolations & explain significance of use of various chemicals & physical conditions.		**H**			**L**					**M**	
			CLO 05: Identify unorganized crude drugs using morphological, chemical, physical & microscopical Characteristics.	**H**				**L**			**M**			

49.	Medicinal Chemistry III– Theory	BP601T	**CLO 01:** To develop an understanding of the physicochemical properties of drugs.			**H**				**M**			**L**	
			CLO 02: To understand how current drugs were developed by using pharmacophore modeling and docking technique.			**H**			**M**					**L**
			CLO 03: To acquire knowledge and skills in the chemotherapy for cancer and microbial diseases and different anti-viral agents.	**M**			**H**							
			CLO 04: To acquire knowledge about the mechanism pathways of different class of medicinal Compounds.				**H**					**M**		
			CLO 05: To have been introduced to a variety of drug classes and some pharmacological properties.		**H**			**M**			**L**			

			CLO 06: To acquire knowledge on thrust areas for further research.				**H**			**M**				
50.	Pharmacology III –Theory	BP602T	**CLO 01:** Elaborate on mechanism of drug action and its relevance in the treatment of different Infectious diseases			**H**			**L**			**M**		
			CLO 02: They comprehended the principles of toxicology and skilled in the treatment of various poisoning symptoms			**H**			**M**				**L**	
			CLO 03: They came across the methods of toxicity studies		**H**		**M**		**L**					
			CLO 04: They studied about symptoms of several poisonings		**M**		**L**			**M**				
			CLO 05: They studied about treatment of several poisonings			**H**		**L**						

			CLO 06: Students understood the toxicity Profile of each drugs			**H**			**L**			**M**		
51.	Herbal Drug Technology – Theory	BP603T	**CLO 01:** gain knowledge of the basic and applied know-how and professional skills in Herbal drug Science and Technology and the necessary training for admission to the postgraduate courses in this field.		**L**			**M**						

			CLO 02: acquire operative knowledge and able to carryout technical and management tasks and professional activities in the areas of transformation of medicinal herbs, management of the quality of the processes, marketing of medicinal plants and derivatives for use in herbal, food and cosmetic products, Guaranteeing conformity with the national and EU laws inforce.			**M**			**H**			**L**		
			CLO 03: acquired the recognition, collection and preservation of medicinal plants. Analyses and dosage of active ingredients. The		**H**			**M**				**L**		

			biological effects of medicinal plants. The toxicological aspects of active ingredients and finished products.											
			CLO 04: The study, design, management, control and conduction of the processing systems of medicinal plants and derivatives.		**M**			**H**						
			CLO 05: Manage quality of medicinal plant products and derivatives.		**H**				**M**			**L**		
			CLO 06: study medicinal plants and derivatives as health Products, including the food		**H**			**M**			**L**			
			CLO 01: Understand the concept and skills of ADME of drug in human body.		**H**			**M**		**L**				

52.	Biopharmaceutics and Pharmacokinetics –Theory	BP604T	**CLO 02:** Determine the various pharmacokinetic parameters from either plasma concentration or urinary excretion data for drug			**H**		**M**				**L**		
			CLO 03: Apply the various regulations related to developing BA-BE study protocol for the new drug molecule.		**H**				**M**					
			CLO 04: study the concept of pharmacokinetics parameters		**H**			**M**		**L**				
			CLO 05: understand the basics of multi compartment model			**H**		**M**				**L**		
53.	Pharmaceutical Biotechnology – Theory	BP605T	**CLO01:** Students will understand the various Techniques used in modern biotechnology.		**H**			**M**			**L**			

			CLO 02: Students can design research strategy with step-by-step instructions to address a Research problem		**H**		**M**		**L**					
			CLO 03: Students can able to provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic		**M**			**H**						
			CLO 04: Students can explain the concept and application of monoclonal antibody technology for employability		**L**			**H**			**M**			

			CLO 05: Students can demonstrate and Provide examples on how to use microbes and mammalian cells for the production of pharmaceutical products		**H**				**M**		**L**			
			CLO 06: Students can able to explain the general principles of generating transgenic plants, animals And microbes			**H**		**M**		**L**				
54.	Quality Assurance –Theory	BP606T	**CLO 01:** Students will understand the importance of quality in pharmaceutical products.		**H**		**M**		**L**					
			CLO 02: Students will explore the importance of Good practices such as GMP, GLP ect.			**L**		**M**		**H**				
			CLO 03: Students will explore the factors affecting the quality of pharmaceutical			**M**		**L**		**H**				

			products.											
			CLO 04: Students will be able to understand the regulatory aspects of pharmaceutical industries		**H**		**M**		**L**					
			CLO 05: Students will be able to learn the process involved in manufacturing of pharmaceuticals different section/department and activity for entrepreneaurship.		**H**					**M**				
			CLO 06: Students will study various documentation processes		**H**			**M**			**L**			
55.	Medicinal Chemistry III–	BP607P	**CLO 01:** Understand how to make correct use of various equipments & take safety measures while working in medicinal chemistry		**M**		**L**		**H**					

	Practical		Laboratory to get employable in pharmaceutical industry.											
			CLO 02: Develop skills involved in thin layer chromatography techniques and purification of synthesized compounds by Column chromatography.		**H**			**M**						
			CLO 03: Synthesize, Re-crystallize and understand reaction mechanisms involved in synthesis of medicinally important organic Compounds.	**H**			**M**			**L**				
			CLO 04: To interpret the spectral characterizations made by IR and 1H-NMRs Of synthesized compounds.		**H**				**M**			**L**		

			CLO 05: Draw structures and reactions using softwares (Chemdraw)	**H**			**M**			**L**				
56.	Pharmacology III –Practical	BP608P	**CLO 01:** Understand the OECD guidelines (425) to develop skills for acute oral toxicity.		**H**			**M**		**L**				
			CLO 02: Introduction to principles of bioassay, its types including advantages and disadvantages		**H**				**M**			**L**		
			CLO 03: Determination of unknown concentration of Acetylcholine and Histamine using suitable isolated tissue preparations (Matching bioassay method)		**H**		**M**			**L**				
			CLO 04: Determination of unknown concentration of Acetylcholine and Histamine using suitable		**H**			**M**			**L**			

			isolated tissue preparations (Bracketing bioassay method)											
			CLO 05: Determination of unknown concentration of Acetylcholine and Histamine using suitable isolated tissue preparations(Interpolation bioassay method)	**M**				**H**						
			CLO 06: Study the analgesic activity by using Eddy's hot plate Analgesiometer in Mice.		**H**			**M**				**L**		
57.	Herbal Drug Technology – Practical	BP609P	**CLO 01:** Prepare, label& Evaluate herbal/ TSM formulations.		**H**				**L**			**M**		
			CLO 02: Evaluate marketed cosmetic & nutraceutical Formulations for developing skills for		**H**			**M**		**L**				

			entrepreneurship.											
			CLO 03: Conduct pre-formulation parameters & Understand underlying rationale		**H**		**M**				**L**			
			CLO 04: Conduct in vitro assays for correlation with Biological efficacy		**H**			**L**				**M**		
			CLO 05: analyze the monographs herbal drugs from recent Pharmacopoeias		**H**			**M**		**L**				
58.	Instrumental Methods of Analysis–Theory	BP701T	**CLO 01:** The basic theoretical knowledge and develop skills of the instrumentation techniques available.		**H**			**M**						
			CLO 02: Theoretically understand the aspects of separation for multi components			**H**		**M**			**L**			

			CLO 03: Practical skills for the analysis of drugs and excipients using various instrumentation techniques.			**H**		**L**			**M**			
			CLO 04: To make accurate analysis and report the results in defined formats.	**H**		**M**			**L**					
			CLO 05: To learn documentation and express the observations with clarity.	**H**		**L**		**M**						
			CLO 06: To understand the professional and safety responsibilities for working in the analysis laboratory.	**H**					**M**					
59.	Industrial Pharmacy II – Theory	BP702T	**CLO 01:** Understand pilot plant technique, its significance and basic requirements.		**H**		**M**			**L**				
			CLO 02: Understand the pilot plant and scale up techniques for various dosage forms in		**H**		**L**		**M**					

			pharmaceutical industry.											
			CLO 03: Understand the concept of technology transfer and its utilization in commercial batch for employability		**H**					**M**				
			CLO 04: Understand the regulatory requirements for drug product approvals and marketing.		**H**		**L**				**M**			
			CLO 05: Role of quality management system and its certification.		**H**			**L**			**M**			
			CLO 06: Study of various Indian regulatory commissions.	**M**			**H**					**L**		
60.	Pharmacy Practice– Theory	BP 703T	**CLO 01:** Students will demonstrate knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative aspects,			**L**			**H**			**M**		

			health policy and legal issues in the practice of pharmacy.											
			CLO 02: Students will use knowledge of drug distribution methods in hospital and apply it in the practice of pharmacy.		**H**		**M**			**L**				
			CLO 03: Students will effectively apply principles of drug store management and inventory control to medication use.		**H**			**L**			**M**			
			CLO 04: Students will provide patient-centered care to diverse patients using the best available evidence and monitor drug therapy of patient through medication chart review, obtain medication history interview and counsel the patients, identify drug related problems.	**M**			**H**					**L**		

			CLO 05: Students will engage in innovative activities by making use of the knowledge of clinical trials which will help them to become an entrepreneur.		**H**		**M**			**L**				
			CLO 06: Students will exhibit professional ethics by producing safe and appropriate medication use throughout society		**H**			**M**		**L**				
61.	Novel Drug Delivery System –Theory	BP704T	**CLO 01:** analyze various approaches for development of skills on novel drug delivery systems.		**H**		**L**		**M**					
			CLO 02: understand the criteria for selection of drugs and polymers for the development of NTDS		**M**			**L**		**H**				
			CLO 03: formulate and evaluate novel drug		**H**		**M**							

			delivery systems											
			CLO 04: apply approaches to design-controlled release formulations based on diffusion		**H**					**M**				
			CLO 05: apply approaches for transdermal drug delivery systems and permeation across the skin.		**H**		**L**				**M**			
62.	Instrumental Methods of Analysis – Practical	BP705P	**CLO 01:** to understand the interaction of matter with electromagnetic radiations.		**H**			**M**		**L**				
			CLO 02: A pplications of e lectromagnetic radiations in Drug analysis		**H**			**M**				**L**		
			CLO 03: Understand and develop skills on the chromatographic separation and analysis of drugs and perform quantitative &			**H**				**L**			**M**	

			qualitative analysis of Drugs using various analytical instruments.											
			CLO 04: determine the sodium and potassium by flame photometry		**H**			**M**		**L**				
			CLO 05: perform separation of sugar and amino acids by chromatographic technique.			**H**				**L**			**M**	
63.	Pharmacy Practice (Practice School)	BP706PS	**CLO 01:** prepare and formulated different dosage forms		**H**				**M**					
			CLO 02: sterilize formulated dosage forms		**H**		**M**						**L**	
			CLO 03: perform identification test of tincture of iodine		**H**		**M**			**L**				
			CLO 04: understand the clinical case studies		**M**		**H**			**L**				

			CLO 05: study the drug information based on industrial application for inculcating employability skills in pharmaceutical industries	**H**			**L**				**M**			
64.	Biostatistics and Research Methodology	BP801T	**CLO 01:** Students will learn and develop skills on how to create frequency distribution, apply correlation and regression tools on Pharmaceutical problems.							**M**				**H**
			CLO 02: Students will be able to carry out different tests on the observations from clinical trials and surveys.		**H**			**M**			**L**			
			CLO 03: Students will learn about factorial designs and Blocking and confounding system for Two- level		**H**		**M**		**L**					

			factorials.											
			CLO 04: Design and Analysis of experiments by Response Surface methodology.		**H**		**M**						**L**	
			CLO 05: apply hypothesis testing in Simple and Multiple regression models		**M**		**H**			**L**				
65.	Social and Preventive Pharmacy	BP802T	**CLO 01:** Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.		**H**		**M**			**L**				
			CLO 02: Have a critical way of thinking based on current healthcare development to become an entrepreneur		**M**		**H**			**L**				

			CLO 03: Evaluate alternative ways of solving problems related to health and pharmaceutical issues.	**H**			**L**				**M**			
			CLO 04: Study of National health intervention programmed for mother and child.		**L**		**M**			**L**				
			CLO 05: Study of community services in rural, urban and school health.		**M**			**H**			**L**			
66.	Pharm. Marketing Management-Theory	BP803ET	**CLO 01:** Understand the concept of marketing, selling and marketing environment	**H**			**M**				**L**			
			CLO 02: Analyze the competitive and consumer buying behavior.	**H**		**M**				**L**				
			CLO 03: Study various qualitative and quantitative aspects related to size and		**H**			**M**					**L**	

			composition of market.											
			CLO 04: Study various pharmaceutical marketing channels to become an entrepreneaur.	**H**			**L**			**M**				
			CLO 05: Vertical and Horizontal Marketing concepts.			**H**		**L**					**M**	
67.	Pharmaceutical Regulatory Science- Theory	P804ET	**CLO 01:** Understand stages of drug discovery, development, preclinical, non-clinical and clinical studies to get an employability		**M**		**H**			**L**				
			CLO 02: Develop generic drug product development.	**H**			**L**				**M**			
			CLO 03: perform regulatory approval processes.		**L**		**M**			**L**				
			CLO 04: learn and study the procedure for export of pharmaceutical products and Registration of Indian drug product in		**M**			**H**			**L**			

			overseas market.											
			CLO 05: Develop skills in creating clinical trial protocols and guidelines of regulatory commissions.		**H**		**M**			**L**				
68.	Pharmacovigilance- Theory	BP805T	**CLO 01:** analyze the importance of safety monitoring of Medicine and Pharmacovigilance Program of India.	**H**			**L**					**M**		
			CLO 02: Develop skills and methods in Causality assessment; Severity and seriousness assessment.	**H**				**M**				**L**		
			CLO 03: learn WHO adverse reaction terminologies.		**H**			**M**			**L**			
			CLO 04: establish pharmacovigilance programme in a hospital.		**H**			**M**				**L**		
			CLO 05: understand ICH Guidelines for Pharmacovigilance.	**M**				**L**			**H**			
			CLO 06: understand Drug safety evaluation in	**H**				**L**				**M**		

			special population.											
69.	Quality Control and Standardization of Herbals- Theory	BP806ET	**CLO 01:** Understand skills related to various basic tests for drugs, Medicinal plants materials and dosage forms.	**H**			**M**				**L**			
			CLO 02: learn and understand the quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine.	**H**				**M**					**L**	
			CLO 03: learn EU and ICH guidelines for quality control of herbal drugs.	**H**				**M**				**L**		
			CLO 04: understand the regulatory requirements for herbal medicines	**H**	**M**					**L**				
			CLO 05: study WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance	**H**			**L**			**M**				

			systems											
70.	Computer Aided Drug Design-Theory	BP807ET	**CLO 01:** understand the stages of drug discovery and development for entrepreneaurship.		**H**			**M**				**L**		
			CLO 02: study the history and development of QSAR	**M**				**L**			**H**			
			CLO 03: learn and understand the molecular modeling and virtual screening techniques	**H**				**L**				**M**		
			CLO 04: understand the informatics and methods in drug design	**H**			**M**				**L**			
			CLO 05: perform and apply molecular docking techniques.	**H**				**M**					**L**	
71.	Cell and Molecular Biology- Elective Subject	BP808ET	**CLO 01:** Students will learn theoretical basis and applications of cell and molecular biology.		**H**			**M**					**L**	
			CLO 02: Students will study the flow of	**H**			**L**			**M**				

			molecular information.											
			CLO 03: Students will understand and learn the structure and functions of proteins and regularities in proteins.			**H**		**L**						**M**	
			CLO 04: Students will remember the Genetics and cell signaling.		**M**		**H**			**L**					
			CLO 05: develop skills in positive control and significance of protein synthesis	**M**		**H**			**L**						
72.	Cosmetic Science-Theory	BP809ET	**CLO 01:** Understand principles of formulation and building blocks of skin care products.			**M**			**H**						
			CLO 02: learn various oily and dry skin, causes leading to dry skin, skin moisturization.		**H**			**M**							
			CLO 03: Understands principle of cosmetic evaluation and get skilled in various cosmetology techniques		**H**		**L**						**M**		

			CLO 04: study various principles of cosmetic evaluation	**M**		**H**			**L**					
			CLO 05: understand building blocks for skin care products.	**M**		**H**			**L**					
73.	Experimental Pharmacology-Theory	BP810ET	**CLO 01:** Students will Understands CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals.			**H**		**L**					**M**	
			CLO 02: Students will study various preclinical screening models.		**M**		**H**			**L**				
			CLO 03: Students will develop skills in screening preclinical models for ANS activity, CVS activity.			**M**			**H**					
			CLO 04: Students will gain knowledge and study research methodology and biostatics in the		**H**			**M**						

			Selection of research topic, review of literature, research hypothesis and study design											
			CLO 05: interpretate pre-clinical data analysis using Students 't'test; and One-way ANOVA.		**H**				**M**			**L**		
74.	Advanced Instrumentation Techniques	BP811ET	**CLO 01:** learn basic theoretical knowledge of NMR and mass spectrometry.		**H**				**M**			**L**		
			CLO 02: theoretically understand the aspects thermal methods of analysis and X-ray diffraction.		**H**					**M**				
			CLO 03: develop practical skills for the analysis of drugs and excipients using various instrumentation techniques.		**H**			**M**					**L**	
			CLO 04: make accurate analysis and report the		**M**		**H**			**L**				

			results in defined formats.											
			CLO 05: learn calibration and validation-as per ICH and USFDA guidelines			**M**			**H**					
			CLO 06: understand the extraction techniques and hyphenated techniques.		**H**			**M**						
75.	Dietary Supplements and Nutraceuticals	BP812ET	**CLO 01:** Understand the role of Functional foods, Nutraceuticals and Dietary supplements.		**H**				**M**			**L**		
			CLO 02: Understand the chemical nature and medicinal benefits of Phytochemicals as nutraceuticals to become an entrepreneur		**M**		**H**			**L**				
			CLO 03: understand the role and damaging reactions of free radicals.			**M**			**H**					
			CLO 04: understand											

			the role of free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage.		**H**			**M**						
			CLO 05: analyze the effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.		**H**				**M**			**L**		
76.	Project Work	BP813PW	**CLO 01:** gain knowledge regarding regulations related to pre-formulation, formulation development, stability assessment, manufacturing and quality control testing.			**M**								**H**

			CLO 02: study Pharmaceutical Excipients in pharmaceutical product development with a special reference to Tablet and capsule excipients, directly compressible vehicles, Coat materials, Excipients in parenteral and aerosols products		**H**			**M**					**L**	
			CLO 03: evaluate selection and quality control testing of packaging materials for pharmaceutical product development-regulatory considerations and understand the basic concept of industrial entreprenurship		**M**		**H**			**L**				

			CLO 04: develop skills by performing quality control testing of manufactured products			**M**			**H**					
			CLO 05: perform optimization techniques in pharmaceutical product development		**H**			**M**						