GURU KASHI UNIVERSITY

Bachelor of Pharmacy

Session: 2025-26
Department of Pharmacy

Graduate Attributes of the Programme:

Type of learning outcomes	**The Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/inter disciplinary areas of learning	Pharmacy Graduates will be competent professional pharmacist who will utilize and practice professional principles of pharmacy in self-practice, hospitals, government and non-government organizations, academics, research institutions and co-operate sector.
	Graduates will integrate knowledge of basic sciences and pharmaceuticals in order to modify treatment approaches that reflect the breadth and scope of pharmacy practice and demonstrate clinical competency in evaluation, treatment planning and implementation.
	Graduates will have leadership skills with high level of integrity for team building and also have ability to function professionally with ethical responsibility as an individual as well as in multidisciplinary team with positive attitude.
	Pharmacy Graduates will sustain continual professional development through lifelong learning activities and work for development of field that includes creation, absorption and adoption of new knowledge and tools.
	Pharmacy Graduates will have knowledge to support the pharmaceutical industries, in their economic development, legal and regulatory prospective of drug approvals at national international level and will be able to address social and economic challenges of the nation.
Generic learning outcomes	Pharmacy Graduates will have fundamental knowledge in preparing conventional as well as novel pharmaceutical dosage forms, their methods of dispensing and recent advancements made in the field of Pharmaceutical Product Development.
	The Graduates will develop an ability to design, conduct, and interpret various analytical studies/reports being used by pharmaceutical industries during drug design, formulation design, and production etc

	Pharmacy Graduates will have an understanding about different laws that govern different aspects of pharmacy that builds up their fundamental knowledge about the ethics associated with the profession of pharmacy.

Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5 :

Element of the Descriptor	**Programme learning outcomes relating to Undergraduate Certificate**
The graduates should be able to demonstrate the acquisition of:	
Domain Expertise	Apply comprehensive knowledge and basic principles of Pharmaceutical and other associated sciences.
Professional Skills	Demonstrate an ability to identify, formulate and solve complex problems of Pharmaceutical Industry, Community & Hospital Pharmacy.
Research Orientation	Apply and demonstrate their professional skills and comprehensive knowledge to carry out research in the core and applied areas of pharmaceutical sciences.
Planning Abilities	Demonstrate effective planning, delegation skills, organizational skills and resource management abilities for their effective implementation.
Critical Thinking	Utilize the principles of scientific enquiry, thinking analytically, and critically, for solving pharmaceutical problems and drawing decisions.
Modern tool usage	Apply appropriate methods, procedures, resources, and modern pharmacy-related computing tools.
Leadership and Team Work	Demonstrate leadership skills with high level of integrity and ethics to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	Communicate effectively with the professional community and with society at large; for effective and impressive representation.
Professional Ethics	Possess personal & universal values and apply ethical principles in professional and social contexts.
Social Responsibility	Apply contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
Leadership and Teamwork	Understand the impact of professional pharmacy solutions in context environment and demonstrate the knowledge for sustainable development.
Life-long learning	Recognize the need for, Self-assess and effectively

	use the feedback from others to identify learning needs to compete globally.
Credit requirements	212
Entry requirements	Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to10+2 examination by the Association of the Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics/ Biology as optional subjects individually. However the students possessing 10+2 qualification from non-formal and non-class rooms based schooling such as National Institute of Open schooling, open school systems of states etc. shall not be eligible for admission to B. Pharmacy course. Any other qualification approved by the Pharmacy council of India as equivalent to any of the above examinations.

Course Structure of the Program

Semester- I									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP101T	Human Anatomy and Physiology I	Core Course	3	1	0	4	25	75	100
BP102T	Pharmaceutical Analysis I	Core Course	3	1	0	4	25	75	100
BP103T	Pharmaceutics I	Core Course	3	1	0	4	25	75	100
BP104T	Pharmaceutical Inorganic Chemistry	Core Course	3	1	0	4	25	75	100
BP105T	Communication skills *	Ability Enhancement	2	0	0	2	15	35	50
BP106 RBT	Remedial Biology	Deficient Course (Select any one)	2	0	0	2	15	35	50
BP106 RMT	Remedial Mathematics*								
BP107P	Human Anatomy and Physiology I (Lab)	Technical Enhancemen	0	0	4	2	15	35	50
BP108P	Pharmaceutical Analysis I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP109P	Pharmaceutics I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP1110P	Pharmaceutical Inorganic Chemistry (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP111P	Communication skills– (Lab)*	Ability Enhancement	0	0	2	1	10	15	25
BP1112 RBP	Remedial Biology (Lab)*	Ability Enhancement	0	0	2	1	10	15	25
Total			32/34$/ 36#			27/29$ /30#	185/ 200$/ 210#	490/ 525$/ 540#	675/ 725$/ 750#

#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.

Semester- II									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP201T	Human Anatomy and Physiology II	Core Course	3	1	0	4	25	75	100
BP202T	Pharmaceutical Organic Chemistry-I	Core Course	3	1	0	4	25	75	100
BP203T	Biochemistry	Core Course	3	1	0	4	25	75	100
BP204T	Pathophysiology	Core Course	3	1	0	4	25	75	100
BP205T	Computer Applications in Pharmacy*	Technical Enhancement	3	0	0	3	25	50	75
BP206T	Environmental sciences *	Ability Enhancement	3	0	0	3	25	50	75
BP207P	Human Anatomy and Physiology II(Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP208P	Pharmaceutical Organic Chemistry I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP209P	Biochemistry (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP210P	Computer Applications in Pharmacy (Lab)*	Technical Enhancement	0	0	2	1	10	15	25
		Total	18	4	14	29	205	520	725

*Non University Examination (NUE)

Semester- III									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP301T	Pharmaceutical Organic Chemistry II	Core Course	3	1	0	4	25	75	100
BP302T	Physical Pharmaceutics I	Core Course	3	1	0	4	25	75	100
BP303T	Pharmaceutical Microbiology	Core Course	3	1	0	4	25	75	100
BP304T	Pharmaceutical Engineering	Core Course	3	1	0	4	25	75	100
BP305P	Pharmaceutical Organic Chemistry II (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP306P	Physical Pharmaceutics-I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP307P	Pharmaceutical Microbiology(Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP308P	Pharmaceutical Engineering (Lab)	Technical Enhancement	0	0	4	2	15	35	50
			12	4	16	24	160	440	600

Semester- IV									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP401T	Pharmaceutical Organic Chemistry III	Core Course	3	1	0	4	25	75	100
BP402T	Medicinal Chemistry- I	Core Course	3	1	0	4	25	75	100
BP403T	Physical Pharmaceutics II	Core Course	3	1	0	4	25	75	100
BP404T	Pharmacology- I	Core Course	3	1	0	4	25	75	100
BP405T	Pharmacognosy and Phytochemistry I	Core Course	3	1	0	4	25	75	100
BP406P	Medicinal Chemistry I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP407P	Physical Pharmaceutics II (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP408P	Pharmacology- I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP409P	Pharmacognosy and Phyto chemistry I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
		Total	15	5	16	28	185	515	700

Semester- V									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP501T	Medicinal Chemistry- II	Core Course	3	1	0	4	25	75	100
BP502T	Industrial Pharmacy -I	Core Course	3	1	0	4	25	75	100
BP503T	Pharmacology- II	Core Course	3	1	0	4	25	75	100
BP504T	Pharmacognosy and Phyto chemistry II	Core Course	3	1	0	4	25	75	100
BP505T	Pharmaceutical Jurisprudence	Core Course	3	1	0	4	25	75	100
BP506P	Industrial Pharmacy I (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP507P	Pharmacology II (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP508P	Pharmacognoy and Phyto-chemistry II (Lab)	Technical Enhancement	0	0	4	2	15	35	50
		Total	15	5	12	26	170	480	650

Semester- VI									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP601T	Medicinal Chemistry- III	Core Course	3	1	0	4	25	75	100
BP602T	Pharmacology III	Core Course	3	1	0	4	25	75	100
BP603T	Herbal Drug Technology	Core Course	3	1	0	4	25	75	100
BP604T	Biopharmaceutics and Pharmacokinetics	Core Course	3	1	0	4	25	75	100
BP605T	Pharmaceutical Biotechnology	Core Course	3	1	0	4	25	75	100
BP606T	Quality Assurance	Core Course	3	1	0	4	25	75	100
BP607P	Medicinal chemistry III (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP608P	Pharmacology III (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP609P	Herbal Drug Technology (Lab)	Technical Enhancement	0	0	4	2	15	35	50
		Total	18	6	12	30	195	555	750

Semester- VII									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int.**	**Ext.**	**Total Marks**
BP701T	Instrumental Methods of Analysis	Core Course	3	1	0	4	25	75	100
BP702T	Industrial Pharmacy II	Core Course	3	1	0	4	25	75	100
BP703T	Pharmacy Practice	Core Course	3	1	0	4	25	75	100
BP704T	Novel Drug Delivery System	Core Course	3	1	0	4	25	75	100
BP705P	Instrumental Methods of Analysis (Lab)	Technical Enhancement	0	0	4	2	15	35	50
BP706PS	Practice School*	Technical Enhancement	0	0	12	6	25	125	150
			12	4	16	24	140	460	600

*Non University examination(NUE)

Semester –VIII									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**	**Int**	**Ext**	**Total Marks**
BP801T	Biostatistics and ResearchMethodology	Foundation Compulsory	3	1	0	4	25	75	100
BP82T	Social and Preventive Pharmacy	Ability Enhancement	3	1	0	4	25	75	100
	Elective (Any two of the following)								
BP803ET	Pharma Marketing Management	Discipline Elective (Select any Two)	(3+3)=6	(1+1)=2	0	(4+4) = 8	25	75	100
BP804ET	Pharmaceutical Regulatory Science						25	75	100
BP805ET	Pharmacovigilance						25	75	100
BP806ET	Quality Control and Standardization of Herbals						25	75	100
BP807ET	Computer Aided Drug Design						25	75	100
BP808ET	Cell and Molecular Biology						25	75	100
BP809ET	Cosmetic Science						25	75	100
BP810ET	Experimental Pharmacology						25	75	100
BP811ET	Advanced Instrumentation Techniques						25	75	100
BP812ET	Dietary Supplements and Nutraceuticals						25	75	100
BP813PW	Project Work	Technical Enhancement	0	0	12	6	0	150	150
Total			**12**	**4**	**12**	**22**	**100**	**450**	**550**
Grand Total			**135**	**36**	**118**	**212**	**1365**	**3960**	**5325**

Total Number of Course	76
Number of Theory Course	49
Number of Practical Course	27
Total Number of Credits	**212**

Internal assessment: Continuous mode

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

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

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

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

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

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.

Academic Progression:

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

- A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of I and II semesters are successfully completed.
- A student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of I, II, III and IV semesters are successfully completed.
- A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.
- A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 26.
- A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.
- A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed.
- A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 26.
- Any student who hasgiven 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 ABshould 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 projectunder the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subject opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

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

Evaluation of Dissertation Book:

Objective(s) of the work done	15 Marks
Methodology adopted	20 Marks
Results and Discussions	20 Marks
Conclusions and Outcomes	20 Marks
Total 75 Marks	

Evaluation of Presentation:

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

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

Attendance

ACADEMIC INSTURCTIONS

A student shall have to attend 80% of the scheduled periods in each course in a semester; otherwise he / she shall not be allowed to appear in that course in the University examination and shall be detained in the course(s). The University may condone attendance shortage in special circumstances (as specified by the Guru Kashi University authorities). A student detained in the course(s) would be allowed to appear in the subsequent university examination(s) only on having completed the attendance in the program, when the program is offered in a regular semester(s) or otherwise as per the PCI guidelines.

Assessment of a course

Each course shall be assessed out of 100 marks. The distribution of these 100 marks is given in subsequent sub sections (as per PCIguidelines).

	Internal (25)			**External(75)**	**Total**
Components	**Continuous Assessment**	**MST 1**	**MST2**	**ETE**	
Weightage	10	15	15	75	100
Average Weightage	10	15		75	100

Passing Criteria

The students have to pass both in internal and external examinations. The minimum passing marks to clear in examination is 50% of the total marks as per PCI guidelines.

Note:

Lateral entry students have to appear for

- BP105T Communication Skill(Theory)
- BP111P Communication Skill(Practical)
- BP205T Computer application in Pharmacy(Theory)
- BP210P Computer application In Pharmacy (Practical) in their 3rd and 4th semester as per PCIguidelines.

SEMESTER: I

Course Title: HUMAN ANATOMY AND PHYSIOLOGY I	L	T	P	Credits
Course Code: BP101T	3	1	0	4

Total:45 Hours

Learning Outcomes

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

1	Recognize anatomical terms and characterize positions of major organsof human body systems
2	Apply medical terminology and functionality of body systems in health education and health promotion.
3	Analyze disorders of skeletal muscle, smooth muscle, cardiovascular system, lymphatic system and digestive system.
4	Evaluate Bleeding time, clotting time, Blood group of various individuals
5	Develop advanced physiological and health-related tests using their skills

Course Content

Unit I **10 Hours**

Introduction to human body

Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization

Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine

Tissue level of organization

Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10 Hours**

Integumentarysystem

Structure and functions of skin

Skeletal system

Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

Joints

Structural and functional classification, types of joints movements and its articulation

Unit III **10 Hours**

Body fluids and blood

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

Lymphatic system

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

Unit IV **08 Hours**

Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.Origin and functions of spinal and cranial nerves.

Special senses

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

Unit V **07 Hours**

Cardiovascularsystem

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee brothers Medical Publishers, NewDelhi.*
- *Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic PublishersKolkata.*

SEMESTER: I

Course Title: PHARMACEUTICAL ANALYSIS I	L	T	P	Credits
Course Code: BP102T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize qualitative, quantitative and semi-quantitative estimation.
2	Comprehend the principles of volumetric and electro chemical analysis.
3	Develop analytical skills.
4	Check the purity and strength of the drug formulations.
5	Cognize the different separation techniques and their applications in analysis of drugs

Course Content

Unit-I **10Hours**

Pharmaceutical analysis-

Definition andscope

i) Different techniques of analysis

ii) Methods of expressingconcentration

iii)Primary and secondarystandards.

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

Errors: Sources of errors, types of errors, methods of minimizing errors,accuracy, precision and significantfigures. Pharmacopoeia, Sources of impurities in medicinal agents,limittests.

Unit-II **10 Hours**

Acidbasetitration: Theoriesofacidbaseindicators, classification ofacidbasetitrationsand theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.

Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.

Unit-III **10 Hours**

Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.Basic Principles, methods and application of diazotisation titration.

UNIT-IV **08 Hours**

Redox titrations

Concepts of oxidation andreduction

Types of redox titrations (Principles andapplications)Cerimetry, Iodimetry, Iodometry,Bromatometry, Dichrometry, and Titration with potassium iodate.

Unit-V **07 Hours**

Electrochemical methods of analysis

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings (Latest Editions)

- *A.I. Vogel (1978), Text Book of Quantitative Inorganic Analysis, J.Bassett et.alLondon.*
- *Indian Pharmacopoeia(2018*

SEMESTER: I

Course Title: PHARMACEUTICS-I	L	T	P	Credits
Course Code: BP103T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	RecognizetheFormulationofdosageforms
2	Apply the methods of preparation of extracts and principle of infusion, decoction etc.
3	Analyze Resolve the problems through the application of fundamental principles of pharmaceutical metrology and conclude the decision.
4	Evaluate the Pharmacopeial standards for the preparation of various dosages forms.
5	Create the mouth washes, syrups.

Course Content:

Unit – I **10 Hours**

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

Dosage forms: Introduction to dosage forms, classification and definitions

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

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

Unit – II **10 Hour**

Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients usedinformulation of liquid dosage forms. Solubility enhancementtechniques.

Unit – III **08 Hours**

Monophasic liquids: Definitions and preparations of Gargles,

Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids:

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

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

Unit – IV **08 Hours**

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.

Pharmaceutical incompatibilities: Definition, classification,physical, chemical and therapeutic incompatibilities with examples.

Unit – V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Lachmann (2020). Theory and Practice of Industrial Pharmacy, Lea&FebigerPublisher, The University ofMichigan.*
- *Indian Pharmacopoeia (2018).*
- *British Pharmacopoeia (2019).*
- *Alfonso R. Gennaro Remington (2006). The Science and Practice of Pharmacy, Lippincott Williams, NewDelhi.*

SEMESTER: I

Course Title: Pharmaceutical InorganicChemistry	L	T	P	Credits
Course Code: BP104T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Deals with monograph of inorganic drug and pharmaceutics.
2	Recognize acid base and buffers.
3	Familiarize with a variety of inorganic drug classes
4	Clarify topical agents, gases and vapors, dental products and radio pharmaceuticals
5	Get Awareness about the sources of impurities

Course Content

Unit I **10 Hours**

Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

General methods of preparation, assay for the compounds superscripted with **asterisk (*),**properties and medicinal uses of inorganic compounds belonging to the following classes.

Unit II **10 Hours**

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

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Unit III **10 Hours**

Gastrointestinal agents

Acidifiers: Ammonium chloride* and Dil. HCl

Antacid: Ideal properties of antacids, combinations of antacids, Sodium

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture
Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin andBentonite
Antimicrobials: Mechanism, classification, Potassium permanganate, Boricacid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.

Unit IV **08 Hours**

Miscellaneous compounds

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

UNIT V **07 Hours**

Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Anand & Chatwal (2018). Inorganic Pharmaceutical Chemistry, Himalaya Publishing House.*
- *A.H. Beckett & J.B. Stenlake's (2005). Practical Pharmaceutical Chemistry Vol 1, 2. Stahlone Press of University ofLondon*
- *A.I. Vogel (1989). Text Book of Quantitative InorganicAnalysis*
- *Indian Pharmacopoeia(2018)*

SEMESTER: I

Course Title: COMMUNICATION SKILLS	L	T	P	Credits
Course Code: BP105T	2	0	0	2

Total: 30 Hours

Learning Outcomes:

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

1	Improve proof-reading skills and language awareness so that one can spot mistakes and correct their own work
2	Comprehend the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation.
3	Develop interview skills
4	Communicate effectively (Verbal and Non-Verbal)
5	Improve writing skills

Course content:

Unit – I **07 Hours**

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

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotionalbarriers

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

Unit – II **07 Hours**

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

Unit – III **07 Hours**

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

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

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

Unit –IV **05 Hours**

Interview Skills: Purpose of an interview, Do's and Dont's of an interview.

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

Unit – V **04 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Andreja. J. Ruther Ford (2011). Basic communication skills for Technology, Pearson Education.*
- *Communication skills (2011). Sanjay Kumar, Pushpalata, OxfordPress,*
- *Stephen .P. Robbins (2013).Organizational Behaviour, 1st Edition, Pearson*

SEMESTER: I

Course Title: REMEDIAL BIOLOGY	L	T	P	Credits
Course Code: BP106RBT	2	0	0	2

Total: 30 Hours

Learning Outcomes:

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

1	Recognize the basic concept of plant morphology.
2	Study the morphology of flowering plant.
3	Be familiar with Theory of evolution
4	Recognize Cell biology (Basic Nature of Plant cell and Animal cell)

Course Content

Unit I **07 Hours**

Living World:

Definition and characters of living organisms Diversity in the living worldBinomial nomenclature.Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus.

Morphology of Flowering plants

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

Unit II **07 Hours**

Body fluids and circulation

Composition of blood, blood groups, coagulation of blood Composition and functions of lymph

Human circulatory system

Structure of human heart and blood vessels Cardiac cycle, cardiac output and ECG

Digestion and Absorption

Human alimentary canal and digestive glands Role of digestive enzymesDigestion, absorption and assimilation of digested food

Breathing and respiration

Human respiratory system

Mechanism of breathing and its regulationExchange of gases, transport of gases and regulation of respiration Respiratory volumes

Unit III **07 Hours**

Modes of excretion

Human excretory system- structure and function Urine formation.Rennin angiotensin system

Neural control and coordination

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

Chemical coordination and regulation

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

Human reproduction

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

Unit IV **05 Hours**

Plants and mineral nutrition:

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

Photosynthesis

Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factorsaffecting photosynthesis.

Unit V **04 Hours**

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

Plant growth and development

Phases and rate of plant growth, Condition of growth. Introduction to plant growth regulators
Cell- The unit of life: Structure and functions of cell and cell organelles.Cell divisionTissues: Definition, types of tissues, location and functions.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *S. B. Gokhale (2008). Text book of Biology.Pragtai Books Pvt.Ltd.*
- *Dr. Thulajappa and Dr. Seetaram (2015). A Text book of Biology. CengageLearning India PrivateLtd.*

SEMESTER: I

Course Title: REMEDIAL MATHEMATICS	L	T	P	Credits
Course Code: BP106RMT	2	0	0	2

Total: 30Hours

Learning Outcomes:

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

1	Deal with introduction of partial fraction, logarithm, matrix, Calculus.
2	Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.
3	Create, use and analyze mathematical representations and mathematical relationships.
4	Communicate mathematical knowledge and understanding to help in the field of Clinical Pharmacy.

Course Content

Unit – I **06 Hours**

Partial fraction

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

Logarithms

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

Function:Real Valued function, Classification of real valued functions.

Limits and continuity:

Introduction, Limit of a function, Definition of limit offunction (-definition)

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

Unit –II **06 Hours**

Matrices and Determinant:

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

Unit – III **06 Hours**

Differentiation : Introductions, Derivative of a function, Derivative of aconstant, Derivative of a product of a constant and a function , Derivativeof the sum or difference of two functions, Derivative of the product of twofunctions (product formula), Derivative of the quotient of two functions(Quotient formula) –Without Proof, Derivative of *xnw.r.t*x,where*n*is anyrational number, Derivative of *ex,*, Derivative of loge *x,* Derivative of*ax,*Derivative of trigonometric functions from first principles (withoutProof),SuccessiveDifferentiation, Conditions for a function to be amaximum or a minimum at a point. Application.

Unit – IV **06 Hours**

Analytical Geometry

Introduction: Signs of the Coordinates, Distance formula.

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

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

Unit-V **06 Hours**

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

Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemicalkineticsand Pharmacokinetics equations.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings (Latest Edition)

- *Panchaksharappa Gowda D.H (2014). Pharmaceutical Mathematics with applicationto Pharmacy*

SEMESTER: I

Course Title: HUMAN ANATOMY AND PHYSIOLOGY I	L	T	P	Credits
Course Code: BP107P	0	0	4	4

Total: 45 Hours

Learning Outcomes:

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

1	Recognize the construction, working, care and handling of instruments, glassware and equipment required forpractical
2	Apply body fluids and blood knowledge in Hemoglobin detection and measurement of blood pressure.
3	Analyze working pattern of different organs of each system.
4	Evaluate pulse rate, heart rate, erythrocyte sedimentation rate
5	Develop reports of white blood cells and red blood cells count

Course Content

1. Study of compoundmicroscope.
2. Microscopic study of epithelial and connectivetissue
3. Microscopic study of muscular and nervoustissue
4. Identification of axialbones
5. Identification of appendicularbones
6. Introduction tohemocytometry.
7. Enumeration of white blood cell (WBC)count
8. Enumeration of total red blood corpuscles (RBC)count
9. Determination of bleedingtime
10. Determination of clottingtime
11. Estimation of hemoglobincontent
12. Determination of bloodgroup.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulserate.
15. Recording of bloodpressure.

Suggested Readings

- *K. Sembulingam and P. Sembulingam (2012). Essentials ofMedical Physiology, Jaypee Brothers Medical Publishers, NewDelhi.*
- *Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1,2, Academic PublishersKolkata*

SEMESTER: I

Course Title: PHARMACEUTICAL ANALYSIS-I	L	T	P	Credits
Course Code: BP108P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Perform limit test, preparation, standardization and determination of Normality.
2	Carryout various volumetric and electrochemical titrations.
3	Develop analytical skills.
4	Perform analysis of drugs using Fluorimetry, nepheloturbidimetry and flame photometry
5	Cognize the different separation techniques and their applications in analysis of drugs

Course Content

I Limit Test of thefollowing

(1) Chloride
(2) Sulphate
(3) Iron
(4) Arsenic

II Preparation and standardizationof

(1) Sodiumhydroxide
(2) Sulphuric acid
(3) Sodiumthiosulfate
(4) Potassiumpermanganate
(5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization ofTitrant

(1) Ammonium chloride by acid basetitration
(2) Ferrous sulphate byCerimetry
(3) Copper sulphate byIodometry
(4) Calcium gluconate bycomplexometry
(5) Hydrogen peroxide byPermanganometry
(6) Sodium benzoate by non-aqueoustitration
(7) Sodium Chloride by precipitationtitration

IV Determination of Normality by electro-analyticalmethods

(1) Conductometric titration of strong acid against strongbase
(2) Conductometric titration of strong acid and weak acid against strongbase
(3) Potentiometric titration of strong acid against strongbase

Suggested Readings (Latest Editions)

- *A.I. Vogel (1978), Text Book of Quantitative Inorganic Analysis, J.Bassett et.alLondon.*
- *Indian Pharmacopoeia(2018)*

SEMESTER: I

Course Title: PHARMACEUTICS-I	**L**	**T**	**P**	**Credits**
Course Code: BP109P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the Formulation of dosage forms
2	Apply the methods of preparation of extracts and principleof infusion, decoction etc.
3	Analyze Resolve the problems through the application of fundamental principlesof pharmaceutical metrology and conclude the decision.
4	Evaluate the Pharmacopeial standards for the preparation of various dosagesforms.
5	Create the mouthwashes, syrups

Course Content

(1)**Syrups:**

Syrup IP'66

Compound syrup of Ferrous Phosphate BPC'66

(2)Elixirs:

Piperazine citrateelixir

Paracetamol pediatricelixir

(3)Linctus:

Terpin Hydrate LinctusIP'66

Iodine Throat Paint (MandlesPaint)

(4)Solutions:

Strong solution of ammoniumacetate

Cresol with soapsolution

Lugol'ssolution

(5) Suspensions:

Calaminelotion

Magnesium Hydroxidemixture

Aluminum Hydroxidegel

6. Emulsions

Turpentine Liniment

Liquid paraffinemulsion

7. Powders andGranules

ORS powder (WHO)

Effervescentgranules

Dustingpowder

Dividedpowders

8. Suppositories

Glycero gelatinsuppository

Coca buttersuppository

Zinc Oxidesuppository

9. Semisolids

Sulphurointment

Non staining-iodine ointment with methylsalicylate

Carbopalgel

10. Gargles andMouthwashes

Iodine gargle

Chlorhexidinemouthwash

Suggested Readings (Latest Editions)

- *Lachmann (2020). Theory and Practice of Industrial Pharmacy, Lea&FebigerPublisher, The University ofMichigan.*
- *Indian Pharmacopoeia (2018).*
- *British Pharmacopoeia (2019).*
- *Alfonso R. Gennaro Remington (2006). The Science and Practice of Pharmacy, Lippincott Williams, NewDelhi.*

SEMESTER: I

Course Title: PHARMACEUTICALINORGANIC CHEMISTRY	L	T	P	Credits
Course Code: BP110P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Know about identification, purity and limit tests.
2	Develop information of preparation of inorganic pharmaceuticals
3	Get Awareness about the sources of impurities
4	Acquire Knowledge about methods of determination of the impurities in inorganic drugs and pharmaceuticals
5	Familiarize with a variety of inorganic drug classes

Course Content

I. Limit tests for followingions

Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test forIron

Limit test for Heavymetals Limit test for Lead

Limit test for Arsenic

II. Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Coppersulphate

III. Test forpurity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV.Preparation of inorganicpharmaceuticals

Boric acid, Potash alum ferrous sulphate

Suggested Readings

- *Anand & Chatwal (2018). Inorganic Pharmaceutical Chemistry, HimalayaPublishing House.*
- *A.H. Beckett & J.B. Stenlake's (2005). Practical Pharmaceutical Chemistry Vol1, 2. Stahlone Press of University ofLondon*
- *A.I. Vogel (1989). Text Book of Quantitative Inorganicanalysis*
- *Indian Pharmacopoeia (2018).*

SEMESTER: I

Course Title: COMMUNICATION SKILLS	L	T	P	Credits
Course Code: BP111P	0	0	2	1

Total: 30 Hours

Learning Outcomes

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

1	Acquire modules that are to be conducted using English language lab software.
2	Comprehend the behavioral needs for a Pharmacist to function efficiently.
3	Establish the team as an effective team player

Course Content

Basic communication covering the following topics

Meeting People
Asking Questions
Making Friends
What did you do?
Dos and Dont's

Pronunciations covering the following topics

Pronunciation and Nouns
Pronunciation (Consonant Sounds)
Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills, Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills

Suggested Readings

- *Andreja. J. Ruther Ford (2011). Basic communication skills for Technology, Pearson Education,.*
- *Communication skills (2011). Sanjay Kumar, Pushpalata, OxfordPress,*
- *Stephen .P. Robbins (2013).Organizational Behaviour, 1stEdition, Pearson.*

SEMESTER: I

Course Title: REMEDIAL BIOLOGY	L	T	P	Credits
Course Code: BP112RBP	0	0	2	1

Total: 30 Hours

Learning Outcomes

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

1	Recognize microscopic study and identification of tissues Study of cell, Stem, Root, Leaf, seed, fruit, and flower.
2	Carry out detailed study of frog by using computer models
3	Perform determination of blood group and check blood pressure and tidal volume.
4	Solve different type of problems by applying theory

Course Content

1. Introduction to experiments in biology

a) Study ofMicroscope

b) Section cuttingtechniques

c) Mounting andstaining

d) Permanent slidepreparation

2. Study of cell and itsinclusions

3. Study of Stem, Root, Leaf, seed, fruit, flower and theirmodifications

4. Detailed study of frog by using computermodels

5. Microscopic study and identification of tissues pertinent to Stem, Root, Leaf, seed, fruit andflower

6. Identification ofbones

7. Determination of bloodgroup

8. Determination of bloodpressure

9. Determination of tidalvolume

Reference Books

- *S.B.Gokhale, C.K.Kokate and S.P.Shriwastava (2007).A Manual of Pharmaceutical Biology Practical. NiraliPrakashan.*

SEMESTER: II

Course Title: HUMAN ANATOMY AND PHYSIOLOGY-II	L	T	P	Credits
Course Code: BP201T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Know about the various tissues and organs of different systems of human body.
2	Analyze the relevance and significance of Human Anatomy and Physiology to Pharmaceutical Sciences
3	Perform the hematological tests like blood cell counts, hemoglobin estimationetc and also record blood pressure, heart rate, pulse andrespiratory volume
4	Inspect Homeostatic mechanisms and their imbalances in the human body
5	Determine the proper care for each individual patient and their specific symptoms.

Course Content

Unit I **10 Hours**

Nervous system

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid, structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts,reflex activity)

Unit II **10 Hours**

Digestive system

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

Energetics

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III **10 Hours**

Respiratory system

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

Urinary system

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

Unit IV **09Hours**

Endocrine system

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

Unit V **09 Hours**

Reproductive system

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

Introduction to genetics

Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee brother's medical publishers, New Delhi.*
- *Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1, 2, Academic PublishersKolkata*

SEMESTER: II

Course Title: **PHARMACEUTICAL ORGANIC CHEMISTRY –I**	**L**	**T**	**P**	**Credits**
Course Code: BP202T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Learn the classification of organic compounds on the basis of functional group and IUPAC nomenclature of different organic compounds.
2	Apply concepts of organic chemistry related to hybridization, types of bonds and isomerism , Methods of preparation ,elimination and addition reactions of different compounds
3	Identify/confirm the identification of organic compound
4	Examine various techniques of purification of the synthesized compounds using precipitation or recrystallization
5	Explore molecules and compounds.

Course Content:

UNIT-I **07 Hours**

Classification, nomenclature and isomerism

Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds

UNIT-II **10 Hours**

Alkanes*, Alkenes* and Conjugated dienes*

SP3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes

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

Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

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

UNIT-III **10 Hours**

Alkyl halides*

SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides,

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

UNIT-IV **10 Hours**

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

UNIT-V **08 Hours**

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

Transaction Mode
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Morrison and Boyd (2010). OrganicChemistry.Pearson.*
- *Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry.Pearson*

SEMESTER: II

Course Title: PHARMACEUTICAL ORGANIC CHEMISTRY –I	L	T	P	Credits
Course Code: BP203T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize role of biochemical processes and cell metabolism.
2	Implement basics like chemistry, function, classification, biological importance, qualitative tests & applications of various biomolecules. e.g. proteins, carbohydrates and lipids, etc
3	Detect and identify proteins, amino acids and carbohydrates by various qualitative as well as quantitative tests.
4	Estimate the fundamentals of metabolism, process, steps involved in metabolism of carbohydrates, lipids, protein and nucleic acid.
5	Construct tests used to detect infections, genetic disorders, and other diseases

Course Content

UNIT I **08 Hours**

Biomolecules

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

Bioenergetics

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

UNIT II **10 Hours**

Carbohydrate metabolism

Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance

HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance. Hormonal regulation of blood glucose level and Diabetes mellitus

Biological oxidation

Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate phosphorylation Inhibitors

ETC and oxidative phosphorylation/Uncouplers level

UNIT III **10 Hours**

Lipid metabolism

β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid). Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D.

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

Amino acid metabolism

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

UNIT IV **10 Hours**

Nucleic acid metabolism and genetic information transfer

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

UNIT V **07 Hours**

Enzymes

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Lehninger (2021). Principles of Biochemistry. W H Freeman &CO.*

Robert K. Murry, Daryl K. Granner and Victor W. Rodwell (2020). Harper's Biochemistry. Vitae GenBiotech.

SEMESTER: II

Course Title: PATHOPHYSIOLOGY	L	T	P	Credits
Course Code: BP204T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the etiology and pathogenesis of the selected disease states
2	Learn the signs and symptoms of the diseases
3	Analyze the etiology and pathogenesis of the selected disease states
4	Recognize the complications of the diseases

Course Content:

Unit I **10 Hours**

Basic principles of Cell injury and Adaptation:

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

Basic mechanism involved in the process of inflammation and repair:

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

Unit II **10 Hours**

Cardiovascular System:

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

Respiratory system: Asthma, Chronic obstructive airways diseases.

Renal system: Acute and chronic renal failure.

Unit III **10 Hours**

Haematological Diseases:

Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia

Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones

Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric.
Disorders: depression, schizophrenia and Alzheimer's disease.
Gastrointestinal system: Peptic Ulcer

Unit IV **08 Hours**

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

Unit V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

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

SEMESTER: II

Course Title: **COMPUTER APPLICATIONS IN PHARMACY**	**L**	**T**	**P**	**Credits**
Course Code: BP205T	3	0	0	3

Total: 30 Hours

Learning Outcomes

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

1	Recognize Database, Database Management system,Computer application in clinical studies and use of databases.
2	Practice drug interactions, drug information services and patient counseling.
3	Analyze automated technology can also improve patient care safety by reducing medication errors, maintaining patient's medication records.
4	Evaluate abnormal changes in patients faster and with more accuracy
5	Design Automated Dispensing Units and Medication Reminder Devices

Course Content:

UNIT – I **06 Hours**

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

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

UNIT –II **06 Hours**

Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products. Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III **06 Hours**

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring. Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

UNIT – IV **06 Hours**

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

UNIT-V **06 Hours**

Computers as data analysis in Preclinical development:

Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *William E.Fassett Lea and Febiger (1986).Computer Application in Pharmacy, 600 South Washington Square, USA, (215)922-1330.*
- *Sean Ekins, Wiley-Interscience (2006). Computer Application in Pharmaceutical Research and Development, A John Willey and Sons, INC., Publication,USA*
- *S.C.Rastogi (2007). Bioinformatics (Concept, Skills and Applications) CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)*

SEMESTER: II

Course Title: ENVIRONMENTAL SCIENCES	L	T	P	Credits
Course Code: BP206T	3	0	0	3

Total: 30 Hours

Learning Outcomes

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

1	Generate the awareness about environmental problems in the society
2	Develop an attitude of concern for the environment
3	Attain harmony with Nature.
4	Develop knowledge about natural resources.

Course Content:

Unit-I **10 Hours**

The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems

a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-II **10 Hours**

Ecosystems Concept of an ecosystem.

Structure and function of an ecosystem.

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

Unit- III **10 Hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition):

- *Y.K. Sing,(2006). Environmental Science, New Age International Pvt,Publishers, Bangalore*
- *Agarwal, K.C (2001). Environmental Biology, Nidi Publ. Ltd.Bikaner.*
- *Brunner R.C. (1989). Hazardous Waste Incineration, McGraw Hill Inc.480p*

SEMESTER: II

Course Title: HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	Credits
Course Code: BP207P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the construction, working, care and handling of instruments, glassware and equipment required for practical
2	Apply body fluids and blood knowledge in Hemoglobin detection and measurement of blood pressure.
3	Analyze working pattern of different organs of each system.
4	Evaluate pulse rate, heart rate, erythrocyte sedimentation rate
5	Develop reports of white blood cells and red blood cells count

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 neurologicalexamination
5. To demonstrate the function of olfactorynerve
6. To examine the different types oftaste.
7. To demonstrate the visualacuity
8. To demonstrate the reflexactivity
9. Recording of bodytemperature
10. To demonstrate positive and negative feedbackmechanism.
11. Determination of tidal volume and vitalcapacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts andspecimens.
13. Recording of basal massindex.
14. Study of family planning devices and pregnancy diagnosistest.
15. Demonstration of total blood count by cellanalyser
16. Permanent slides of vital organs andgonads.

Suggested Readings

- *K. Sembulingam and P. Sembulingam (2012). Essentials of Medical Physiology, Jaypee BrothersMedical Publishers, New Delhi.*
- *Dr. C.C.Chatterjee (2018). Human Physiology.Vol 1, 2, Academic Publishers Kolkata*

SEMESTER: II

Course Title: **PHARMACEUTICAL ORGANIC CHEMISTRY –I**	**L**	**T**	**P**	**Credits**
Course Code: BP208P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the principle behind various qualitative tests and analyze the givenunknown organic compound having different functional groups
2	Apply various laboratory techniques for the synthesis of organic compounds, purification of the synthesized compounds using precipitation or recrystallization.
3	Analyze organic compounds qualitatively, synthesis of derivatives.
4	Evaluate correct use of various equipment& Safety measures in Pharmaceutical Chemistry laboratory.
5	Creation of polymers, like plastics and nylons

Course Content

Systematic qualitative analysis of unknown organic compoundslike

- Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation andunsaturation.
- Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne'stest
- Solubilitytest
- Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds andAnilides.
- Melting point/Boiling point of organiccompounds
- Identification of the unknown compound from the literature using melting point/ boiling point.
- Preparation of the derivatives and confirmation of the unknown compound bymelting point/ boilingpoint.
- Minimum 5 unknown organic compounds to be analysedsystematically.

Preparation of suitable solid derivatives from organiccompounds

Construction of moleculermodels

Suggested Readings

- *Morrison and Boyd (2010).OrganicChemistry.Pearson.*
- *Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson*

SEMESTER: II

Course Title: BIOCHEMISTRY	L	T	P	Credits
Course Code: BP209P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Develop skill for qualitative analysis of carbohydrates, Proteins, urine analysis, enzymes
2	Apply the skills for physiological and pathological condition of chemicals.
3	Analyze the interpretation of data emanating from a Clinical Test Lab.
4	Evaluate physiological conditions, influence the structures and re-activities of biomolecules
5	Construct tests used to detect infections, genetic disorders, and other diseases

Course Content

1. Qualitativeanalysisofcarbohydrates(Glucose,Fructose,Lactose,Maltose,Sucroseand starch)
2. Identification tests for Proteins (albumin andCasein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuretmethod)
4. Qualitative analysis of urine for abnormalconstituents
5. Determination of bloodcreatinine
6. Determination of bloodsugar
7. Determination of serum totalcholesterol
8. Preparation of buffer solution and measurement ofpH
9. Study of enzymatic hydrolysis ofstarch
10. Determination of Salivary amylaseactivity
11. Study the effect of Temperature on Salivary amylaseactivity.
12. Study the effect of substrate concentration on salivary amylaseactivity.

Suggested Readings

1. *Lehninger (2021).Principles of Biochemistry. W H Freeman &CO.*
2. *Robert K. Murry, Daryl K. Granner and Victor W. Rodwell (2020).Harper's Biochemistry. Vitae GenBiotech.*

SEMESTER: II

Course Title: COMPUTER APPLICATIONS IN PHARMACY	L	T	P	Credits
Course Code: BP210P	0	0	2	1

Total:30 Hours

Learning Outcomes

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

1	Know the various types of databases
2	Generate report and printing the report from patient database
3	Design a questionnaire using a word processing package to gather informationabout a particular disease.
4	Retrieve the information of a drug and its adverse effects using online tools
5	Create and work with queries in MS Access

Course Content

1. Design a questionnaire using a word processing package to gather information about a particulardisease.
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 MSWORD
4. Create a database in MS Access to store the patient information with the required fields using access
5. Design a form in MS Access to view, add, delete and modify the patient record in the database
6. Generating report and printing the report from patientdatabase
7. Creating invoice table using – MSAccess
8. Drug information storage and retrieval using MSAccess
9. Creating and working with queries in MSAccess
10. Exporting Tables, Queries, Forms and Reports to webpages
11. Exporting Tables, Queries, Forms and Reports to XMLpages

Suggested Readings

- *William E.Fassett Lea and Febiger (1986).Computer Application in Pharmacy, 600 South Washington Square, USA, (215)922-1330.*
- *Sean Ekins, Wiley-Interscience(2006).Computer Application in Pharmaceutical Research and Development, A John Willey and Sons, INC., Publication,USA*
- *S.C.Rastogi (2007). Bioinformatics (Concept, Skills and Applications),CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110002(INDIA)*

SEMESTER: III

Course Title: **PHARMACEUTICAL ORGANIC CHEMISTRY-II**	**L**	**T**	**P**	**Credits**
Course Code: BP301T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize methods of preparation and reactions of organic compounds
2	Apply on heterocyclic compounds
3	Analyze the Chemistry of fats and oils
4	Evaluate reactions, reactivity, mechanisms, and orientation of organic compounds
5	Create electrophilic and nucleophilic reactions.

Course Content

Unit I **10 Hours**

Benzene and its derivatives

Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel'srule

Reactions of benzene - nitration, sulphonation, halogenationreactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcraftsacylation.

Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilicsubstitutionreaction

Structure and uses of DDT, Saccharin, BHC andChloramine

UNIT II **10 Hours**

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitativetests, 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 andimportant reactions of benzoic acid.

UNIT III **10 Hours**

Fats and Oils

Fatty acids –reactions

Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Dryingoils.

Analytical constants – Acid value, Saponification value, Ester value,Iodine

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

UNIT IV **08 Hours**

Polynuclear hydrocarbons:

Synthesis,reactions. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene,Diphenylmethane, Triphenylmethane and theirderivatives

UNIT V **07 Hours**

Cyclo alkanes*

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory,Coulson and Moffitt's modification, Sachse Mohr's theory (Theory ofstrainless rings), reactions of cyclopropane and cyclobutaneonly.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Morrison and Boyd (2010). OrganicChemistry.Pearson.*
- *Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry. Pearson.*

SEMESTER: III

Course Title: PHYSICAL PHARMACEUTICS-I	L	T	P	Credits
Course Code: BP302T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the various physicochemical properties of drug molecules in the designing the dosage forms.
2	Apply the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
3	Analyze use of physicochemical properties in the formulation development and evaluation of dosage forms.
4	Evaluate the role of surfactants, interfacial phenomenon and thermodynamics.
5	Create physicochemical properties of drug molecules in formulation and research development.

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

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

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

UNIT-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces,

surface active agents, HLB Scale, solubilization, detergency, adsorption at solid interface.

UNIT-IV **08 Hours**

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

UNIT-V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.*

SEMESTER: III

Course Title: PHARMACEUTICAL MICROBIOLOGY	L	T	P	Credits
Course Code: BP303T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Performsterilization in pharmaceutical processing and industry
2	Analyze microbiological standardization of Pharmaceuticals
3	Evaluate sterility testing of pharmaceutical products
4	Develop cell cultures for pharmaceutical industry and research

Course Content:

Unit I **10 Hours**

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

Unit II **10 Hours**

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

Equipment employed in large scale sterilization. Sterility indicators.

Unit III **10 Hours**

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

Unit IV **08 Hours**

Designing of aseptic area, laminar flow equipment's; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological

assay.Methods for standardization of antibiotics, vitamins and amino acids.Assessment of a new antibiotic.

Unit V **07 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latestedition)

- *W.B. Hugo and A.D. Russel (2013).Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.*
- *Prescott and Dunn (2002). Industrial Microbiology, CBS Publishers & Distributors, Delhi.*

SEMESTER: III

Course Title: PHARMACEUTICAL ENGINEERING	L	T	P	Credits
Course Code: BP304T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize various unit operations used in Pharmaceutical industry.
2	Apply various processes involved in pharmaceutical manufacturing.
3	Analyse various tests to prevent environmental pollution.
4	Evaluate appreciate and comprehend significance of plant layout design for optimum use ofresources.
5	Create the various preventive methods used for corrosion control in pharmaceutical industry

Course Content:

UNIT-I **10 Hours**

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

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

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

UNIT-II **10 Hours**

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

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

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

distillation & molecular distillation

UNIT-III **08 Hours**

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

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

UNIT-IV **08 Hours**

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

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

UNIT- V **07 Hours**

Materials of pharmaceutical plant construction, Corrosion and its Prevention:

Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic non-metals, basic of material handlingsystems.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Martin, (2005).Remington Practice ofPharmacy.*
- *Lachmann (2018).Theory and Practice of IndustrialPharmacy.*

SEMESTER: III

Course Title: PHARMACEUTICAL ORGANIC CHEMISTRY-II	L	T	P	Credits
Course Code: BP305P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the laboratory techniques for Recrystallization, and Steam distillation.
2	Determine oil values.
3	Analyze and prepare compounds
4	Evaluate the reactivity of organic compounds
5	Create steam distillation techniques

Course Content

I Experiments involving

Laboratorytechniques Recrystallization, Steam distillation

II. Determination of following oil values (including standardization ofreagents) Acidvalue, Saponification value Iodine value

II Preparation ofcompounds

Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction. 2, 4, 6-Tribromo aniline/Para bromo acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction.

5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene by nitration reaction.

Benzoic acid from Benzyl chloride by oxidation reaction.

Benzoic acid/Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.

Benzil from Benzoin by oxidation reaction.

Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction Cinnammic acid from Benzaldehyde by Perkin reaction*P*-Iodo benzoic acid from *P*-amino benzoic acid

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Morrison and Boyd (2010). OrganicChemistry.Pearson.*
- *Fumiss S. Brian (2005).Vogel's Text book of Practical Organic Chemistry.Pearson*

SEMESTER: III

Course Title: PHYSICAL PHARMACEUTICS-I	L	T	P	Credits
Course Code: BP306P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the determination of solubility of drug, pKa value, Partition co-efficient, % composition, surface tension, HLB number, Freundlich and Langmuir constants, critical micellar concentration, stability constant and donor acceptor ratio
2	Demonstrate use of physicochemical properties in the formulation development andevaluation of dosage forms.
3	Analyze the determination of expiry date of formulations.
4	Evaluate the chemical stability tests of various drug products.
5	Create the pH titration method.

Course Content

1. Determination the solubility of drug at roomtemperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalchequation.
3. Determination of Partition co-efficient of benzoic acid in benzene andwater
4. Determination of Partition co-efficient of Iodine in CCl4 andwater
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 weightmethod
7. Determination of HLB number of a surfactant by saponificationmethod
8. Determination of Freundlich and Langmuir constants using activated charcoal
9. Determination of critical micellar concentration ofsurfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeinecomplex by solubilitymethod
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycinecomplex by pH titrationmethod

Suggested Readings (Latest Editions)

- *Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.*

SEMESTER: III

Course Title: PHARMACEUTICAL MICROBIOLOGY	L	T	P	Credits
Course Code: BP307P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize Introduction and study of different equipment and processing.
2	Apply importance of microbial limit tests, preservative efficacy test & standardizationprocesses
3	Analyze sterilization status of glassware, culture media
4	Evaluate various structural features, biology & characteristics of microbes
5	Develop new antibiotics and pure cultures of microorganisms for vaccine production

Course Content

1. Introduction and study of different equipment and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimentalmicrobiology.
2. Sterilization of glassware, preparation and sterilization ofmedia.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slantspreparations.
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 othermethods
7. Motility determination by hanging dropmethod.
8. Sterility testing ofpharmaceuticals.
9. Bacteriological analysis ofwater
10. Biochemicaltest.

Suggested Readings (Latest edition)

- *W.B. Hugo and A.D. Russel (2013).Pharmaceutical Microbiology, Blackwell Scientific publications, OxfordLondon.*
- *Prescott and Dunn (2002). Industrial Microbiology.*
- *CBSPublishers &Distributors, Delhi.*

SEMESTER: III

Course Title: PHARMACEUTICAL ENGINEERING	L	T	P	Credits
Course Code: BP308P	0	0	4	2

Total: 45 Hours

Learning Outcomes:

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

1	Recognize the determination of radiation constant, overall heat transfer coefficient, moisture content and loss on drying, humidity of air.
2	Apply Construction working and application of Pharmaceutical Machinery
3	Analyze Size analysis by sieving.
4	Evaluate size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
5	Create steam distillation

COURSE CONTENT

I. Determination of radiation constant of brass, iron, unpainted and paintedglass.

II. Steam distillation – To calculate the efficiency of steamdistillation.

III. To determine the overall heat transfer coefficient by heatexchanger.

IV. Construction of drying curves (for calcium carbonate andstarch).

V. Determination of moisture content and loss ondrying.

VI. Determination of humidity of air – i) from wet and dry bulb temperatures –use of Dew pointmethod.

VII. Description of Construction working and application of Pharmaceutical Machinerysuch as rotary tablet machine, fluidized bed coater, fluid energy mill, dehumidifier.

VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations–Construction of various size frequency curves includingarithmeticAndlogarithmic probability plots.

IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of BallMill.

X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajorequipment.

XI. FactorsaffectingRateofFiltrationandEvaporation(Surfacearea, Concentrationand Thickness/viscosity)

XII. To study the effect of time on the Rate ofCrystallization.

XIII. To calculate the uniformity Index for given sample by using Double

ConeBlender.

Suggested Readings

- *Martin, (2005).Remington practice of Pharmacy.*
- *Lachmann (2018).Theory and practice of industrial pharmacy*

SEMESTER: IV

Course Title: **PHARMACEUTICAL ORGANIC CHEMISTRY –III**	**L**	**T**	**P**	**Credits**
Course Code: BP401T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize anatomical terminology to identify and describe locations of majororgansof human body systems.
2	Analyze the advanced concepts of cardiovascular physiology.
3	Identify the major components of the lymphatic system and describe their functions.
4	Evaluate coordinated working pattern of different organs of each system.
5	Develop isomers

COURSE CONTENT

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

UNIT-I **10 Hours**

Optical isomerism –

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

UNIT-II **10 Hours**

Geometrical isomerism

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

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds /derivativesPyrrole, Furan, and Thiophene. Relative aromaticity and

reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **08 Hours**

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

UNIT-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birchmreduction, Wolff Kishner reduction.Oppenauer-oxidation and Dakin reaction. Beckmann's rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Morrison and Boyd (2010). OrganicChemistry.Pearson.*
- *Fumiss S. Brian (2005).Vogel's text book of Practical Organic Chemistry.Pearson*

SEMESTER: IV

Course Title: MEDICINAL CHEMISTRY–I	L	T	P	Credits
Course Code: BP402T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Correlate between pharmacology of a disease and its mitigation or cure.
2	Analyze the structural activity relationship of different class of drugs.
3	Compose the chemical synthesis of some drugs.
4	Evaluate the Structural Activity Relationship (SAR) of different class of drugs.
5	Develop advancements in the Structural Activity Relationship (SAR) of different class of drugs.

Course Content:

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry physicochemical properties in relation to biological action. Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

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

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System Adrenergic Neuro transmitters:

Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

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

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol,

Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 Hours**

Cholinergic neurotransmitters:

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

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):

Physostigmine,Neostigmine*,Pyridostigmine,Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothio phateiodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

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

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

UNIT- IV **08 Hours**

Drugs acting on Central Nervous System

Sedatives andHypnotics:

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

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

Miscelleneous:

Amides & imides: Glutethmide, Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazinehydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

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

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.
Beta amino ketones: Molindone hydrochloride.
Benzamides: Sulpieride.
Anticonvulsants: SAR of Anticonvulsants**,** mechanism ofanticonvulsantAction
Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione. **Succinimides:** Phensuximide, Methsuximide, and Ethosuximide*
Urea andmonoacylureas: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam
Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V **07 Hours**
Drugs acting on Central Nervous System
General anesthetics:
Inhalation anesthetics: Halothane*,Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*, Thiamylalsodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanoltartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphantartarate, Naloxone hydrochloride.
Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Transaction Mode
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning
Suggested Readings

- *Foye's Principles of Medicinal Chemistry (2019). WoltersKluwer.*
- *Burger's Medicinal Chemistry, Vol I toIV.*
- *Remington's Pharmaceutical Sciences (2008).*

SEMESTER: IV

Course Title: PHYSICAL PHARMACEUTICS-II	L	T	P	Credits
Course Code: BP403T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the physicochemical properties of drug molecules, pH, and solubility.
2	Determine use of physicochemical properties in the formulation development and evaluation of dosage forms.
3	Differentiate disperse system in different pharmaceutical preparation.
4	Evaluate half-life.
5	Formulate pure drug substance into a dosage form

Course Content:

UNIT-I **07 Hours**

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

UNIT-II **10 Hours**

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

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

UNIT-III **10 Hours**

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

UNIT-IV **10 Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle

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

UNIT-V **10 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *Cooper and Gunn (2008).Tutorial Pharmacy, S J Carter.*

SEMESTER: IV

Course Title: PHARMACOLOGY-I	L	T	P	Credits
Course Code: BP404T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the application of basic pharmacological knowledge in the prevention and treatment of various diseases.
2	Analyze the signal transduction mechanism of various receptors.
3	Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
4	Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
5	Modify mechanism of action of different drugs

Course Content:

UNIT-I **08 Hours**

GeneralPharmacology

Introduction toPharmacology- Definition, historical landmarks and scope ofpharmacology, 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 ofelimination

UNIT-II **12 Hours**

General Pharmacology

Pharmacodynamics-Principles and mechanisms of drug action. Receptor theoriesand classification of receptors, regulation of receptors. drug receptors interactionssignal transduction mechanisms, G-protein–coupled receptors, ion channel receptor,transmembrane enzyme linked receptors, transmembrane JAK-STAT bindingreceptor and receptors that regulate transcription factors, dose responserelationship, therapeutic index, combined effects of drugs and factors modifying drugaction.

Adverse drugreactions.

Drug interactions (pharmacokinetic and pharmacodynamic) d.Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials andpharmacovigilance.

UNIT-III **10 Hours**

Pharmacology of drugs acting on peripheral nervoussystem

Organization and function ofANS.

Neurohumoraltransmission, co-transmission and classification ofneurotransmitters.Parasympathomimetics,Parasympatholytics,Sympatho mimetics ,sympatholytics.Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).Local anestheticagents.Drugs used in myasthenia gravis andglaucoma

UNIT-IV **08 Hours**

Pharmacology of drugs acting on central nervoussystem

Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.General anesthetics andpre-anesthetics**.**Sedatives, hypnotics and centrally acting musclerelaxants.Anti-epileptics, Alcohols anddisulfiram

UNIT-V **07 Hours**

Pharmacology of drugs acting on central nervous system

Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxietyagents, anti-manics andhallucinogens.Drugs used in Parkinson's disease and Alzheimer'sdisease.CNS stimulants andnootropics.Opioid analgesics andantagonists. Drug addiction, drug abuse, tolerance anddependence.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil LivingstoneElsevier Goodman and Gilman's (2017).*
- *The Pharmacological Basis ofTherapeutics*.

SEMESTER: IV

Course Title: **PHARMACOGNOSY AND PHYTOCHEMISTRY I**	**L**	**T**	**P**	**Credits**
Course Code: BP405T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the recognition of medicinal plants, identification of adulteration and Contamination.
2	Analysis of organoleptic microscopic properties of herbal drugs
3	Apply chemical constituents of drug in commercial pharmaceutical aids
4	Recognize evaluation techniques for the herbal drugs.
5	Develop plant tissue cultures

Course Content:

UNIT-I **08 Hours**

Introduction to Pharmacognosy:

Definition, history, scope and development ofPharmacognosy, Sources of Drugs – Plants, Animals, Marine & Tissueculture. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gumsand mucilages, oleoresins and oleo- gum-resins).

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

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

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications.Polyploidy, mutation and hybridization with reference to medicinal plants. Conservation of medicinal plants

UNIT-III **07 Hours**

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

Aplications of plant tissue culture in pharmacognosy. Edible vaccines.

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V **08 Hours**

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

Plant Products:

Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders &Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea andFebiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhale (2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*
- *Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.*

SEMESTER: IV

Course Title: MEDICINAL CHEMISTRY – I	L	T	P	Credits
Course Code: BP406P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Get well acquainted with the synthesis of some important classes of drugs.
2	Analyze the chemistry of drugs with respect to their pharmacological activity.
3	Evaluate the synthesis of some important classes of drugs.
4	Examine mechanism pathways of different classes of medicinal. Compounds
5	Develop skills involved in thin layer chromatography techniques and purification ofsynthesized compounds by column chromatography

Course Content

I Content analysis

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

II Assay of drugs

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

III Determination of Partition coefficient for any two drugs.

Recommended Books

1. Foye's Principles of Medicinal Chemistry (2019). WoltersKluwer.
2. Burger's Medicinal Chemistry, Vol I toIV.
3. Remington's Pharmaceutical Sciences (2008).
4. Indian Pharmacopoeia (2018).

SEMESTER: IV

Course Title: PHYSICAL PHARMACEUTICS-II	L	T	P	Credits
Course Code: BP407P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations.
2	Analyze the pharmaceutical applications of various physical.
3	Examine the chemical stability tests of various drug products
4	Evaluaterheological parameters of pharmaceutical suspensions and colloids
5	Develop new techniques for the evaluation of parameters of dosage forms

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 andporosity
4. Determine the angle of repose and influence of lubricant on angle ofrepose
5. Determination of viscosity of liquid using Ostwald'sviscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determinationsedimentation 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 secondorder.
11. Accelerated stability studies

Suggested Readings (Latest Editions)

- *Cooper and Gunn (2008).Tutorial Pharmacy, S JCarter.*

SEMESTER: IV

Course Title: PHARMACOLOGY-I	L	T	P	Credits
Course Code: BP408P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize what drugs do to the living organisms and how their effects can be applied to therapeutics
2	Analyze correlation of pharmacology with other bio medical sciences.
3	Apply laboratory techniques for animal studies
4	Observe the effect of drugs on animals by simulated experiments
5	Invent laboratory techniques for animal studies

Course Content

1. Introduction to experimentalpharmacology.
2. Commonly used instruments in experimentalpharmacology.
3. Study of common laboratoryanimals.
4. Maintenance of laboratory animals as per CPCSEAguidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasmaseparation, anesthetics and euthanasia used for animalstudies.
6. Study of different routes of drugs administration inmice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitonesleeping time inmice.
8. Effect of drugs on ciliary motility of frogoesophagus
9. Effect of drugs on rabbiteye.
10. Effects of skeletal muscle relaxants using rota-rodapparatus.
11. Effect of drugs on locomotor activity usingactophotometer.
12. Anticonvulsant effect of drugs byMES and PTZmethod.
13. Study of stereotype and anti-catatonic activity of drugs onrats/mice.
14. Study of anxiolytic activity of drugs usingrats/mice.
15. Study of local anesthetics by differentmethods

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

Suggested Readings

- *Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019).*
- *Rang and Dale's Pharmacology, Churchil Livingstone Elsevier*
- *Goodman and Gilman's (2017).The Pharmacological Basis of Therapeutics*

SEMESTER: IV

Course Title: **PHARMACOGNOSY& PHYTOCHEMISTRY I**	**L**	**T**	**P**	**Credits**
Course Code: BP409P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize Phytotherapy and the Elderly, Phytotherapy and Children
2	Analyze the Material Medicine.
3	Conduct extractions/isolations & explain significance of use of various chemicals & physical conditions.
4	Identify unorganized crude drugs using morphological, chemical, physical & microscopical characteristics.
5	Develop plant tissue cultures

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 andindex
3. Determination of vein islet number, vein islet termination and palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piecemicrometer
5. Determination of Fiber length andwidth
6. Determination of number of starch grains by Lycopodium sporemethod
7. Determination of Ashvalue
8. Determination of Extractive values of crudedrugs
9. Determination of moisture content of crudedrugs
10. Determination of swelling index andfoaming

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhlae (2007), Text book of Pharmacognosy. NiraliPrakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*
- *Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.*

SEMESTER: V

Course Title: Medicinal Chemistry	L	T	P	Credits
Course Code: BP501T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the chemical synthesis of drugs.
2	Apply on drug metabolic pathway, adverse effect and therapeutic value of drugs
3	Analyze structural activity relationship of different class of drugs.
4	Evaluate and acquire knowledge about the chemotherapy for cancer.
5	Create drug metabolic pathways

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 ofselective class of drugs as specified in the course and synthesis of drugs superscripted(*)

UNIT- I **10 Hours**

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

H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidaminetartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidinemaleate, 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, Vincristinsulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

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

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

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol

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

UNIT- III **10 Hours**

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

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol **Coagulant & Anticoagulants**: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

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

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

Drugs for erectile dysfunction: Sildenafil, Tadalafil.

Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol

Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

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

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations
Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin.Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide.Glucosidase inhibitors: Acrabose, Voglibose.
Local Anesthetics: SAR of Local anesthetics
Benzoic Acid derivatives;Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Pierocaine. **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.
Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.
Miscellaneous: Phenacaine, Diperodon, and Dibucaine.*

Transaction Mode
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings
- *Foye's Principles of Medicinal Chemistry (2019). WoltersKluwer.*
- *Burger's Medicinal Chemistry, Vol I toIV.*
- *Remington's Pharmaceutical Sciences (2008).*
- *Indian Pharmacopoeia (2018).*

SEMESTER: V

Course Title: Industrial Pharmacy-I	L	T	P	Credits
Course Code: BP 502T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

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

Course Content

UNIT-I **07 Hours**

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

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

Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization

BCS classification of drugs & its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosageforms.

UNIT-II **10 Hours**

Tablets: Introduction, ideal characteristics of tablets, classification of tablets.Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablettooling.Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects incoating.Quality control tests: In process and finished producttests

Liquid orals: Formulation andmanufacturing consideration of syrups and elixirs suspensionsandemulsions; Fillingandpackaging; evaluation ofliquidoralsofficialin pharmacopoeia

UNIT-III **08 Hours**

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 forcapsules.

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

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

UNIT-IV **10 Hours**

Parenteral Products: Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance ofisotonicity. Production procedure, production facilities and controls, asepticprocessing. 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 parenteralproducts.

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

UNIT-V **10 Hours**

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

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

• *H. C.Ansel, Lea &Febiger, Philadelphia (2005).Introduction to Pharmaceutical Dosage Forms.*

SEMESTER: V

Course Title: PHARMACOLOGY-II	L	T	P	Credits
Course Code: BP503T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the effect of drugs on physiological system.
2	Acquire the knowledge of newer targets of several disease conditions fortreatment.
3	Appreciate correlation of pharmacology with related medical sciences.
4	Recognize the Assumption the mechanism of drug action and its relevance in the treatment of different diseases.

Course Content:

UNIT-I **10 Hours**

Pharmacology of drugs acting on cardio vascular system

Introduction to hemodynamic and electrophysiology ofheart.Drugs used in congestive heartfailure, Anti-hypertensive drugs.Anti-anginaldrugs.Anti-arrhythmic drugs.Anti-hyperlipidemic drugs.

UNIT-II **10 Hours**

Pharmacology of drugs acting on cardio vascular system

Drug used in the therapy ofshock.Hematinics, coagulants and anticoagulants. Fibrinolytics and anti-platelet drugs, Plasma volume expanders.

Pharmacology of drugs acting on urinary system

Diuretics, Anti-diuretics.

UNIT-III **10 Hours**

Autocoids and related drugs

Introduction to autacoids andclassification, Histamine, 5-HT and theirantagonists. Prostaglandins, Thromboxanes andLeukotrienes. Angiotensin, Bradykinin and Substance P. Non-steroidal anti-inflamma toryagents, Anti-goutdrugs, Antirheumatic drugs

UNIT-IV **08 Hours**

Pharmacology of drugs acting on endocrinesystem

Basic concepts in endocrinepharmacology.

Anterior Pituitary hormones- analogues and their inhibitors. Thyroid hormones- analogues and their inhibitors. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. Insulin, Oral Hypoglycemic agents and glucagon. ACTH and corticosteroids.

UNIT-V **07 Hours**

Pharmacology of drugs acting on endocrine system

Androgens and Anabolicsteroids. Estrogens, progesterone and oral contraceptives. Drugs acting on the uterus.

Bioassay

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier*
- *Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics*

SEMESTER: V

Course Title: PHAMACOGNOSY AND PHYTOCHEMISTRY II	L	T	P	Credits
Course Code: BP504T	3	1	0	4

Total: 45 Hours

Learning Outcomes: On successful completion of this course, the students will be able to:

1	Recognize the preparation and development of herbal formulation.
2	Apply and Carry-out isolation and identification of phytoconstituents
3	Analyze the preparation and development of herbal formulation.
4	Evaluate the isolation and identification of phytoconstituents
5	Create the modern extraction techniques

Course Content:

UNIT-I **07 Hours**

Metabolic pathways in higher plants and their determination

Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway. Acetate pathways and amino acidpathway. Study of utilization of radioactive isotopes in the investigation of Biogeneticstudies.

UNIT-II **14 Hours**

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

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

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

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

Tannins: Catechu, Pterocarpus

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

Glycosides: Senna, Aloes, Bitter Almond

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

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents.

Terpenoids: Menthol, Citral, Artemisin

Glycosides: Glycyrhetinic acid & Rutin

Alkaloids: Atropine,Quinine, Reserpine, Caffeine

Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

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

UNIT V **08 Hours**

Basics of Phytochemistry

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhlae (2007), Text book of Pharmacognosy. Nirali Prakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*
- *Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi.*

SEMESTER: V

Course Title:PHAMACEUTICAL JURISPRUDENCE	L	T	P	Credits
Course Code: BP505T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
2	Apply Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
3	Analyze the code of ethics during the pharmaceutical practice.
4	Evaluate the basic knowledge on important legislations related to the profession of Pharmacy in India
5	Create detailed study of Schedules

Course Content:

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.** Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

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

Offences and Penalties

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

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

UNIT-IV **08 Hours**

Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes ofExempted 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 andPenalties

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

UNIT-V **07 Hours**

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

Code of Pharmaceutical ethics Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath**,** Medical Termination of Pregnancy Act, Right to Information Act, Introduction to Intellectual Property Rights (IPR)

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Edition)

- *B.M. Mithal (2017).Text book of Forensic Pharmacy, Nirali Publication.*
- *N.K. Jain (2020). A text book of Forensic Pharmacy.*
- *Drugs and Cosmetics Act/ Rules by Govt. of Indiapublications.*

- *Medicinal and Toilet preparations act 1955 by Govt. of Indiapublications.*
- *Narcotic drugs and psychotropic substances act by Govt. of Indiapublications*
- *Drugs and Magic Remedies act by Govt. of Indiapublication*
- *Bare Acts of the said laws published by Government. Reference books(Theory)*

SEMESTER: V

Course Title: Industrial Pharmacy-I Lab	L	T	P	Credits
Course Code: BP506P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Articulate solid, liquid and semisolid dosage forms and evaluate them for theirQuality.
2	Recognize and appreciate the influence of pharmaceutical additives.
3	Know about Development of pharmaceutical dosage form.
4	Design and layout of various procedures in pharmaceutical industry.

Course Content

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

Suggested Readings (Latest Editions)

- *H. C.Ansel, Lea & Febiger, Philadelphia (2005). Introduction to Pharmaceutical Dosage Forms.*

SEMESTER: V

Course Title: PHARMACOLOGY-II	L	T	P	Credits
Course Code: BP507P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Demonstrate the various receptor actions using isolated tissue preparation.
2	Establish isolation of different organs/tissues from the laboratory animals by simulated experiments
3	Perform various in-vitro experiments to demonstrate receptor action
4	Appreciate the correlation of pharmacology with related medical sciences

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 ofdog.
4. Study of diuretic activity of drugs usingrats/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 pigileum.
13. Effect of spasmogens and spasmolytics using rabbitjejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edemamodel.
15. Analgesic activity of drug using central and peripheralmethods

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

Suggested Readings

- *Rang H.P.,Dale M.M.,Ritter J.M.,Flower R.J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier*
- *Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics*

SEMESTER: V

Course Title: PHARMACOGNOSY AND PHYTOCHEMISTRY	L	T	P	Credits
Course Code: BP508P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the preparation and development of herbal formulation.
2	Apply isolation and identification of phytoconstituents
3	Analyze the identification of phytoconstituents
4	Evaluate the development of herbal formulation.
5	Find out the separation of sugars by paper chromatography

Course Content

1. Morphology, histology and powder characteristics & extraction & detectionof: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander

2. Exercise involving isolation & detection of active principles

a. Caffeine - from teadust.

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 byTLC

6. Analysis of crude drugs by chemicaltests:

(i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhlae (2007), Text book of Pharmacognosy. Nirali Prakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*

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

SEMESTER: VI

Course Title:MEDICINAL CHEMISTRY – III	L	T	P	Credits
Course Code: BP601T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the importance of drug design and different techniques of drug design.
2	Assume drug metabolism, bioavailability, and pharmacokinetics.
3	Analyze the result of drug designing and relationship of SAR.
4	Evaluate the relationship between structure and biological activity of drug.
5	Discover and design the drug with modern techniques.

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 ofselective class of drugs as specified in the course and synthesis of drugs superscripted by(*)

UNIT – I **10 Hours**

Antibiotics

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

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

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II **10 Hours**

Antibiotics

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

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.
Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.
Miscellaneous: Pyrimethamine, Artesunete, Artemether, and Atovoquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

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

Urinary tract anti-infective agents

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

Antiviral agents:

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

UNIT – IV **08 Hours**

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.
Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.
Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.
Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.
Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.
Sulfones: Dapsone*.

UNIT – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design.

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Foye's Principles of Medicinal Chemistry (2019). Wolters Kluwer.*
- *Burger's Medicinal Chemistry, Vol I to IV.*
- *Remington's Pharmaceutical Sciences (2008).*
- *Indian Pharmacopoeia (2018).*

SEMESTER: VI

Course Title: PHARMACOLOGY-III	L	T	P	Credits
Course Code: BP602T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the pharmacological activity of drug.
2	Apply their assumption on drug metabolism, bioavailability, and pharmacokinetics.
3	Analyzethe result of drug designing and relationship of SAR.
4	Evaluatethe relationship between structure and biological activity of drug.
5	Create discover and design the drug with modern techniques.

Course Content:

UNIT-I **10 Hours**

1. Pharmacology of drugs acting on Respiratorysystem

a. Anti –asthmatic drugs
b. Drugs used in the management ofCOPD
c. Expectorants and antitussives
d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

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

UNIT-II **10 Hours**

3. Chemotherapy

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

UNIT-III **10 Hours**

3. Chemotherapy

a. Antitubercular agents
b. Antileprotic agents
c. Antifungal agents

d. Antiviral drugs
e. Anthelmintics
f. Antimalarial drugs
g. Antiamoebic agents

UNIT-IV **08 Hours**

3. Chemotherapy

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

4. Immunopharmacology

a. Immunostimulants
b. Immunosuppressant

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

UNIT-V **07 Hours**

5. Principles of toxicology

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

6. Chronopharmacology

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings.

- *Rang H. P., Dale M. M., Ritter J. M., Flower R. J (2019). Rang and Dale's Pharmacology, Churchil Livingstone Elsevier*
- *Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics*

SEMESTER: VI

Course Title:HERBAL DRUG TECHNOLOGY	L	T	P	Credits
Course Code: BP603T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognizethe raw material as source of herbal drugs from cultivation to herbal drug product.
2	Apply their ideas on the WHO and ICH guidelines for evaluation of herbal drugs.
3	Analyzethe behavior herbal cosmetics, natural sweeteners, nutraceuticals.
4	Evaluate WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.
5	Follow the ideas on GMP GUIDELINES.

Course content:

UNIT-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs.Selection, identification and authentication of herbal materials processing of herbal raw material

Biodynamic Agriculture

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

Indian Systems of Medicine

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

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

UNIT-II **07 Hours**

Nutraceuticals

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

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

Herbal-Drug and Herb-Food Interactions:

General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-

kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III **10 Hours**

Herbal Cosmetics

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

Herbal excipients:

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

Herbal formulations:

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

UNIT- IV **10 Hours**

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

Patenting and Regulatory requirements of natural products:

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

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

UNIT-V **07 Hours**

General Introduction to Herbal Industry

Herbal drugs industry: Present scope and future prospects.

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

Schedule T–Good Manufacturing Practice of Indian systems of medicine

Components of GMP (Schedule – T) and its objectives.

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhlae (2007), Text book of Pharmacognosy. Nirali Prakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*
- *Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi*

SEMESTER: VI

Course Title: BIOPHARMACEUTICS AND PHARMACOKINETICS	L	T	P	Credits
Course Code: BP604T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognizethe concepts of bioavailability and bioequivalence of drug products and their significance
2	Applythe concept of metabolism, elimination, bioavailability and bioequivalence.
3	Analyze the principles of pharmacokinetics that underline the absorption, distribution, metabolismand elimination of drug.
4	Evaluatethe effect of physiological factor and variability of pharmacokinetics parameters towards drug deposition within body.
5	Unsderstand the various causes of non- linear pharmacokinetics.

Course Content:

UNIT-I **10 Hours**

Introduction Biopharmaceutics to Absorption;

Mechanisms of drug absorption through GIT, factors influencing drugabsorption though GIT, absorption of drug from Non per oral extra-vascularroutes,

Distribution

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

UNIT- II **10 Hours**

Elimination:

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

Bioavailability and Bioequivalence:

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

UNIT- III **10 Hours**

Pharmacokinetics:

Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, one compartment open model.

(a) Intravenous Injection(Bolus)

(b)Intravenous infusion and

(c) Extra vascular administrations.

Pharmacokinetics parameters - KE, t1/2, VD, AUC, Ka, Clt and CLR-definitions methods of eliminations, Recognizeing of their significance andApplication

UNIT- IV **08 Hours**

Multicompartment models:

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

UNIT- V **07 Hours**

Nonlinear Pharmacokinetics:

- Introduction,
- Factors causingNon-linearity.
- Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *Thomas (1995) .N. Tozen, Lea and Febrger, Philadelphia.*
- *Dissolution, Bioavailability and Bioequivalence (1989) By Abdou H.M, Mack, Publishing Company, Pennsylvania.*
- *Rebort F Notari Marcel 1987. Biopharmaceutics and Clinical Pharmaco kinetics- An introduction, New York and Basel.*

SEMESTER: VI

Course Title: PHARMACEUTICAL BIOTECHNOLOGY	L	T	P	Credits
Course Code: BP605T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Design research strategy with step-by-step instructions to address a research problem.
2	Explain the concept and application of monoclonal antibody technology
3	Know about the Importance of Monoclonal antibodies in Industries
4	Appreciate the use of microorganisms in fermentation technology.

Course Content

Unit I **10 Hours**

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

Unit II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNAligase.
b) Recombinant DNA technology. Application of genetic engineering inmedicine.
c) Application of r DNA technology and genetic engineering in the productionof:
i) Interferon
ii) Vaccines- hepatitis-B
iii) Hormones-Insulin.
d) Brief introduction toPCR

Unit III **10 Hours**

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

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

Unit IV **08 Hours**

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

Unit V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition):

- *B.R. Glick and J.J. Pasternak (2017).Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press WashingtonD.C.*
- *RA Goldshy et. Al.: Kuby Immunology.*
- *J.W.Goding: Monoclonal Antibodies.*

SEMESTER: VI

Course Title:PHARMACEUTICAL QUALITY ASSURANCE	L	T	P	Credits
Course Code: BP606T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the responsibilities of QA & QC departments, cGMP aspects in a pharmaceutical industry
2	ApplyGMP overviews of ICH guidelines.
3	Analyze the scope of quality certifications applicable to pharmaceutical industries
4	Evaluatethe basic fundamental of quality concepts.
5	Acquirea thorough understanding of important QC, QA.

Course Content

UNIT – I **10 Hours**

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

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

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

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

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

NABL accreditation: Principles and procedures

UNIT – II **10 Hours**

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

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

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

UNIT – III **10 Hours**

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

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

UNIT – IV **08 Hours**

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

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

UNIT – V **07 Hours**

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

Warehousing: Good warehousing practice, materials management

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Edition)

- *Quality Assurance Guide by organization of Pharmaceutical Products of India.*
- *Good Laboratory Practice Regulations, 2nd Edition, SandyWeinberg Vol.69.*
- *ISO 9000 and Total Quality Management – Sadhank GGhosh*
- *The International Pharmacopoeia(2018) Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosageforms*
- *ICH guidelines, ISO 9000 and 14000 guidelines*

SEMESTER: VI

Course Title:MEDICINAL CHEMISTRY- III Lab	L	T	P	Credits
Course Code: BP607P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1.	Recognize the structure, chemistry and therapeutic value of drugs and
2.	Apply synthesis and SAR of drug.
3.	Analyze the chemistry of drug.
4.	Evaluate the relationship between structure and biological activity of various drug molecules.
5.	Create the structure and physical properties of drugs to their pharmacological activity.

CourseContent

I. Preparation of drugs and intermediates

1 Sulphanilamide
2 7-Hydroxy, 4-methylcoumarin
3 3Chlorobutanol
4 Triphenylimidazole
5 Tolbutamide
6 Hexamine

II Assay of drugs

1. Isonicotinic acid hydrazide
2. Chloroquine
3. Metronidazole
4. Dapsone
5. Chlorpheniraminemaleate
6. Benzylpenicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiationtechnique

IV Drawing structures and reactions using chemdraw®

V Determination of physicochemical properties such as logP, clogP,MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (LipinskiesRO5)

Suggested Readings

- *Foye's Principles of Medicinal Chemistry (2019). WoltersKluwer.*
- *Burger's Medicinal Chemistry, Vol I toIV.*
- *Remington's Pharmaceutical Sciences (2008).*
- *Indian Pharmacopoeia (2018)*

SEMESTER: VI

Course Title: PHARMACOLOGY-III Lab	L	T	P	Credits
Course Code: BP608P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognizethe various Biostatistics methods in experimental pharmacology.
2	Apply drugs into animal and record response.
3	Analyze various in-vitro experiments to demonstrate receptor action using isolated tissue preparation.
4	Evaluatethe toxic effects of drugs.
5	Create record report of drugs therapeutic effects.

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 ulcermodel.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pigileum
6. Estimation of serum biochemical parameters by using semi-auto analyser
7. Effect of saline purgative on frogintestine
8. Insulin hypoglycemic effect inrabbit
9. Test for pyrogens (rabbitmethod)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Ranktest)

*Experiments are demonstrated by simulated experiments/videos

Suggested Readings

- *RangH.P.,Dale M.M., RitterJ.M.,FlowerR.J(2019).*
- *Rang and Dale's Pharmacology, Churchil Livingstone Elsevier*

Goodman and Gilman's (2017). The Pharmacological Basis of Therapeutics

SEMESTER: VI

Course Title:HERBAL DRUG TECHNOLOGY Lab	L	T	P	Credits
Course Code: BP609 P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Recognize the Management of quality of medicinal plant products and derivatives.
2	Apply raw material as source of herbal drugs from cultivation to herbal drug product.
3	Analyze Quality and Quantity Assurance of herbal drugs, cosmetics.
4	Evaluate toxicological aspects of active ingredients and finished products, WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.
5	Create herbal formulations like syrups, mixtures and tablets and Novel dosage

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 naturalorigin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Suggested Readings (Latest Editions)

- *W.C.Evans (2009). Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London.*
- *Tyler, V.E., Brady, L.R. and Robbers (1988) J.E., Pharmacognosy, Lea and Febiger, Philadelphia.*
- *C.K. Kokate, Purohit, Gokhlae (2007), Text book of Pharmacognosy. Nirali Prakashan, New Delhi.*
- *R.D. Choudhary (1996) Herbal drug industry, Eastern Publisher, New Delhi.*
- *Dr.SH.Ansari, IInd edition (2007). Essentials of Pharmacognosy, Birla publications, New Delhi*

SEMESTER: VII

Course Title: INSTRUMENTAL METHODS OF ANALYSIS	**L**	**T**	**P**	**Credits**
Course Code: BP701T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Appreciate the interaction of matter with electromagnetic radiations and its applications in drug analysis.
2	Comprehend the chromatographic separation and analysis of drugs
3	Recognize quantitative & qualitative analysis of drugs using various analytical instruments
4	Learn documentation and express the observations with clarity.

Course Content

UNIT –I **10 Hours**

UV Visible spectroscopy

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

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

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

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

UNIT –II **10 Hours**

IR spectroscopy

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

Flame Photometry- Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III **10 Hours**

Introduction to chromatography

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

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

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

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

UNIT –IV **08 Hours**

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

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

UNIT –V **07 Hours**

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

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

• *B.K Sharma (2004). Instrumental Methods of Chemical Analysis, CBS publication.*

SEMESTER: VII

Course Title: INDUSTRIAL PHARMACY II	L	T	P	Credits
Course Code: BP702T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Know the process of pilot plant and scale up of pharmaceutical dosage forms.
2	Recognize the process of technology transfer from lab scale to commercial Batch.
3	Apply Regulatory requirements for drug approval.
4	Comprehend the approval process and regulatory requirements for drug products.
5	Implement different Laws and Acts that regulate pharmaceutical industry

Course Content:

UNIT-I **10 Hours**

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

UNIT-II **10 Hours**

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

UNIT-III **10 Hours**

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

Regulatory requirements for drug approval: Drug Development Teams, Non- ClinicalDrug Development, Pharmacology, Drug Metabolism and Toxicology, Generalconsiderations 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 forFDA Submissions, Management of Clinical Studies.

UNIT-IV **08 Hours**

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

UNIT-V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

• *H. C.Ansel, Lea &Febiger, Philadelphia (2005).Introduction to Pharmaceutical Dosage Forms.*

SEMESTER: VII

Course Title: PHARMACY PRACTICE	L	T	P	Credits
Course Code: BP703T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize drug distribution methods in hospital and apply it in the practice of pharmacy.
2	Apply and Interpret role of pharmacist in education and training program.
3	Analyze requirements essential for hospital, community and hospital pharmacy management.
4	Evaluate medication history, medication adherence and adverse effects of drugs
5	Develop clinical report, adverse reaction report of patients

Course Content

Unit I **10 Hours**

a) Hospital and it'sorganization

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 theirfunctions.

b) Hospital pharmacy and itsorganization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout andstaff requirements, and Responsibilities and functions of hospitalpharmacists.

c) Adverse drugreaction

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 detectingdrug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

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

Unit II **10 Hours**

a) Drug distribution system in a hospital

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

b) Hospital formulary

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

c) Therapeutic drug monitoring

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

d) Medication adherence

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

e) Patient medication history interview

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

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III **10 Hours**

a) Pharmacy and therapeutic committee

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

b) Drug informationservices

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

c) Patient counseling

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

d) Education and training program in the hospital

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

e) Prescribed medication order and communication skills

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

Unit IV **08 Hours**

a) Budget preparation andimplementation

Budget preparation andimplementation

b) ClinicalPharmacy

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, Medicationhistory and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) Over the counter (OTC) sales

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

Unit V **07 Hours**

a) Drug store management and inventorycontrol

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

b) Investigational use of drugs

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

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Edition):

- *Merchant S.H. and Dr. J.S.Quadry.2001A textbook of hospital pharmacy, 4th ed. Ahmadabad: B.S. ShahPrakakshan.*
- *Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata.2004A textbook of Clinical Pharmacy Practice- essential concepts and skills, 1st ed. Chennai: Orient Longman Private Limited.*
- *William E. Hassan.1986Hospital pharmacy, 5th ed. Philadelphia: Lea & Febiger.*
- *Tipnis Bajaj2008. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications.*
- *Scott LT 2009. Basic skills in interpreting laboratory data, 4th ed.American Society of Health System PharmacistsInc*

SEMESTER: VII

Course Title: NOVEL DRUG DELIVERY SYSTEMS	L	T	P	Credits
Course Code: BP704T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize various properties of sustained and controlled drug delivery systems.
2	Apply formulation and evaluation of various controlled drug delivery system for oral and parenteral.
3	Analyze design of a drug delivery system.
4	Evaluate current development in drug delivery system.
5	Create selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation.

Course Content

Unit-I **10 Hours**

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

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II **10 Hours**

Microencapsulation: Definition, advantages and disadvantages, micro spheres/microcapsules, microparticles, methods of microencapsulation, applications

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

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

Unit-III **10 Hours**

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

Gastroretentive drug delivery systems: Introduction, advantages,

disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and theirapplications

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

Unit-IV **08 Hours**

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

Unit-V **07 Hours**

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *Y W. Chien 1992. Novel Drug Delivery Systems, revised and expanded, Marcel Dekker, Inc., NewYork.*
- *Robinson, J. R., Lee V. H. L (1992). Controlled Drug Delivery Systems, Marcel Dekker, Inc., NewYork.*

SEMESTER: VII

Course Title: INSTRUMENTAL METHODS OF ANALYSIS	**L**	**T**	**P**	**Credits**
Course Code: BP705P	0	0	4	2

Total: 45 Hours

Learning Outcomes

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

1	Prepare accurate analysis and report the results in defined formats.
2	Develop practical skills for the analysis of drugs and excipients using various instrumentation techniques.
3	Perform quantitative and qualitative analysis of drugs using various analytical methods
4	Recognize the chromatographic separation and analysis of drugs.

Course Content

1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2 Estimation of dextrose bycolorimetry
3 Estimation of sulfanilamide bycolorimetry
4 Simultaneous estimation of ibuprofen and paracetamol by UVspectroscopy 5 Assay of paracetamol by UV-Spectrophotometry
5. Estimation of quinine sulfate by fluorimetry
5 Study of quenching of fluorescence
8 Determination of sodium by flamephotometry
9 Determination of potassium by flamephotometry
10 Determination of chlorides and sulphates by nephelo turbidometry
11 Separation of amino acids by paperchromatography
12 Separation of sugars by thin layerchromatography
13 Separation of plant pigments by columnchromatography
14 Demonstration experiment on HPLC
15 Demonstration experiment on Gas Chromatography

Suggested Readings

- *B.K Sharma (2004). Instrumental Methods of Chemical Analysis, CBS publication.*

SEMESTER: VIII

Course Title: BIOSTATISITCS AND RESEARCH METHODOLOGY	**L**	**T**	**P**	**Credits**
Course Code: BP801T	**3**	**1**	**0**	**4**

Total: 45 Hours

Learning Outcomes

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

1	Recognize about operation of M.S. Excel, SPSS, R and MINITAB, DoE (Design of Experiment).
2	Applydesign of Experiments, Experiential Design Technique, plagiarism**,** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph
3	Analyze distinguish the application of statistical in clinical data management
4	Evaluate the sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, variousphases
5	Create the appreciate statistical techniques in solving the problems

Course Content

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

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

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

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

Unit-II **10 Hours**

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

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

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

Unit-III **10 Hours**

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

Unit-IV **08 Hours**

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regression models

Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V **07 Hours**

Design and Analysis of experiments:

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

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition):

• *S.C.Guptha (2018). Fundamental of Statistics – Himalaya Publishing House*

SEMESTER: VIII

Course Title: **SOCIAL AND PREVENTIVE PHARMACY**	**L**	**T**	**P**	**Credits**
Course Code: BP 802T	**3**	**1**	**0**	**4**

Total: 45 Hours

Learning Outcomes

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

1	Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
2	Apply a critical way of thinking based on current health care development
3	Analyze improvement in rural sanitation, national urban health mission, Health promotion and education in school
4	Evaluate alternative ways of solving problems related to health and Pharmaceutical issues.
5	Create a better health care service system.

Course Content

Unit I **10 Hours**

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

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

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

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

Unit II **10 Hours**

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

Unit III **10 Hours**

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

HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness,

Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV **8 Hours**

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

Unit V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition)*:*

- *Short Textbook of Preventive and Social Medicine, Prabhakara, 2010 JAYPEE Publications.*
- *Mahajan and Gupta 2008. Textbook of Preventive and Social Medicine Saha Indranil, JAYPEE Publications*
- *Community Pharmacy Practice, Ramesh Adepu, BSP publishers,Hyderabad.*

SEMESTER: VIII

Course Title: PHARMA MARKETING MANAGEMENT	L	T	P	Credits
Course Code: BP803ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize know how of marketing management and grooming the people for taking a challenging role in Sales and Product management.
2	Apply new product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.
3	Analyze distinguish the methods, determinants of promotional mix, promotional budget.;Analyzing consumer buying behavior; industrial buying behavior.
4	Evaluate of the various policies for drug inventory management.
5	Create retail and wholesale marketing.

Course Content

Unit I **10 Hours**

Marketing:

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

Pharmaceutical market:

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

Unit II **10 Hours**

Product decision:

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

Unit III **10 Hours**

Promotion:

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

Unit IV **8 Hours**

Pharmaceutical marketing channels:

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

Professional sales representative (PSR):

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

Unit V **7 Hours**

Pricing:

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

Emerging concepts in marketing:

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

• *Philip Kotler and Kevin Lane Keller (2017). Marketing Management, Prentice Hall of India, New Delhi*

SEMESTER: VIII

Course Title: **PHARMACEUTICAL REGULATORY SCIENCE**	**L**	**T**	**P**	**Credits**
Course Code: BP804 ET	**3**	**1**	**0**	**4**

Total: 45 Hours

Learning Outcomes

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

1	Recognize about the process of drug discovery and development.
2	Apply clinical studies, Innovator and generics, Concept of generics, Generic drug product development.
3	Analyze about legal aspects and quality polices for drug manufacturing
4	Evaluatethe regulatory approval process and their registration in Indian and international markets.
5	Identify the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.

Course Content

Unit I **10 Hours**

New Drug Discovery and development

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

Unit II **10 Hours**

Regulatory Approval Process

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

Regulatory authorities and agencies

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

Unit III **10 Hours**

Registration of Indian drug product in overseas market

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

Unit IV **08 Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent

Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors &Monitors, Managing and Monitoring clinical trials, Pharmacovigilance – safetymonitoring in clinical trials

Unit V **07 Hours**

Regulatory Concepts

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition):

• *Dr. N.S. Vyawahare (1905). Drug Regulatory Affairs by Sachin Itkar, Nirali Prakashan.*

SEMESTER: VIII

Course Title: PHARMACOVIGILANCE	L	T	P	Credits
Course Code: BP 805T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize about national and international scenario of pharmacovigilance
2	Apply the various methods that can be used to generate safety data and signal detection
3	Develop the skills of classifying drugs, diseases and adverse drug reactions.
4	Evaluate why drug safety monitoring is important.
5	Create differences in Indian and global pharmacovigilance requirements.

Course Content

Unit I **10 Hours**

Introduction to Pharmacovigilance

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

Introduction to adverse drug reactions

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

Basic terminologies used in pharmacovigilance

Terminologies of adverse medication related events Regulatory terminologies

Unit II **10 Hours**

Drug and disease classification

Anatomical, therapeutic and chemical classification of drugs International classification of diseasesdaily defined dosesInternational Non-proprietary Names for drugs

Drug dictionaries and coding in pharmacovigilance

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

Information resources in pharmacovigilance Basic drug information resources specialised resources for ADRs

Establishing pharmacovigilance programme

Establishing in a hospital Establishment & operation of drug safety departmentin industry Contract Research Organisations (CROs)

Establishing a national programme

Unit III **10 Hours**

Vaccine safety surveillance: Vaccine Pharmacovigilance Vaccination failure. Adverse events following immunization.

Pharmacovigilance methods: Passive surveillance – Spontaneous reports and case series Stimulated reporting.Active surveillance–Sentinel sites, drug event monitoring and registries. Comparative observational studies – Cross sectional study, case control study and cohort study

Targeted clinical investigations

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

Unit IV **08 Hours**

Safety data generation: Pre-clinical phase Clinical phase. Post approval phase (PMS)**.** ICH Guidelines for Pharmacovigilance:Organization and objectives of ICH Expedited reporting. Individual case safety reports Periodic safety update reports Post approval expedited reporting Pharmacovigilance planning. Good clinical practice in pharmacovigilance studies

Unit V **07 Hours**

Pharmacogenomics of adverse drug reactions: Genetics related ADR with example focusing PK parameters. Drug safety evaluation in special population Paediatrics: Pregnancy and lactation Geriatrics. CIOMS: CIOMS Working Groups CIOMS Form. CDSCO (India) and Pharmacovigilance: D&C Act and Schedule Y**.** Differences in Indian and global pharmacovigilance requirements

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest edition):

- *Practical Drug Safety from A to Z by Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.*
- *Mann's Pharmacovigilance: Elizabeth B. Andrews, Nicholas, Wiley Publishers.*
- *Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.*
- *An Introduction to Pharmacovigilance: Patrick Waller, WileyPublishers.*

SEMESTER: VIII

Course Title: QUALITY CONTROL AND STANDARDIZATION OF HERBALS	L	T	P	Credits
Course Code: BP 806 ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the regulatory approval process and its registration in Indian and international markets.
2	Apply WHO guidelines for quality control of herbal drugs.
3	Analyze EU and ICH guidelines for quality control of herbal drugs.
4	Evaluate quality assurance in herbal drug industry
5	Create preparation of documents for new drug application and export registration.

Course Content

Unit I **10 Hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage Forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use

Unit II **10 Hours**

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

Unit III **10 Hours**

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

Unit IV **08 Hours**

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

Unit V **07 Hours**

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

in standardization of herbal products

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (Latest Editions)

- *Rangari, V.D.(2006) Text book of Pharmacognosy and Phytochemistry Vol. I, CarrierPub.*
- *Mukherjee, P.W.(2002).Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India.*

SEMESTER: VIII

Course Title:COMPUTER AIDED DRUG DESIGN	L	T	P	Credits
Course Code: BP 807 ET	3	1	0	4

Total 45 Hours

Learning Outcomes

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

1	Recognize design and discovery of lead molecule .Stages of drug discovery and development
2	Apply 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.
3	Analyze the concept of QSAR and docking
4	Evaluate about various strategies to develop new drug.
5	Create design new drug molecules using molecular modeling software.

Course Content

UNIT-I **10 Hours**

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies

UNIT-II **10 Hours**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III **10 Hours**

Molecular Modeling and virtual screening techniques

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

Molecular docking: Rigid docking, flexible docking, manual docking,

Docking based screening. *De novo* drug design.

UNIT-IV **08 Hours**

Informatics & Methods in drug design

Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT-V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.*
- *Martin YC. "Quantitative Drug Design" Dekker, NewYork.*

SEMESTER: VIII

Course Title:CELL AND MOLECULAR BIOLOGY	L	T	P	Credits
Course Code: BP808ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the chemical foundation of cell biology know about the cellular functioning and composition
2	Apply; DNA and the Flow of Molecular Information ,DNA Functioning, DNA and RNA,Types of RNA
3	Validate properties of cells and cell membrane.
4	Evaluate comprehend the DNA properties of cell biology.
5	Analyse the history of cell and molecular biology

Course Content

Unit I **10 Hours**

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

Unit II **10 Hours**

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

Unit III **10 Hours**

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

Unit IV **08 Hours**

a) Science ofGenetics
b) Transgenics and Genomic Analysis

c) Cell Cycleanalysis
d) Mitosis and Meiosis
e) Cellular Activities and Checkpoints

Unit V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (latestedition):

- *W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.*
- *RA Goldshy et.al., Kuby Immunology.*

SEMESTER: VIII

Course Title: COSMETIC SCIENCE	L	T	P	Credits
Course Code: BP809ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize types of cosmetics and cosmetic expients.
2	Apply principles of formulation of cosmetics products
3	Analze the quality of skin care products
4	Evaluate skin and hair texture usingvarious instruments
5	Create new cosmetic products after identification of skin problems.

Course Content

UNIT I **10 Hours**

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, rheologymodifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II **10 Hours**

Principles of formulation and building blocks of skin care products:

Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmeceuticals.

Antiperspants & deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo, Hairoils.

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

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for

shampoo, skincream and toothpaste**.**

UNIT IV **08 Hours**

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.

UNIT V **07 Hours**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic Understanding of the terms comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes. Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.*

SEMESTER: VIII

Course Title: PHARMACOLOGICAL SCREENING METHODS	L	T	P	Credits
Course Code: BP810T	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.
2	Apply the application of various commonly used laboratory animals.
3	Analyze topic, review of literature, research hypothesis and study design Pre- clinical data analysis
4	Evaluation of biostatistics and research methodology. Appreciate the application of various commonly used laboratory animals.
5	Create the various screening methods used in preclinical research.

Course Content

Unit –I **08 Hours**

Laboratory Animals:

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

Unit–II **10 Hours**

Preclinical screening models

Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animal's andimportance of sham negative and positive controlgroups. Rationale for selection of animal species and sex for the study.

Study of screening animal modelsfor: Diuretics, nootropics, anti-Parkinson's, antiasthmatics,

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

Unit –III **10 Hours**

Preclinical screening models: for ANS activity, sympathomimetics,

sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics.

Unit–IV **10 Hours**

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

Unit V **07 Hours**

Research methodology and Bio-statistics

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings (latest edition):

• *Fundamentals of experimental Pharmacology-by M.N.Ghosh*

SEMESTER: VIII

Course Title: ADVANCED INSTRUMENTATION TECHNIQUES	L	T	P	Credits
Course Code: BP811ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the advanced instruments used and its applications in drug analysis.
2	Apply the chromatographic separation and analysis of drugs
3	Analyzethe subject that deals with the application of instrumental methods in qualitative and quantitative analysis of drugs
4	Evaluation comprehend the calibration of various analytical instruments
5	Create general principle and procedure involved in the solid phase extraction and liquid-liquid extraction

Course Content

UNIT-I **10 Hours**

Nuclear Magnetic Resonance spectroscopy

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

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

UNIT-II **10 Hours**

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

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

UNIT-III **10 Hours**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

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

UNIT-IV **08 Hours**

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

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

UNIT-V **07 Hours**

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

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Instrumental Methods of Chemical Analysis by B.KSharma*
- *Spectrophotometric identification of Organic Compounds bySilverstein*

SEMESTER: VIII

Course Title: DIETARY SUPPLEMENTS AND NUTRACEUTICALS	**L**	**T**	**P**	**Credits**
Course Code: BP812ET	3	1	0	4

Total: 45 Hours

Learning Outcomes

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

1	Recognize the outcomes of deficiencies in dietary supplements.
2	Apply public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.
3	Study the various optimization techniques for pharmaceutical product development
4	Evaluate the regulatory and commercial aspects of dietary supplements including health claims.
5	Formulate advanced study of Pharmaceutical Excipients.

Course Content

UNIT I **07 Hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertensionetc.
b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education incommunity.
c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko,Flaxseeds

UNIT II **15 Hours**

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

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

UNIT III **07 Hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.
b) Dietary fibres and complex carbohydrates as functional foodingredients.

UNIT IV **10 Hours**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders.Free radical's theory ofageing.
b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, and Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxyAnisole.
c) Functional foods for chronic diseaseprevention

UNIT V **06 Hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential ofnutraceuticals.
b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.
c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Dietetics by SriLakshmi*
- *Role of dietary fibres and neutraceuticals in preventing diseases by K.TAgusti and P.Faizal: BS Publication.*