The Indian Pharmaceutical Association-Maharashtra State Branch's

Bombay College of Pharmacy-Autonomous

Kalina, Santacruz (E), Mumbai 400 098

(Approved by AICTE, PCI and affiliated to University of Mumbai)

Detailed Syllabus structure and Syllabus for B.Pharm- PCI

w.e.f. Academic year 2024-25

Table-I:Course of study for Semester I

Coursecode	Name of the course	No. of hours	Tutorial	Credit points
BP101T	HumanAnatomyandPhysiologyI–Theory	3	1	4
BP102T	PharmaceuticalAnalysisI–Theory	3	1	4
BP103T	Pharmaceutics I–Theory	3	1	4
BP104T	PharmaceuticalInorganicChemistry–Theory	3	1	4
BP105T	Communicationskills–Theory	2	-	2
BP106RBT BP106RMT	Remedial Biology/RemedialMathematics–Theory	2	-	2
BP107P	HumanAnatomyandPhysiology–Practical	4	-	2
BP108P	PharmaceuticalAnalysis I–Practical	4	-	2
BP109P	Pharmaceutics I–Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communicationskills–Practical	4	-	1
BP112RBP	RemedialBiology–Practical	4	-	1
Total		**34/36$/40#**	**4**	**27/29$/30#**

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

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

Table-II:Course of study for Semester II

CourseCode	Nameofthecourse	No. ofhours	Tutorial	Creditpoints
BP201T	HumanAnatomyandPhysiologyII– Theory	3	1	4
BP202T	PharmaceuticalOrganic ChemistryI–Theory	3	1	4
BP203T	Biochemistry– Theory	3	1	4
BP204T	Pathophysiology– Theory	3	1	4
BP205T	ComputerApplicationsinPharmacy–Theory	3	-	3
BP206T	Environmentalsciences– Theory	3	-	3
BP207P	HumanAnatomyandPhysiologyII–Practical	4	-	2
BP208P	PharmaceuticalOrganicChemistryI–Practical	4	-	2
BP209P	Biochemistry– Practical	4	-	2
BP210P	ComputerApplications inPharmacy–Practical	2	-	1
Total		**32**	**4**	**29**

Table-III:CourseofstudyforSemesterIII

Coursecode	Nameofthecourse	No. ofhours	Tutorial	Creditpoints
BP301T	PharmaceuticalOrganicChemistryII–Theory	3	1	4
BP302T	PhysicalPharmaceuticsI–Theory	3	1	4
BP303T	PharmaceuticalMicrobiology–Theory	3	1	4
BP304T	PharmaceuticalEngineering–Theory	3	1	4
BP305P	PharmaceuticalOrganicChemistryII– Practical	4	-	2
BP306P	PhysicalPharmaceutics I –Practical	4	-	2
BP307P	PharmaceuticalMicrobiology–Practical	4	-	2
BP308P	PharmaceuticalEngineering–Practical	4	-	2
Total		**28**	**4**	**24**

Table-IV:CourseofstudyforSemesterIV

Coursecode	Nameofthecourse	No. ofhours	Tutorial	Creditpoints
BP401T	PharmaceuticalOrganicChemistryIII– Theory	3	1	4
BP402T	MedicinalChemistryI –Theory	3	1	4
BP403T	PhysicalPharmaceuticsII–Theory	3	1	4
BP404T	PharmacologyI–Theory	3	1	4
BP405T	PharmacognosyandPhytochemistryI–Theory	3	1	4
BP406P	MedicinalChemistryI –Practical	4	-	2
BP407P	PhysicalPharmaceuticsII–Practical	4		2
BP408P	PharmacologyI –Practical	4	-	2
BP409P	PharmacognosyandPhytochemistryI–Practical	4	-	2
Total		**31**	**5**	**28**

Table-V:CourseofstudyforSemesterV

Coursecode	Nameofthecourse	No.of hours	Tutorial	Creditpoints
BP501T	MedicinalChemistryII –Theory	3	1	4
BP502T	IndustrialPharmacyI– Theory	3	1	4
BP503T	PharmacologyII–Theory	3	1	4
BP504T	PharmacognosyandPhytochemistryII–Theory	3	1	4
BP505T	PharmaceuticalJurisprudence– Theory	3	1	4
BP506P	IndustrialPharmacyI–Practical	4	-	2
BP507P	PharmacologyII –Practical	4	-	2
BP508P	PharmacognosyandPhytochemistryII– Practical	4	-	2
Total		**27**	**5**	**26**

Table-VI:CourseofstudyforSemesterVI

Coursecode	Nameofthecourse	No.of hours	Tutorial	Creditpoints
BP601T	MedicinalChemistryIII–Theory	3	1	4
BP602T	PharmacologyIII– Theory	3	1	4
BP603T	HerbalDrugTechnology–Theory	3	1	4
BP604T	BiopharmaceuticsandPharmacokinetics – Theory	3	1	4
BP605T	PharmaceuticalBiotechnology–Theory	3	1	4
BP606T	Quality Assurance–Theory	3	1	4
BP607P	MedicinalchemistryIII –Practical	4	-	2
BP608P	PharmacologyIII–Practical	4	-	2
BP609P	HerbalDrugTechnology–Practical	4	-	2
Total		**30**	**6**	**30**

Table-VII:CourseofstudyforSemesterVII

Coursecode	Nameofthecourse	No.of hours	Tutorial	Creditpoints
BP701T	InstrumentalMethodsof Analysis–Theory	3	1	4
BP702T	IndustrialPharmacyII–Theory	3	1	4
BP703T	PharmacyPractice–Theory	3	1	4
BP704T	NovelDrugDeliverySystem–Theory	3	1	4
BP705P	InstrumentalMethods ofAnalysis–Practical	4	-	2
BP706PS	PracticeSchool	12	-	6
Total		**28**	**5**	**24**

Table-VIII:CourseofstudyforSemesterVIII

Coursecode	Nameofthecourse	No.of hours	Tutorial	Creditpoints
BP801T	Biostatistics andResearchMethodology	3	1	4
BP802T	SocialandPreventivePharmacy	3	1	4
BP803ET-BP813ET	ElectiveI*+ElectiveII*	3+3	1+1	4+4
BP813PW	Project Work	12	-	6
Total		**24**	**4**	**22**

*StudentsmayselectanytwoelectivesfromthoselistedintheSyllabus.

Program Outcomes (PO)

PO 1: Pharmacy Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.

PO 2: Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO 3: Problem analysis: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

PO 4: Modern tool usage: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO 5: Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.

PO 6: Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

PO 7: Pharmaceutical Ethics: Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO 8: Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO 9: The Pharmacist and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO 10: Environment and sustainability: Understand the impact of professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 11: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self- assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

SEMESTER

IBP101T

HUMANANATOMYANDPHYSIOLOGY-I(Theory) 45Hours

CourseObjectives:

Toimpartfundamentalknowledgeon theanatomy,physiology,and functionsofthevarioussystemsofthehumanbody.

CourseOutcomes:

Thelearnershouldbeableto:

1. Explainthegross morphology,structure,andfunctionsofvariousorgansofthehumanbodywithrespecttothelevelsof

organisationandcommunication

2. Explainthevarioushomeostaticmechanismsandtheirimbalancesofthelymphatic,nervousandcardiovascularsystemsinrelationtotheknowledgeof thepathophysiologyofdiseases.
3. Discussthe composition and functionsof blood,explain the processofhaemostasis,and correlate theknowledgetohaematologicaldisorders.
4. Understandcoordinatedworkingpatternof differentmusclesandorgansofeachsystem.

MappingCO-PO:

BP101T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	2	-	3	-	2	3	-	3
CO2	3	2	2	2	-	3	-	2	3	-	3
CO3	3	2	2	2	-	3	-	2	3	-	3
CO4	3	2	2	2	-	3	-	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours
1	Introductiontohumanbody • Definitionandscopeofanatomyandphysiology • Levelsofstructuralorganizationandbodysystems • Basiclifeprocesses,homeostasis	**1**
2	Cellular leveloforganization • Structureandfunctionsofcell • Transportacrosscellmembrane,celldivision,celljunctions • Generalprinciplesofcellcommunication:intracellularsignalingpathwayactivationextracellularsignalmolecule,Formsofintracellularsignaling: a) Contact-dependentbyb)Paracrinec)Synapticd)Endocrine	**2**
3	Tissuelevelof organization • Structuralandfunctionalcharacteristics offollowingtissues:Epithelial,Connective,Nervous,Muscle	**2**
4	Integumentarysystem • Structureandfunctionsofskin	**2**

5	SkeletalsystemandJoints • Divisions ofskeletalsystem • Typesofbone, salientfeatures,andfunctionsofbones • Organizationofskeletalmuscle • Physiologyofmusclecontraction,neuromuscularjunction • Structuralandfunctionalclassificationofjoints • Typesofjointsmovementsanditsarticulation	**8**
6	Bodyfluidsandblood	**6**

	• Bodyfluids • Compositionandfunctionsofblood • Hemopoeisis,formationofhaemoglobin,anaemia • Mechanismsofcoagulation • Bloodgrouping,Rhfactors,transfusion,its significance • Leucopoiesis • Immunity:Basicsandtypes • Disorders ofblood,reticuloendothelialsystem	
7	Lymphaticsystem • Components andfunctionsoflymphaticsystem • Lymphaticorgansandtissues • Organizationoflymphvessels • Formationandflowof lymph	**3**
8	PeripheralNervous System • Classificationofperipheralnervoussystem • Structureandfunctionsofsympatheticandparasympatheticnervoussyst em • Originandfunctionsofspinalandcranialnerves • Methodstomeasureelectricalactivityofbrain	**9**
9	StructureandFunction offollowingsensoryorgansandtheirdisorders: • Eye • Ear • Tongue • Nose	**5**
10	Cardiovascular system • Functionalanatomyofheart • Conductingsystemofheart,Cardiaccycle,Electrocardiogram(ECG) • Physiologyofbloodcirculation,Functionalanatomyofbloodvessels • Blood pressure and factors regulating blood pressure, baroreceptors,chemoreceptors,vasomotorcentre, humoralandneuronalcontrolofbloodpressureandcirculationdisordersof heart.	**7**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. WaughA,andGrantA,Ross&Wilson,Anatomy&PhysiologyinHealth&Illness,9th edition,ChurchillLivingstone,NewYork,2001.
2. TortoraG.J.&DerricksonB,PrincipalsofAnatomy&Physiology,15th edition,JohnWileyandSons,Inc.,NewJersey,2016
3. GuytonA.C.,HallJ.E.,TextbookofMedicalPhysiology,12th edition,W.B.SaundersCompany,USA/PrismBooksLtd.India,2010.
4. MackennaB.R.&Callander R.,McNaught&Callander's,IllustratedPhysiology, 5th editionChurchillLivingstone,NewYork,2012.

5. Kaplan,Jack,Opheim,Toivola,Lyon,ClinicalChemistry:Interpretation&Techniques,4th editionLippincott,William sandWilkins,USA,1995.
6. GodkarP.B.,Godkar,D.P.,TextbookofMedicalLaboratoryTechnology,3rd edition,BhalaniPublish ingHouse,Mumbai,India,2014.
7. MohanH,TextbookofPathology,6th edition,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi,201 0.
8. Chatterjee,C.C.,HumanPhysiology(vol1and2),11th edition,CBSPublishersandDistributors,Kolkata., 2017.

BP102T

PHARMACEUTICALANALYSIS(Theory) 45 Hours

CourseObjectives:

Thiscoursedealswiththefundamentalsofanalyticalchemistryandprinciplesofelectrochemicalanalysisofdrugs.

CourseOutcomes:

Uponcompletionof thecoursestudentshallbeableto:

1.Analyse the different techniques used in pharmaceutical analysis, evaluate sources of errors in analytical chemistry and propose effective methods to minimise errors.

2.Understand the principle, techniques, and applications of volumetric titrations.

3.Comprehend the fundamental principles and steps involved in gravimetric analysis

4.Comprehend the fundamental principles, instrumentation, and various titration methods related to electrochemical techniques.

5.Apply mathematical concepts to solve numerical related to pharmaceutical analysis and including volumetric, gravimetric, and electrochemical analysis.

MappingCO-PO:

BP102T ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	1	-	3	3	1	3	-	3
CO2	3	2	3	1	-	3	3	1	3	1	3
CO3	3	2	3	1	-	3	3	1	3	1	3
CO4	3	2	3	1	-	3	3	1	3	-	3
CO5	3	3	3	1	-	3	3	1	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak), no correlation–

Unit	Details	Hours

1	(a) **Pharmaceuticalanalysis**-Definitionandscope i) Differenttechniquesofanalysis(InstrumentalandNon-Instrumental). ii) Methodsofexpressingconcentration-Molarity,Molality,percentconcentration,ppm,ppb,Normality,Numericals. iii) Primaryandsecondarystandards. iv) Preparation and standardization of various molar and normal solutions-Oxalic acid,sodium hydroxide,hydrochloric acid,sodium thiosulphate,sulphuricacid,potassiumpermanganateandceric ammoniumsulphate. (b) **Errors:** Sources of errors, types of errors, methods of minimizing errors,accuracy, precision, Concepts and numerical of Mean, Median, Standarddeviation,RelativestandarddeviationandSignificantfigures. (c) **Pharmacopoeia**–IntroductiontoPharmacopoeialmonographsandtheir significance (relevance of all the tests to be discussed), Sources ofimpuritiesinmedicinalagents,limittests.	**10**
2	(a) **Titrations**(Theoreticalterms)-Titrimetricanalysis,Titrant,Titrand,Theoretical end point or equivalence point, End point of titration, Titrationerror,Conditionsfortitrimetricanalysis,Classificationofreactionsfortitrimetric analysis. (b) Law of Mass Action, Equilibrium Constant, pH, pKa, pKb, hydrolysis ofsalts,Buffersolutions,BufferCapacity,Numericals forpHcalculation. (c) **Acid base titration**: Theories of acid base indicators (Ostwald's theory,Resonancetheory),Mixedindicators,conceptofrangeofindicators,Choice of indicators; Classification of acid base titrations and theory involved intitrationsofstrong,weak,andveryweakacidsandbases,Neutralization	**10**
	curves;Methodsoftitration(Directtitration,backtitration,blankdetermination,Factorcalculationforassays);Assayof benzoicacid. (d)**Nonaqueoustitration**:Solvents(aprotic,protophilic,protogenic,amphiprotic), characteristics of solvents for non-aqueous titrations (acid-basecharacter,dielectricconstant,levelinganddifferentiatingeffect), Indicators for non-aqueous titrations, Acidimetry and alkalimetry titrationandestimationof SodiumbenzoateandEphedrineHCl.	

3	(a) **Precipitation titrations**: Common Ion Effect, Solubility Product, Factorsaffecting solubility of precipitates, Fractional precipitation; Mohr's method,Volhard's, Modified Volhard's, Fajans method, Standardization of silvernitrate,Estimationofsodiumchloride. (b) **Complexometrictitration**:Terms-Complex,Complexingagents(Complexones), Chelate, Ligand, Co-ordination number, Chelating agent,Sequesteringagent,Metal-ligandcomplex;Formationsofcomplexes;Classification (Direct method, back titration, replacement titration), Metalion indicators (pM indicators), masking and demasking reagents, estimationof Magnesium sulphate, and calcium gluconate, Determination of mixture oflead,zinc andmagnesium inasample. (c) **Gravimetry**: Principle and steps involved in gravimetric analysis, Organicand inorganic precipitants, Purity of the precipitate:co-precipitation andpostprecipitation,Ostwald'sripening,Degreeofsupersaturation(VonWeimarn ratio), Estimation of barium sulphate, Assay of Aluminium byoxinereagent. (d) **Nitritetitrations**:BasicPrinciples,methodsandapplicationofdiazotisationtitration,Conceptofexternalindicator,AssayofSulphacetamidesodium.	**10**
4	**(a) Redoxtitrations** i) Concepts of oxidation and reduction - Oxidising and reducing agents,Standard reduction potential, Nernst equation, Redox titration curve andEquivalencepoint. ii) Typesofredoxtitrations(Principle,Titrants,IndicatorsandApplication)– Permanganometry(Assayofhydrogenperoxide),Cerimetry(AssayofParacetamolandDriedFerroussulphate),Iodimetry (Assay of Ascorbic acid API), Iodometry (Assay of potassiumpermanganate), Bromatometry (Assay of Isoniazid), Dichrometry (Iron),Titrationwithpotassiumiodate(AssayofPotassiumiodide).	**8**
5	**(a) Electrochemicalmethodsofanalysis** i) **Conductometry-** Introduction,Conductivitycell,Conductometrictitrations,applications. ii) **Potentiometry-** Electrochemicalcell,constructionandworkingofreference(Standardhydrogen,silverchlorideelectrodeandcalomelelectrode)andindicatorelectrodes(metalelectrodesandglasselectrode), methods to determine end point of potentiometric titration(aqueous acid-base titrations -Strong acid vs strong base, strong acid vsweak base, weak acid vs strong base, weak acid vs weak base) andapplications. iii) **Polarography**-Principle,Ilkovicequation,constructionandworking	**7**
	of dropping mercury electrode and rotating platinum electrode, Current-Voltagecurve(Polarogram),supportingelectrolyte,Oxygenwave,polarographicmaxima,factorsaffectinglimitingcurrent,halfwavepotential, applications, Pulse polarography-Normal pulse polarography,Differentialpulsepolarographyandsquarewavepolarography	
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Beckett,A.H.AndJ.B.Stenlake.PracticalPharmaceuticalChemistry:PartIand

II,CBSPublishersandDistributors,India.

2. G.D.Christian, AnalyticalChemistry, 6th edition, JohnWiley&Sons,Singapore, reprintbyWileyIndiaPvt.Ltd,2003.
3. Connors, K. A., A Textbook of Pharmaceutical Analysis,3rd edition,John Wiley and Sons,Canada,2007.
4. Skoog, D. A., F. J. Holler and S. R. Crouch. Principles of Instrumental Analysis, 6th edition, BrooksCole,2006
5. Skoog,D.A., andD.M.West.FundamentalsofAnalyticalChemistry,7thedition,BrooksCole,USA,1995.
6. Watson,D.G. PharmaceuticalAnalysis: A Textbook forPharmacy Studentsand PharmaceuticalChemists,ElsevierHealthSciences,London.
7. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, B. Sivasankar, Vogel's Textbook ofQuantitativeChemicalAnalysis,6thedition,PearsonEducation,NewDelhi,2009.
8. Kar,A.PharmaceuticalDrugAnalysis,NewAgeInternationalIndia.
9. MahajanS.S.InstrumentalMethodsofAnalysis,PopularPrakashanPvt Ltd, India.
10. Chatwal,G.R.,andM.Arora.AnalyticalChemistry,HimalayaPublishingHouse.
11. IndianPharmacopoeia, IndianPharmacopoeiaCommission,India.
12. Willard,H.H.,L.Merritt,F.SettleandJ.A.Dean.InstrumentalMethodsofAnalysis,CBSPublishers&Distributors, India.
13. Ewing,G.W.InstrumentalMethodsofChemicalAnalysis,Mcgraw-HillBookCompany,NewYork.
14. Robinson,J.W.,E.M.S.FrameandG.M.Frame.UndergraduateInstrumentalAnalysis,SkellyFrameandG.M.FrameII,Publication.
15. Kellner,R.,J.M.Mermet,M.Otto,M.ValcárcelandH.M.Widmer.AnalyticalChemistry,JohnWiley&SonsAustralia, Limited.

BP103T

PHARMACEUTICS-I(Theory) 45Hours

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

Course Outcomes:

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

1. Know the history of profession of pharmacy, official compendia and different types of dosage forms.
2. Employ the knowledge of pharmaceutical calculations, pharmaceutical incompatibilities, parts and errors in prescription and posology for handling the prescription and dispensing of medications.
3. Summarize and compare the different formulation and evaluation aspects of pharmaceutical powders, monophasic liquids, biphasic systems, suppositories, and semisolids.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	1	1	3	3	1	2	1	3
CO2	3	1	3	2	1	3	3	2	3	1	3
CO3	3	1	3	2	1	2	2	1	1	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours
1	**Historical background and development of profession of pharmacy**: History ofprofession of Pharmacy in India in relation to pharmacy education, industry andorganization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USPandExtra Pharmacopoeia. **Dosage forms:** Introduction to dosage forms, classification, and definitions**Prescription:**Definition,Partsofprescription,handlingofPrescriptionandErrorsinprescription. **Posology:**Definition,Factorsaffectingposology.Pediatricdosecalculationsbasedonage, bodyweightandbodysurfacearea.	10
2	**Pharmaceutical calculations**: Weights and measures – Imperial & Metric system,Calculations involving percentage solutions,alligation,proof spiritand isotonicsolutionsbasedonfreezingpointandmolecularweight. **Powders:**Definition,classification,advantagesanddisadvantages,Simple&compound powders– officialpreparations,dustingpowders,effervescent,efflorescent,andhygroscopicpowders,eutecticmixtures.Geometricdilutions. **Liquiddosageforms:**Advantagesanddisadvantagesofliquiddosageforms. Excipientsusedin formulationofliquiddosage forms.Solubilityenhancementtechniques	10
3	**Monophasicliquids:**DefinitionsandpreparationsofGargles,Mouthwashes,ThroatPaint,Eardrops,Nasaldrops,Enemas,Syrups,Elixirs,LinimentsandLotions. **Biphasicliquids:** **Suspensions:** Definition, advantages and disadvantages, classifications, Preparationof suspensions; Flocculated and Deflocculated suspension & stability problems andmethodstoovercome. **Emulsions:** Definition, classification, emulsifying agents, tests for identification oftypeofEmulsion,Methodsofpreparation,stabilityproblemsandmethodsto Overcome	9
4	**Suppositories**: Definition,types,advantages and disadvantages,types of bases,methodsofpreparations.Displacementvalue&itscalculations,evaluationofsuppositories. **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical,andtherapeuticincompatibilitieswithexamples.	9
5	**Semisoliddosageforms:**Definitions,classification,mechanisms,andfactorsinfluencing dermal penetration of drugs. Preparation of ointments, pastes, creams,andgels.Excipientsusedinsemisoliddosageforms.Evaluationofsemisolid	7
	dosagesforms	
	TOTAL	**45**

ReferenceBooks(LatestEditionstobe adopted):

1. Ansel H.C., Allen L.V., Pharmaceutical Dosage Forms and Drug Delivery Systems, 10th edition,LippincottWilliamsandWalkins,USA,2014.
2. CarterS.J.,CooperandGunn's-DispensingforPharmaceuticalStudents,12th edition,CBSPublishersandDistributors,NewDelhi,2008.
3. Taylor,K.,AultonM.E.,Pharmaceutics:TheScienceofDosageFormDesign,2nd edition,ChurchillLivingstone,Edinburgh,2001.

4. IndianPharmacopoeia.
5. British Pharmacopoeia.
6. Lachman,L,LiebermanH.A.,Kanig,J.L.,TheTheory andPracticeofIndustrialPharmacy,1st edition,Lea&Febiger,Philadelphia,1986
7. Khar, R.K., Vyas, S.P., Ahmad F.J., Jain G.K., Lieberman, Lachman's - The Theory andPractice of Industrial Pharmacy, 4th edition, CBS Publishers and Distributors,New Delhi,2020.
8. Gennaro A.R., Remington : The Science and Practice of Pharmacy, 21st edition, LippincottWilliamsandWilkins,Philadelphia,2005.
9. CarterS.J.,CooperandGunn's.TutorialPharmacy,6thedition,CBSPublishersandDistributorsPvt.Ltd,Delhi,2005.
10. RawlinsE.A., Bentley'sTextbookofPharmaceutics,8thedition, ElsevierIndia,2010.
11. Ghebre-Sellassie I., Pharmaceutical Pelletization Technology, 1st edition, Marcel Dekker, Inc.,New York,1990
12. Parikh D.M., Handbook of Pharmaceutical Granulation Technology,1stedition,MarcelDekker,Inc.,NewYork,1997.
13. NieloudFandGilberteM.,PharmaceuticalEmulsionsandSuspensions,1stedition,MarcelDekker,Inc.,NewYork,2000.

BP104T

PHARMACEUTICAL INORGANICCHEMISTRY(Theory) 45Hours

CourseObjectives:
Thissubjectdealswiththemonographsof inorganicdrugsandpharmaceuticals.

CourseOutcomes:
Uponcompletionofthecoursethestudentshallbeableto:

1. **Explain** the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
2. **Apply** knowledge of major physiological ions and their functions, including the use of electrolytes such as sodium chloride, potassium chloride, calcium gluconate, and ORS in replacement therapy. Analyze the principles of physiological acid-base balance, considering various clinical scenarios and therapeutic applications.
3. **Understanding** of dental products, including dentifrices and desensitizing agents, and analyze the role of fluoride in treating dental caries. Evaluate the properties and applications of specific dental agents such as calcium carbonate, sodium fluoride, and zinc eugenol cement in dental care.
4. **Apply** knowledge and analyze the mechanisms of action, interactions, and potential side effects of antacids, and critically assess their effectiveness in managing gastrointestinal disorders, using appropriate antacids, acidifiers, cathartics, antimicrobial agents.
5. **Understand and Apply knowledge** of expectorants, emetics, haematinics, poisons, antidotes, and astringents, including the mechanisms of action, dosages, potential side effects, and therapeutic applications of specific substances, in pharmaceutical scenarios.
6. **Understand and Apply knowledge** of radioactivity, including the measurement of radioactivity and the properties of α, β, and γ radiations, to assess the characteristics and behaviour of radioactive substances.

MappingCO-PO:

BP104T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11

CO1	3	1	2	-	-	1	1	2	1	-	2
CO2	3	-	2	-	-	1	1	2	2	-	1
CO3	3	-	3	-	-	2	-	2	2	-	1
CO4	3	-	2	-	-	2	2	1	2	-	1
CO5	3	2	2	-	-	2	2	2	1	-	2
CO6	2	-	2	1	-	1	-	1	1	1	1

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak), no correlation –

Unit	Details	Hours
1	**Impuritiesinpharmaceuticalsubstances:**HistoryofPharmacopoeia,Sourcesandtypes ofimpurities,principleinvolvedinthe limittestforChloride,Sulphate,Iron,Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate**Generalmethodsofpreparation**,assayforthecompoundssuperscriptedwith **asterisk(*),**propertiesandmedicinalusesofinorganiccompoundsbelongingto	**10**
	thefollowingclasses.	
2	**Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffersinpharmaceuticalsystems,preparation,stability,bufferedisotonicsolutions,mea surementsoftonicity,calculations,and methodsofadjustingisotonicity. **1. Major extra and intracellular electrolytes**: Functions of major physiologicalions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassiumchloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acidbasebalance. **2. Dentalproducts**:Dentifrices,roleoffluorideinthetreatmentofdentalcaries,Desensiti zing agents,Calcium carbonate,Sodium fluoride,and Zinceugenolcement.	**10**
3	**Gastrointestinalagents** **Acidifiers:**Ammoniumchloride*anddil.HCl **Antacid:** Ideal propertiesof antacids,combinationsof antacids,SodiumBicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture.**Cathartics:** Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite**Antimicrobials**:Mechanism,classification,Potassiumpermanganate,Borica cid, Hydrogenperoxide*,Chlorinatedlime*,Iodineanditspreparations.	**10**
4	**Miscellaneouscompounds** **Expectorants:** Potassium iodide, Ammonium chloride*.**Emetics**: Copper sulphate*, Sodium potassium tartarate**Haematinics:**Ferrous sulphate*,Ferrousgluconate **PoisonandAntidote:** Sodiumthiosulphate*,Activatedcharcoal, Sodiumnitrite **Astringents**:ZincSulphate,PotashAlum	**8**

5	**Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α,β,γ radiations, Half-life, radioisotopes and study of radioisotopes-Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.	7
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. BeckettA.H.,StenlakeJ.B.,Practical PharmaceuticalChemistry,Vol.I&II,2nd edition,AthlonePress,Universityof London,London,1970.
2. Vogel A.I., Textbook of Quantitative InorganicAnalysis,2nd edition, Longman Green and Co., London,1951.
3. GunduRaoP.,InorganicPharmaceuticalChemistry,1st edition,VallabhPrakashan,Delhi,India,2013.
4. BentleyAO,AtherdenLM,DriverJE,TextbookofPharmaceuticalChemistry,4thedition,OxfordUniversityPress,London,NewYork,andToronto,1945.
5. KennedyJ.H.,PrinciplesofAnalyticalChemistry,2nd edition,Saunders CollegePublishing,USA,1990.
6. IndianPharmacopoeia.

BP105T
COMMUNICATIONSKILLS(Theory) 30Hours

CourseObjectives:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists,physiotherapists, and other health workers. At the end of this course the student will get the soft skills set toworkcohesivelywiththeteamasateamplayerandwilladdvaluetothepharmaceutical business.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeable to:

1. Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceuticaloperation
2. Communicateeffectively(VerbalandNon-verbal)
3. Effectivelymanagetheteamasateamplayer
4. Developinterviewskills
5. DevelopLeadershipqualitiesandessentials

Unit	Details	Hours
1	**CommunicationSkills:**Introduction,Definition,TheImportanceofCommunication, The Communication Process – Source, Message, Encoding,Channel,Decoding,Receiver,Feedback,Context. **1. Barrierstocommunication:**PhysiologicalBarriers,PhysicalBarriers,Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers,PsychologicalBarriers,Emotionalbarriers. **2. PerspectivesinCommunication:**Introduction,VisualPerception,Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings,Environment.	7

2	**1.ElementsofCommunication:**Introduction,FacetoFaceCommunication-Tone of Voice, Body Language (Non-verbal communication), VerbalCommunication,PhysicalCommunicationforeach-DirectCommunicationStyle,Spirited Communication Style,Systematic Communication Style,ConsiderateCommunicationStyle.	7
3	**BasicListeningSkills:**Introduction,Self-Awareness,ActiveListening,BecominganActiveListener,ListeninginDifficultSituations. **1. Effective Written Communication:** Introduction, When and When Not toUse Written Communication - Complexity of the Topic, Amount of Discussion'Required,ShadesofMeaning,FormalCommunication. **2. Writing Effectively:** Subject Lines, Put the Main Point First, Know YourAudience,OrganizationoftheMessage.	7
4	**InterviewSkills:**Purposeofaninterview,Do's andDon'tsofaninterview **1. GivingPresentations:**Dealing with Fears,planning yourPresentation,StructuringYourPresentation,DeliveringYour Presentation,TechniquesofDelivery.	5
5	**GroupDiscussion:**Introduction,Communicationskillsin groupdiscussion,Do'sandDon'tsofgroupdiscussion.	4
	TOTAL	30

ReferenceBooks(LatestEditionstobeadopted):

1. RutherFoord A.J.,Basic Communication Skillsfor Technology,2nd Edition,Pearson Education,Delhi,2011
2. SanjayKumar,Pushp lata,Communicationskills,2ndEdition,OxfordPress,Lucknow2015.
3. RobbinsS.P.,OrganizationalBehaviour,1stEdition,Pearson,SanDiego,USA,2013.
4. HassonG.,Brilliant-Communicationskills,1stEdition,PearsonLife,UK,2011
5. GopalaS.W.,TheAceofSoftSkills:Attitude,CommunicationandEtiquetteforsuccess,5thEdition,PearsonEducation,Delhi,2013.
6. Dalley D,Burton Lois,Greenhall M.,Developing yourinfluencing skills,1stEdition Universe ofLearningLtd,Manchester,UnitedKingdom,2010.
7. Konar N., Communication skills for Professionals, 2nd Edition, New arrivals –PHI Learning Pvt.Ltd,NewDelhi,2011.
8. Mitra,B.K.,Personalitydevelopmentandsoft skills,1stEdition,OxfordPress,Lucknow,2011.
9. ButterField,J.,Softskillforeveryone,1stEdition,CengageLearningIndiaPvt.Ltd,NewDelhi,2011.
10. FrancisPetersSJ,Softskillsandprofessionalcommunication,1stEdition, McGrawHillEducation,New York,2011.
11. AdairJohn,Effectivecommunication,4thEdition,PanMacMillan,2009.
12. DanielsA.C,Bringingoutthebestinpeople,2ndEdition,McGrawHillEducation,NewYork,1999.

BP106RBT

RemedialBiology(Theory) 30 Hours

CourseObjectives:

Togetthelearneracquaintedwiththefacetsofbiologyintheplant andanimal kingdom.

CourseOutcomes:

Thelearnershouldbeableto:

1. Understandtheclassificationandfeaturesofplantandanimalkingdom.
2. Knowtheanatomyandphysiologyofplants.
3. Appreciatetheanatomy&physiologyinanimalsespeciallythehumanbody

BP106RBT *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	-	-	-	1	-	2	1	1
CO2	3	1	2	-	-	-	1	-	2	1	1
CO3	3	2	2	-	2	-	2	1	2	1	1

Unit	Details	Hours
	Livingworld: • Definitionandcharactersof living organism • Diversityinthelivingworld • Binomialnomenclature • Five kingdoms of life and basis of classification. Salient features ofMonera,Potista, Fungi,AnimaliaandPlantae,Virus	**5**
2	MorphologyofFloweringplants • Morphologyofdifferentpartsoffloweringplants– Root,stem,inflorescence,flower,leaf,fruit,seed • GeneralAnatomyofroot,stem, leafof monocotyledons&dicotylidones	**2**
3	Bodyfluidsandcirculation • Compositionofblood,bloodgroups,coagulationofblood • CompositionandfunctionsoflymphH umancirculatorysystem • Structureofhumanheartandblood vessels	**7**
	• Cardiac cycle, cardiac output, and ECGDigestionandAbsorption • Humanalimentarycanalanddigestiveglands • Roleof digestiveenzymes • Digestion,absorption, andassimilationof digestedfoodBreathingandrespiration • Humanrespiratorysystem • Mechanismofbreathinganditsregulation • Exchangeofgases,transportofgasesandregulationofrespiration • Respiratoryvolumes	

4	Excretoryproductsandtheirelimination • Modesofexcretion • Humanexcretorysystem- structureandfunction • Urineformation • Renninangiotensinsystem • Neural control and coordinationDefinitionandclassificationofnerv ous system • Structureof aneuron • Generationandconductionofnerveimpulse • Structureofbrainandspinalcord • Functionsofcerebrum,cerebellum,hypothalamusandmedullaoblongataChe micalcoordinationandregulation Endocrineglandsandtheirsecretions • FunctionsofhormonessecretedbyendocrineglandsHu manreproduction • Partsoffemalereproductivesystem • Partsofmalereproductivesystem • SpermatogenesisandOogenesis • Menstrualcycle	**7**
5	Plantsandmineralnutrition • Essentialmineral,macro,andmicronutrients. • Nitrogenmetabolism,Nitrogencycle,biologicalnitrogenfixation.Ph otosynthesis • Autotrophic nutrition,photosynthesis,Photosyntheticpigments,Factorsaffectingphotosy nthesis.	**5**
6	Plantrespiration • Respiration, glycolysis, fermentation (anaerobic)Plantgrowthanddevelopment. • Phases and rate of plant growth, condition of growth, introduction to plantgrowthregulators. Cell:Theunitoflife • Structure and functions of cell and cell organelle, cell divisionTissues • Definition,typesoftissues,location,andfunctions.	**4**
	TOTAL	**30**

Referencebooks(LatestEditionstobeadopted):

1. Gokhale S.B, Kalaskar M.G, Kulkarni Y.A, Remedial Biology (Pharmaceutical Biology), 1st edition,NiraliPrakashan,Pune,2017.
2. Seetharam P.L, Thulajappa Y, Chavan R.R, Textbook of Biology,1st edition, Expert EducationalPublishers,Bangalore,1995.
3. NaiduB.V.S,RenukumarB.M,TextbookofBiology,1st edition,SriRenukaPublications,Davang ere,1972.
4. NaiduB.V.S,MurthyP.K,TextbookofBiology,1st edition,PrakashSahithye,Bangalore,1972.
5. DuttaA.C,BotanyforDegreestudents,6th edition,MKMPublishersPvt.Ltd,NewDelhi,1998.
6. AyyarE.K; TN Anathakrishnan,A Manual ofZoology,5th edition,S.Viswanathan Pvt.Ltd,Madras,1992.

7. GokhaleS.B,KalaskarM.G,KulkarniY.A,APracticalbookofRemedialBiology,1st edition,NiraliPrakashan,Pune,2018.

BP106RMT

REMEDIALMATHEMATICS(Theory) 30Hours

CourseObjectives:

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

CourseOutcomes:

Uponcompletionofthecoursethestudentshallbeable to:

1. KnowthetheoryandtheirapplicationinPharmacy
2. Solvethedifferenttypesofproblemsbyapplyingtheory
3. AppreciatetheimportantapplicationofmathematicsinPharmacy

BP106RMT *Course Outcomes*	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	3	1	-	-	-	-	1	-	3
CO2	3	2	3	1	-	-	-	-	1	-	3
CO3	3	2	3	1	-	-	-	-	1	-	3

Unit	Details	Hours
1	**Partial fraction** Introduction, Polynomial, Rational fractions, Proper and Improperfractions,Partialfraction,ResolvingintoPartialfraction,ApplicationofPartialFractioninChemicalKineticsandPharmacokinetics. **1. Logarithms** Introduction,Definition,Theorems/Propertiesoflogarithms,Commonlogarithms,CharacteristicandMantissa,workedexamples,applicationoflogarithm tosolvepharmaceuticalproblems. ***2.*** **Function***:* RealValuedfunction,Classificationofrealvaluedfunctions, **3. Limits and continuity**: Introduction, Limit of a function, Definition of limit of afunction(ε-δdefinition), $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$,	6
2	**MatricesandDeterminant:** Introductionmatrices,Typesofmatrices,Operationonmatrices,Transpose ofamatrix, Matrix Multiplication, Determinants, Properties of determinants , Product ofdeterminants,Minorsandco-Factors, Adjointoradjugateofa squarematrix,Singular andnon-singularmatrices,Inverseofamatrix,Solutionofsystemoflinearofequationsusingmatrixmethod,Cramer'srule,Characteristicequationandrootsofa	6
	squarematrix,Cayley–Hamiltontheorem,ApplicationofMatricesinsolvingPharmacokineticequations.	

3	**Calculus** **Differentiation**: Introductions, Derivative of a function, Derivative of a constant,Derivative of a productof aconstantand afunction ,Derivative of the sum ordifferenceoftwo functions,Derivative ofthe productoftwofunctions(productformula), Derivative of the quotient of two functions (Quotient formula) – **WithoutProof**, Derivative of x^n*w.r.t* x, where *n* is any rational number, Derivative of e^x,Derivative of $\log_e x$, Derivative of a^x,Derivative of trigonometric functionsfromfirst principles **(without Proof)**, Successive Differentiation, Conditions for a functiontobeamaximumoraminimumatapoint.Application.	**6**
4	**AnalyticalGeometry** **Introduction:**SignsoftheCoordinates,Distanceformula, **Straight Line**: Slope or gradient of a straight line, Conditions for parallelism andperpendicularity of two lines, Slope of a line joining two points, Slope – interceptformof astraightline. **Integration:**Introduction,Definition,Standardformulae,Rulesofintegration,Method of substitution,Method of Partial fractions,Integration by parts, definiteintegrals,application.	**6**
5	**DifferentialEquations**:Somebasicdefinitions,Orderanddegree,Equationsinseparableform,Homogeneousequations,LinearDifferentialequations,Exactequations,**Applicationinsolving Pharmacokineticequations.** **1. Laplace Transform**: Introduction, Definition, Properties of Laplace transform,Laplace Transformsof elementary functions,Inverse Laplace transforms,Laplacetransformofderivatives,ApplicationtosolveLineardifferentialequations, **ApplicationinsolvingChemicalkineticsandPharmacokinetics equations.**	**6**
	TOTAL	**30**

ReferenceBooks(LatestEditionstobeadopted):

1. Shanti Narayan,MittalP.K,Differential Calculus,revisededition,S.Chand andCo.Pvt.Ltd,NewDelhi,2013.
2. PanchaksharappaGowdaD.H,PharmaceuticalMathematicswithapplicationtoPharmacy,1st Edition,PharmaMedPress,2014
3. ShantiNarayan,MittalP.K,IntegralCalculus,11th edition,S.ChandandCo.Pvt.Ltd,2013.
4. GrewalB.S, HigherEngineeringMathematics,44th edition,KhannaPublishers,NewDelhi,2020.

BP107P

HumanAnatomyandPhysiology(Practical)

CourseObjectives:

Togetthelearneracquaintedwiththediagnosticmethodsemployedindetectionofthepathologyofsomediseasestates.

CourseOutcomes

Thelearnershouldbeableto:

1. Performhematologytests,recordtheheartrate,pulseandbloodpressureandrelatetheresultswithclinicalconditions.
2. Identifyandpostulatethepositionof thebonesinhumanskeleton.
3. Identifyanddescribethevariousbodytissuesandorgansbasedonthestructureandorganizationofcells.

MappingCO-PO:

BP107P *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	2	2	3	3	2	3	-	3
CO2	3	3	3	2	2	3	3	2	3	-	3
CO3	3	3	3	2	2	3	3	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details
1	Studyofcompoundmicroscope.
2	Microscopicstudyofpermanent slidesoftissues:Discussion onthenormalaswellaspathologicalchangeswiththehelpof charts/images. • Columnar,Cuboidal, Squamous,CiliatedEpithelium • Cardiac,Skeletal,Smoothmuscle • Ovary,Testis,Liver,Pancreas,Thyroid,Tongue,Stomach,Intestine,Kidney,Lung,SpinalCord,Cerebrum,Artery,Vein
3	Studyof bones: • Axial • Appendicular
4	Introductiontohemocytometry:Determinationofthehematologystudiesanddiscussionofthepathological deviationsfrombaselinevalues 1) RedBloodcell(RBC) Count 2) TotalLeukocyteCount 3) DifferentialLeukocyte(WBC)Count 4) Haemoglobincontent ofblood 5) Bleeding/ClottingTime 6) Bloodgroups 7) ErythrocyteSedimentationRate(ESR)/ Hematocrit (Demonstration)
5	Determinationofheartrateandpulserate.
6	Recordingof bloodpressure.

ReferenceBooks(LatestEditions tobeadopted):

1. MackennaB.R.&CallanderR.,McNaught&Callander's,IllustratedPhysiology,5th editionChurchillLivingstone,NewYork,2012.
2. Kaplan,Jack,Opheim,Toivola,Lyon,Clinical Chemistry:Interpretation &Techniques,4th editionLippincott,WilliamsandWilkins,USA,1995.
3. Godkar P.B., Godkar, D.P., Textbook of Medical Laboratory Technology,3rd edition, BhalaniPublishingHouse,Mumbai,India,2014.
4. GhaiC.L.,TextbookofPracticalPhysiology,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi
5. MohanH,TextbookofPathology,6th edition,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi,2010.
6. Chatterjee,C.C.,HumanPhysiology(vol1and2),11th edition,CBSPublishersandDistributors,Kolkata., 2017.

BP108PPHARMACEUTICALANALYSIS(Practical)

CourseObjectives:Thiscoursedealswiththefundamentalsofanalyticalchemistryandprinciplesoftitrimetry,turbidometry,electrochemicalanalysisandgravimetry.

Course Outcomes:

Upon completion of the course student shall be able to:

1. Demonstrate proficient preparation and dilution techniques to ensure accuracy of solutions for analysis.
2. Perform, record, calculate and interpret data obtained from volumetric analysis, gravimetric analysis, and electrochemical titrations.
3. Apply the principles of GLP in the laboratory to ensure data accuracy and compliance.

BP108P ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	1	3	3	2	3	1	3
CO2	3	3	3	3	1	3	3	2	3	1	3
CO3	3	3	3	3	1	3	3	2	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

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I Preparationandstandardizationof-

(1) Sodiumhydroxide.
(2) Sulphuricacid.
(3) Sodiumthiosulfate.
(4) Potassiumpermanganate.
(5) Cericammoniumsulphate.

II Assayofthefollowingcompounds alongwithStandardizationofTitrant-

(1) Ammoniumchloridebyacidbasetitration.
(2) FerroussulphatebyCerimetry.
(3) CoppersulphatebyIodometry/Sodiummetabisulphite.
(4) Calciumgluconatebycomplexometry.
(5) Hydrogenperoxidebypermanganometry.
(6) Sodiumbenzoatebynon-aqueoustitration.
(7) SodiumChloridebyprecipitationtitration.
(8) AssayofAspirin(Backtitration).
(9) Assay ofSulphacetamidesodium(Nitritetitration).
(10) AssayofAscorbicacid(Iodimetry).

III DeterminationofNormalitybyelectro-analyticalmethods

(1) Conductometrictitrationofstrongacidagainststrongbase.
(2) Conductometric titrationofstrongacidandweakacidagainststrongbase.
(3) Potentiometrictitrationofstrongacidagainststrongbase.
(4) Potentiometrictitrationofweakacidagainststrongbase.

IV Gravimetricanalysis

(1)Determination ofBariumasBariumsulphate.

ReferenceBooks(LatestEditionstobeadopted):

1. BeckettA.H.,StenlakeJ.B.,PracticalPharmaceuticalChemistry,Vol.I&II,2nd edition,AthlonePress,Univ ersityof London,London,1970
2. VogelA.I.,TextbookofQuantitativeInorganicAnalysis,2nd edition,LongmanGreenandCo.,London,195 1
3. GunduRaoP.,InorganicPharmaceuticalChemistry,1st edition,VallabhPrakashan,Delhi,India,2013
4. BentleyAO,Atherden LM,DriverJE,Textbook ofPharmaceuticalChemistry,4thedition,OxfordUniversityPress,London,NewYork,andToronto,1945
5. KennedyJ.H.,PrinciplesofAnalyticalChemistry,2nd edition,SaundersCollegePublishing,USA, IndianPharmacopoeia
6. Christian,G.D.,Dasgupta,P.K.,Schug,K.A.,AnalyticalChemistry,7th edition,WileyIndiaPvt.Limited,2 013.
7. J.Mendham,R.C.Denney,J.D.Barnes,M.J.K.Thomas,B.Sivasankar,Vogel'sTextbookofQuantitativeChe micalAnalysis,6th edition,PearsonEducation,NewDelhi,2009.

BP109P
PHARMACEUTICS -I(Practical)

CourseObjectives:

Thiscourse isdesigned toimpartfundamentalknowledge forpreparing selected conventionaldosageforms.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Understand the basics ofdifferentdosage forms andpharmaceutical incompatibilities.
2. Solve different pharmaceutical calculations
3. Preparesomesimpleandconventionaldosageforms.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP 109P CO1	3	1	2	1	1	3	3	2	3	1	3
BP 109P CO2	3	2	3	1	1	3	3	2	1	1	3
BP 109P CO3	3	3	3	2	2	3	3	2	2	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details
1	**Syrups** a) Syrup IP'66 b) Compoundsyrup ofFerrous PhosphateBPC'68
2	**Elixirs**a)Piperazinecitrateelixir b)Paracetamolpediatricelixir
3	**Linctus**a)TerpinHydrateLinctusIP'66

4	**Solutions** b)IodineThroatPaint(MandlesPaint) a) Strongsolutionofammoniumacetate b) Cresolwithsoapsolution c) Lugol'ssolution
5	**Suspensions** a) Calaminelotion b) MagnesiumHydroxide mixture c) AluminumHydroxidegel
6	**Emulsions** a)TurpentineLiniment b)Liquidparaffinemulsion
7	**PowdersandGranules** a) ORSpowder (WHO) b) Effervescentgranules c) Dustingpowder d) Dividedpowders
8	**Suppositories** a) Glycerogelatinsuppository b) Coca buttersuppository
	c)ZincOxidesuppository
9	**Semisolids** a) Sulphurointment b) Non-staining-iodineointmentwithmethylsalicylate c) Carbopolgel
10	**GarglesandMouthwashes** a) Iodinegargle b) Chlorhexidinemouthwash

ReferenceBooks(LatestEditionstobeadopted):

1. Ansel H.C., Allen L.V., Pharmaceutical Dosage Forms and Drug Delivery Systems, 10th edition,LippincottWilliamsandWalkins,USA,2014.
2. CarterS.J.,CooperandGunn's-DispensingforPharmaceuticalStudents,12thedition,CBSPublishersandDistributors,NewDelhi, 2008.
3. Taylor, K., Aulton M.E., Pharmaceutics: The Science of Dosage Form Design, 2nd edition, ChurchillLivingstone,Edinburgh,2001.
4. IndianPharmacopoeia.
5. BritishPharmacopoeia.
6. Lachman,L,LiebermanH.A.,Kanig,J.L., The Theory and Practice ofIndustrialPharmacy,1stedition,Lea&Febiger,Philadelphia,1986
7. Khar,R.K.,Vyas,S.P.,AhmadF.J.,JainG.K.,Lieberman,Lachman's-TheTheoryandPracticeofIndustrialPharmacy,4thedition,CBSPublishers andDistributors, NewDelhi,2020.
8. GennaroA.R.,Remington:TheScienceandPracticeofPharmacy,21stedition,LippincottWilliams andWilkins,Philadelphia,2005.
9. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBSPublishers and DistributorsPvt.Ltd,Delhi,2005.
10. RawlinsE.A., Bentley'sTextbookofPharmaceutics,8thedition,ElsevierIndia, 2010.
11. Ghebre-SellassieI.,PharmaceuticalPelletizationTechnology,1stedition,MarcelDekker,Inc.,New York,1990
12. Parikh D.M., Handbook ofPharmaceutical Granulation Technology,1stedition,Marcel Dekker,Inc.,NewYork,1997.

13.NieloudFandGilberteM.,PharmaceuticalEmulsionsandSuspensions,1st edition,MarcelDekker ,Inc.,NewYork,2000.

BP110P
PHARMACEUTICALINORGANICCHEMISTRY(Practical)

CourseObjectives:
Thiscourseisdesignedtoimpartafundamentalknowledgeforpreparationofsaltsandtestingthepresenceofdifferentions,salts,andtheirpurity

CourseOutcomes:
Uponcompletionof thiscoursethestudentshouldbeableto:

1. **Demonstrate** the quality control tests in limiting traces of impurities present in pharmaceuticals by performing limit tests Preparesomesimpleinorganicpharmaceuticals.
2. **Outline** the synthesis and evaluate the physical and chemical properties of inorganic compounds of medicinal interest.
3. **Identify** cations and anions present in the inorganic drugs.
4. **Apply** the pharmacopoeial methods for preparation of standard solutions of known concentration.
5. **Determine** the acid neutralizing capacity of antacid tablets.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP110P CO1	3	1	2	-	-	2	1	1	1	-	1
BP110P CO2	2	1	2	-	-	1	1	1	1	-	-
BP110P CO3	2	2	2	-	-	-	1	-	-	-	-
BP110P CO4	2	1	1	-	-	-	1	-	-	-	-
BP110P CO5	2	1	1	-	-	-	1	1	1	-	-

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as 3 (Strong), 2(Moderate) and1 (Weak), no correlation-.

I.Limittestsforfollowingions
LimittestforChloridesandSulphatesModifiedli
mittestforChloridesandSulphatesLimittestforIr
on
LimittestforHeavymetalsLi
mittestforLead
LimittestforArsenic

II Identificationtest
Magnesium
hydroxideFerroussulp
hateSodium
bicarbonateCalcium
gluconateCoppersulph
ate

III Testforpurity
SwellingpowerofBentonite
Neutralizingcapacityof aluminum hydroxide gel
DeterminationofpotassiumiodateandiodineinpotassiumIodide

IV Preparationofinorganic pharmaceuticals
Boric

acidPotash
alumFerroussulp
hate

ReferenceBooks(LatestEditionstobeadopted):

1. BeckettA.H.,StenlakeJ.B.,PracticalPharmaceuticalChemistry,Vol.I&II,2nd edition,AthlonePress,Universityof London,London,1970.
2. VogelA.I.,TextbookofQuantitativeInorganicAnalysis,2nd edition,LongmanGreenandCo.,London,1951.
3. GunduRaoP.,InorganicPharmaceuticalChemistry,1st edition,VallabhPrakashan,Delhi,India,2013.
4. BentleyAO,Atherden LM,DriverJE,TextbookofPharmaceuticalChemistry,4thedition,OxfordUniversityPress,London,New York,andToronto,1945.
5. KennedyJ.H.,PrinciplesofAnalyticalChemistry,2nd edition,SaundersCollegePublishing,USA,1990.
6. IndianPharmacopoeia.

BP111PCOMMUNICATIONSKILLS(Practical)

CourseObjectives:

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists,physiotherapists, and other health workers. At the end of this course the student will get the soft skills set toworkcohesivelywiththeteamasateamplayerandwilladdvaluetothepharmaceutical business.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeable to:

1. Learn basic communication and pronunciation using English language lab software ‘wordsworth’.
2. Develop writing and presentation skills

BP111P Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
BP111P CO1	3	1	1	-	2	3	1	3	1	-	3
BP111P CO2	3	1	1	-	2	3	1	3	1	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as 3 (Strong), 2(Moderate) and1 (Weak).

1. **Basiccommunicationcoveringthefollowingtopics**
   a. MeetingPeople
   b. AskingQuestions
   c. MakingFriends
   d. What didyoudo?
   e. Do’sandDont’s
2. **Pronunciationscoveringthefollowingtopics**
   a. Pronunciation(ConsonantSounds)
   b. PronunciationandNouns
   c. Pronunciation(VowelSounds)
3. **AdvancedLearning**

a. ListeningComprehension/DirectandIndirectSpeech
b. FiguresofSpeech
c. EffectiveCommunication
d. WritingSkills
e. EffectiveWriting
f. InterviewHandlingSkills
g. E-Mailetiquette
h. PresentationSkills

ReferenceBooks(LatestEditionstobeadopted):

1. RutherFoordA.J.,BasicCommunicationSkillsforTechnology,2nd Edition,PearsonEducation,Delhi,2011
2. SanjayKumar,Pushplata,Communicationskills,2nd Edition,OxfordPress,Lucknow2015.
3. RobbinsS.P.,OrganizationalBehaviour, 1st Edition,Pearson,SanDiego,USA,2013.
4. HassonG.,Brilliant-Communicationskills, 1st Edition,PearsonLife,UK,2011
5. GopalaS.W.,TheAceofSoft Skills:Attitude,CommunicationandEtiquetteforsuccess,5th Edition,PearsonEducation,Delhi,2013.
6. Dalley D,Burton Lois,Greenhall M.,Developing yourinfluencing skills,1stEdition Universe ofLearningLtd,Manchester,UnitedKingdom,2010.
7. Konar N., Communication skills for Professionals, 2nd Edition, New arrivals –PHI Learning Pvt.Ltd,NewDelhi,2011.
8. Mitra,B.K.,Personalitydevelopmentandsoftskills,1st Edition, OxfordPress,Lucknow, 2011.
9. ButterField,J.,Softskillforeveryone,1stEdition,CengageLearningIndiaPvt.Ltd,NewDelhi,2011.
10. FrancisPetersSJ,Softskillsandprofessionalcommunication,1st Edition,McGrawHillEducation,New York,2011.
11. AdairJohn,Effectivecommunication,4th Edition,PanMacMillan,2009.
12. Daniels A.C, Bringing out the best in people, 2nd Edition, Mc Graw Hill Education, New York,1999.

BP112RBP
RemedialBiology(Practical)

CourseObjectives:
Togivethelearnerpreliminaryknowledgeofbiology.
CourseOutcomes
Thelearnershouldbeableto:
1. Haveknowledgeofmicroscopesandmicroscopicstudyoftissues.
2. Identifyplantpartsandmodification.
3. Explainsomebodyprocesses.

BP112RBP *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	-	2	1	-	1	2	2
CO2	3	2	2	2	-	-	1	-	1	2	2
CO3	3	2	2	-	2	2	2	1	2	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details
1	Introductiontoexperimentsinbiology a) StudyofMicroscope b) Sectioncuttingtechniques c) Mountingandstaining d) Permanentslidepreparation
2	Studyofcellanditsinclusions
3	Studyofstem,root,leaf, seed, fruit,flowerandtheirmodifications
4	Detailedstudyoffrogbyusingcomputermodels
5	Microscopic study and identification of tissues pertinent to stem, root, leaf, seed, fruit andflower
6	Identificationofbones
7	Determinationofbloodgroup
8	Determinationofbloodpressure
9	Determinationoftidalvolume

ReferenceBooks(LatestEditionstobeadopted):

1. Kale. S.R. and Kale R.R, Practical Human Anatomy and Physiology,10th edition, Nirali Prakashan, Pune,2020.
2. GokhaleS.B.,KokateC.K.andShriwastava, S.P.AManualofPharmaceuticalbiologypractical.
3. ShafiM,BiologypracticalmanualaccordingtoNationalcorecurriculum.Biologyforumof Karnataka.

SEMESTER
IIBP201T

HumanAnatomyandPhysiology-II(Theory) 45 Hours

CourseObjectives:
Togivethelearnerin-depthinformationontheorgansystems andhomeostaticmechanisms.
CourseOutcomes:
Thelearnershouldbeableto:
1. Elucidatethegrossmorphology,structure,andfunctionsofvariousorgansofthehumanbody.
2. Understandthecoordinated workingpatternamong differentorganswithineachsystem of the human body.
3. Correlatethe mechanisms inthemaintenanceofhomeostasisofhumanbodybycrossfunctioningofthevarioussystems.

MappingCO-PO:

BP201T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	2	2	2	-	3	-	2	3	-	3
CO2	3	2	2	2	-	3	-	2	3	-	3

CO3	3	2	2	2	-	3	-	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours
1	Nervoussystem • Organizationofnervoussystem • Neuron,neuroglia,classification,andpropertiesofnervefibre, • Electrophysiology,actionpotential, nerveimpulse	10
	• Receptors,synapse,andneurotransmitters • Central nervous system: meninges, ventricles of brain and cerebrospinalfluid • Structureandfunctionsofbrain(cerebrum,brainstem,cerebellum),spinal cord (gross structure, functions of afferent and efferent nerve tracts,reflexactivity)	
2	Digestivesystem • Anatomyandphysiology ofthegastrointestinaltractandassociatedorgans • Functions ofstomach • Digestionandabsorptionofcarbohydrates,proteins,andfats	5
3	RespiratorySystem • Anatomyandphysiologyof respiratorysystem • Exchangeof gases • Externalandinternalrespiration • Mechanismandregulation ofrespiration • Lungvolumes andlungcapacities • Artificialrespirationandresuscitationmethods	5
4	Urinarysystem • Anatomyofurinarytractwithspecialreference to anatomyofkidneyandnephrons • Functions ofkidneyandurinarytract, • Physiologyofurineformation,micturitionreflex • Role ofkidneysinacidbasebalance • Role ofrenninangiotensinsystem	7
5	Endocrinesystem • Classificationofhormones • Mechanismof hormoneaction • Structureandfunctionsofendocrinetissuesandglands • Disordersassociatedwith endocrinesystem	8
6	Reproductivesystem • Anatomyofmaleandfemalereproductivesystem • Functionsofmaleandfemalereproductivesystem • Sexhormones • Physiologyof menstruation • Fertilization,spermatogenesis,oogenesis,pregnancy, andparturition • Introduction to genetics: chromosomes,genes and DNA,proteinsynthesis,geneticpatternofinheritance	10

	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. WaughA,andGrantA,Ross&Wilson,Anatomy&PhysiologyinHealth&Illness,9th edition,ChurchillLivingstone,NewYork,2001.
2. TortoraG.J.&DerricksonB,PrincipalsofAnatomy&Physiology,15th edition,JohnWileyandSons,Inc.,NewJersey,2016
3. GuytonA.C.,HallJ.E.,TextbookofMedical Physiology,12th edition,W.B.SaundersCompany,USA/PrismBooksLtd.India,2010.
4. Mackenna B. R. & Callander R., McNaught & Callander's Illustrated Physiology, 5th editionChurchillLivingstone,NewYork,2012.
5. Kaplan,Jack,Opheim,Toivola,Lyon,ClinicalChemistry:Interpretation&Techniques,4th editionLippincott,WilliamsandWilkins,USA,1995.
6. Godkar P.B., Godkar, D.P., Textbook of Medical Laboratory Technology, 3rd edition, BhalaniPublishingHouse,Mumbai,India,2014.
7. MohanH,TextbookofPathology,6th edition,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi,2010.
8. Chatterjee,C.C.,HumanPhysiology(vol1and2),11th edition,CBSPublishersandDistributors,Kolkata., 2017.

BP202T
PHARMACEUTICALORGANICCHEMISTRY–I(Theory) 45Hours

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

CourseOutcomes:

Uponcompletionofthecoursethestudentshallbeable to:

1. **Explain** the reaction, mechanism and reactivity and orientation of elimination reaction, nucleophilic substitution and addition reactions.
2. **Classify** various classes of organic compounds & infer the rules of IUPAC and common system of nomenclature for various classes of organic compounds with examples.
3. **Predict** the effect of various substituents on acidity and basicity of carboxylic acids and amines respectively.
4. **Recall** the structure and medicinal uses of the organic compounds.
5. **Apply** the mechanisms of organic reactions and common naming reactions in the synthesis of drug molecules.
6. **Illustrate** the stereo-chemical features including conformation and stereo electronic effects of organic molecules.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP202T CO1	2	1	1	-	-	1	-	-	1	1	1
BP202T CO2	2	-	2	2	-	-	-	-	-	-	2
BP202T CO3	2	1	3	-	-	1	-	-	-	-	1
BP202T CO4	3	-	1	-	-	2	2	2	2	1	2

BP202T CO5	2	2	2	1	1	1	1	2	1	1	1
BP202T CO6	2	2	2	1	1	1	-	1	-	-	1

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours
	CourseContent: Generalmethodsofpreparationandreactionsofcompoundssuperscriptedwithasterisk(*)tobeexplained. To emphasize on definition, types, classification, principles/mechanisms,applications,examplesa nddifferences.	
1	**Classification,nomenclature,andisomerism** Classification of organic compounds, common and IUPAC systems of nomenclatureoforganiccompounds(upto10Carbonsopenchainandcarbocycliccompo unds) Structuralisomerisminorganiccompounds.	**6**
2	**Alkanes*,Alkenes*andConjugateddienes*** SP^3hybridizationinalkanes,halogenationofalkanes,usesofparaffins.	**10**
	Stabilitiesofalkenes, SP^2hybridizationinalkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangementofcarbocations,Saytzeffsorientationandevidence.E1versesE2reaction s,FactorsaffectingE1andE2reactions. ozonolysis,electrophilicadditionreactionsofalkenes,Markownikoff'sorientation,fre eradicaladditionreactionsofalkenes,AntiMarkownikoff'sorientation. Stabilityofconjugateddienes,Diel-Alder,electrophilicaddition,freeradicaladditionreactionsof conjugateddienes,allylic rearrangement.	
3	**Alkylhalides*** SN1andSN2reactions-kinetics,orderofreactivityofalkylhalides,stereochemistry,andrearrangementof carbocations. SN1versus SN2reactions,factorsaffectingSN1andSN2reactions. Structure and uses of ethyl chloride, chloroform, trichloroethylene,tetrachloroethylene,dichloromethane,tetrachlorometh aneandiodoform. **Alcohols*-** Qualitativetests,Structureandusesofethylalcohol,methylalcohol,chlorobutanol,cetost erylalcohol,benzylalcohol,glycerol,propyleneglycol.	**10**
4	**Carbonylcompounds*(Aldehydesandketones)** Nucleophilicaddition,electromericeffect,aldolcondensation,crossedaldolcondensati on,Cannizzaroreaction,crossedCannizzaroreaction,Benzoincondensation,Perkinco ndensation,qualitativetests,structureandusesof formaldehyde, paraldehyde, acetone, chloral hydrate,hexamine, benzaldehyde,vanillin,cinnamaldehyde.	**9**

5	**Carboxylicacids*** Acidity of carboxylic acids, effect of substituents on acidity, inductive effect andqualitativetestsforcarboxylicacids,amide,andester. Structure and uses of acetic acid, lactic acid, tartaric acid, citric acid, succinic acid,oxalicacid,salicylicacid,benzoicacid,benzylbenzoate,dimethylphthalate,methylsalicylateandacetylsalicylic acid. **Aliphaticamines***basicity,effectofsubstituenton basicity,qualitative test,structureandusesofethanolamine,ethylenediamine,amphetamine.	10
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. MorrisonR.T.,BoydR.N.,OrganicChemistry,6th edition,PrenticeHall,NewJersey,1992
2. FinarI.L., OrganicChemistry,Vol. 1,4th edition,Longman,1963
3. BahlB.S.,BahlA.,TextbookofOrganicChemistry,22nd edition,S.Chandpublishing,Delhi,India,2017
4. SoniP.L.,OrganicChemistry,29th edition,S.Chandpublishing,Delhi,India,2007
5. MannF.G.,Practical OrganicChemistry,4th Edition,Bernard CharlesSaunders,Longman,London,NewYork, andToronto,1960
6. Vogel A.I., Vogel's textbookofPracticalOrganicChemistry,5th edition,PearsonPublishingHouse,India,1989
7. VishnoiN.K.,AdvancedPracticalOrganicChemistry,1st edition,VikasPublishingHouse,Mumbai,1979
8. EngelR.G.,PaviaD.L.,LampmanG.N.,Kriz G.S.,IntroductiontoOrganicLaboratory Techniques,CengageLearning,India,2010.
9. AhluwaliaV.K.,ParasharR.K.,OrganicReactionMechanisms,4th edition,NarosaPublishingHouse,2010

BP203T

BIOCHEMISTRY(Theory) 45 Hours

CourseObjectives:

Biochemistry dealswith complete understanding of the molecular levelsof the chemical processassociated with living cells. The scope of the subject is providing biochemical facts and the principlesto understand metabolism of nutrient molecules in physiological and pathological conditions. It is alsoemphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions ofDNA.

CourseOutcomes:

Uponcompletionof coursestudentshallableto:

1. **Explain** the concept of bioenergetics, energy rich compounds, and to **apply** the principle in electron transport chain and oxidative phosphorylation.
2. **Demonstrate** the catalytic role of enzymes, their application in therapeutic and diagnostic level and to **assess** the significance of enzyme inhibitors in the design of new drugs.
3. **Understand** lipid and amino acid metabolic pathways and study various diseases and disorders linked to them.
4. **Outline** the purine and pyrimidine nucleotide biosynthesis and degradation pathways and various drugs targeting these pathways.
5. **Learn and understand** the structures of DNA, RNA, Proteins and basic cellular processes like DNA replication, transcription and translation.
6. **Elaborate** the principle involved in the metabolism of carbohydrates, proteins and lipids and to interpret their effect on physiological and pathological conditions.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP203T CO1	2	2	2	-	-	1	1	1	-	-	1
BP203T CO2	2	1	2	-	1	2	2	2	1	-	2
BP203T CO3	2	-	2	-	-	1	1	1	1	-	1
BP203T CO4	2	2	2	-	-	1	-	-	1	-	1
BP203T CO5	2	-	1	-	1	-	1	1	1	-	2
BP203T CO6	3	-	2	-	-	2	-	2	2	-	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**Biomolecules** Introduction, classification,chemicalnature,andbiologicalroleofcarbohydrate,lipids, nucleicacids,aminoacids,andproteins. **Bioenergetics** Conceptoffreeenergy,endergonicandexergonicreaction,relationshipbetweenfree energy, enthalpy, and entropy; Redox potential, energyrich compounds;classification;biologicalsignificancesof ATPandcyclic AMP.	8
2	**Carbohydratemetabolism** Glycolysis – pathway, energetics, and significance.Citricacidcycle-pathway,energetics, andsignificance. HMPshuntanditssignificance;Glucose-6-Phosphatedehydrogenase(G6PD)deficiency. Glycogen metabolism pathways and glycogen storage diseases (GSD)Gluconeogenesis-pathwayanditssignificance. Hormonalregulationof bloodglucoselevelanddiabetesmellitus. **Biologicaloxidation** Electron transport chain (ETC) and its mechanism.Oxidativephosphorylation&itsmechanismands ubstrate. PhosphorylationInhibitorsETCandoxidativephosphorylation/uncouplersLevel.	10
3	**Lipid metabolism** β-Oxidation of saturated fatty acid (Palmitic acid).Formationandutilizationofketonebodies; ketoacidosis.Denovosynthesisof fattyacids(Palmiticacid). Biologicalsignificanceofcholesterolandconversionofcholesterolintobileacids, steroid hormone and vitamin D, disorders of lipid metabolism:Hypercholesterolemia,atherosclerosis,fattyliverandobesity.	10

	Amino acidmetabolism Generalreactionsofaminoacidmetabolism:transamination,deamination &decarboxylation,ureacycleanditsdisorders. Catabolism of phenylalanine and tyrosine and their metabolic disorders(phenyketonuria,albinism,alkeptonuria,tyrosinemia). Synthesisandsignificance ofbiologicalsubstances; 5-HT,melatonin,dopamine,noradrenaline,adrenaline. Catabolismofheme;hyperbilirubinemiaandjaundice.	
4	**Nucleicacidmetabolismandgeneticinformationtransfer** Biosynthesisofpurineandpyrimidinenucleotides. Catabolismofpurinenucleotidesandhyperuricemiaandgout disease.Organizationofmammaliangenome. StructureofDNAandRNAandtheirfunctions.DN Areplication(semiconservative model). TranscriptionorRNAsynthesis. Geneticcode,TranslationorProteinsynthesisandinhibitors.	**10**
5	**Enzymes** Introduction, properties, nomenclature and IUB classification of enzymesEnzymekinetics(Michaelisplot,LineweaverBurkeplot,EadieHofsteeplot), enzymeinhibitorswithexamples. Regulationofenzymes:enzymeinductionandrepression,allostericenzymesregulation. TherapeuticanddiagnosticapplicationsofenzymesandisoenzymesCoe nzymes–structureandbiochemicalfunctions.	**7**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1LehningerAL,NelsonDL,CoxMM.LehningerPrinciplesofBiochemistry,7th edition,Macmillan,New York,2017.
2. MurryRK,GrannerDK,MayesPA,RodwellVW,Harper'sBiochemistry,23rdedition,Appleton&Lange ,Connecticut,1993.
3. BergJM,TymoczkoJL,StryerL.Biochemistry,9th edition,WHFreeman,NewYork,2019.
4. Satyanarayan,UandChakrapani,U.Biochemistry,4th edition,Elsevier,NewDelhi,2013.
5. RaoAR.TextbookofBiochemistry,11th edition,UBSPublishersandDistributors,2009.
6. DebAC,FundamentalsofBiochemistry,7th edition,NewCentralBookAgency,Kolkatta,2001.
7. ConnE,StumpfP,OutlinesofBiochemistry,5th edition,JohnWiley& Sons,Newyork,1987.
8. Gupta RC and Bhargava S, Practical Biochemistry, 5th edition, CBS Publishers and Distributors (P),Ltd,NewDelhi.
9. PlummerDT,IntroductionofPracticalBiochemistry(3rdEdition),TataMcGraw-HillEducationPvt.Ltd.,2004.
10. Rajagopal, G. Ramakrishnan, Practical Biochemistry for Medical students, 1st edition, K. K.Publications,NewDelhi,1983.
11. Varley H,Gowenlock A H McMurray JR; McLauchlan DM,Practical Biochemistry,6th edition,CBSPublishersandDistributors,NewDelhi,2006.

BP204T

Pathophysiology (Theory) 45Hours

CourseObjectives:

Toimparttothelearnertheknowledgeofpathophysiologyandapplyittodevelopmentofpharmacotherapeutics.

CourseOutcomes

Thelearnershouldbeableto:

1. Describethe etiologyandpathogenesisof theselecteddiseasestates.
2. Explainthesignsandsymptomsofthediseases.
3. Deducethecomplicationsofpathologyonhealth.

MappingCO-PO:

BP204T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	2	3	3	-	3	3	2	3	-	3
CO2	3	2	3	3	-	3	3	2	3	-	3
CO3	3	2	3	3	-	3	3	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours
1	CellinjuryandAdaptation: • BasicprinciplesofIntroduction,definitions • Homeostasis:componentsandtypesoffeedbacksystems • Causesofcellularinjury. • Mechanismsofcellinjury:cellmembranedamage,mitochondrialdamage,ribosome damage,nucleardamage. • Morphologyofcellinjury:adaptivechanges(atrophy,hypertrophy,hyperplasia,metaplasia,dysplasia),cellswelling,intracellularaccumulation,calcification,enzymeleakage. • CellDeathandapoptosis. • Acidosis&Alkalosis. • Electrolyteimbalance.	6
2	Inflammationandrepair • Basicmechanisminvolvedintheprocessofinflammationandrepair: • Clinicalsigns ofinflammation. • DifferenttypesofInflammation. • MechanismofInflammation– alterationinvascularpermeabilityandbloodflow,migrationof WBC's. • Mediatorsofinflammation. • Basicprinciplesofwoundhealingintheskin.	4
3	Cancer • Classification. • Etiologyandpathogenesisofcancer.	2
4	CardiovascularSystem • Hypertension,congestiveheartfailure,ischemicheartdisease(angina,myocardialinfarction,atherosclerosisandarteriosclerosis).	6
5	Respiratorysystem • Asthma, chronicobstructiveairwaysdiseases.	2
6	Renalsystem • Acuteandchronic renalfailure.	2

7	HaematologicalDiseases • Irondeficiency,megaloblasticanemia (VitB12andfolicacid),sicklecell	**4**
	anemia,thalassemia,hereditaryacquiredanemia,hemophilia.	
8	Endocrinesystem • Diabetes,thyroiddiseases, disordersofsexhormones.	**4**
9	Nervoussystem • Epilepsy,Parkinson'sdisease,stroke,psychiatricdisorders:depression,schizophreniaandAlzheimer'sdisease.	**6**
10	Gastrointestinalsystem • Peptic ulcer, inflammatory bowel diseases, jaundice, hepatitis(A,B,C,D,E,F)alcoholic liverdisease.	**3**
11	Diseaseof bonesandjoints • Rheumatoidarthritis,osteoporosis,andgout.	**2**
12	Infectiousdiseases • Meningitis,typhoid,leprosy,tuberculosis,urinarytractinfections.	**2**
13	Sexuallytransmitteddiseases • AIDS,syphilis,gonorrhoea.	**2**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. KumarVinay,AbbasA.K., Aster,J.C.Robbins&CotranPathologicBasisof Disease;10th edition,SouthAsiaedition;Elsevier,India,2014.
2. MohanH,TextbookofPathology,6th edition,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi,2010.
3. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisof Therapeutics;13thedition,McGraw-HillEducation,NewYork,2017.
4. BestC.H.,TaylorN.B.,WestJ.B,BestandTaylor'sPhysiologicalBasisofMedicalPractice;12thedition,WilliamandWilkins,Baltimore,USA,1991.
5. Walker,B.,College,N.R., RalstonS.,Penman,I.,Davidson'sPrinciplesandPracticeofMedicine;22ndedition,ChurchillLivingstone,NewYork,2014.
6. GuytonA.C.,HallJ.E.,TextbookofMedicalPhysiology,12th edition,Saunders,USA/PrismBooksLtd.India,2010.
7. Di Piro J.T., Talbert, R.L., Yee, G.C., Matzke, G.R., Wells, B.G., Posey, L.M., Pharmacotherapy: APathophysiologicalApproach;9thedition,McGraw-HillMedical,London,2014.
8. Kumar V., Cotran R.S, Robbins S. L, Basic Pathology; 7th edition; WB Saunders Company,Philadelphia/Harcourt (India) Pvt.Ltd.,NewDelhi,2003.
9. WalkerR,Edwards,ClinicalPharmacy andTherapeutics,3rdedition;ChurchillLivingstoneEdinburgh,NewYork,2003.

RecommendedJournals:

1. TheJournalofPathology.ISSN:1096-9896(Online)
2. TheAmericanJournalofPathology.ISSN:0002-9440
3. Pathology.1465-3931(Online)
4. InternationalJournalofPhysiology,PathophysiologyandPharmacology.ISSN:1944-8171(Online)
5. IndianJournalofPathologyandMicrobiology.ISSN-0377-4929.

BP205T

COMPUTERAPPLICATIONSINPHARMACY(Theory) 30hours

CourseObjectives:
Thissubjectdealswith the introductiondatabases,database managementsystems,computerapplicationinclinicalstudiesanduseofdatabases.

CourseOutcomes:
Uponcompletionof thecoursethestudentshallbeable to:
1. Knowthevarious types ofapplicationofcomputersinpharmacy
2. Knowthevarioustypesofdatabases
3. Knowthevariousapplicationsofdatabasesinpharmacy

BP205T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	1	2	1	2	1	2	2
CO2	3	2	2	3	-	1	1	2	1	1	2
CO3	3	2	2	3	1	2	1	2	1	2	2

While mapping Course Outcomes (CO) with POs the degree of associationsisindicated as
3 (Strong), 2(Moderate), 1 (Weak), - (No relation)

Unit	Details	Hours
1	**Number system**: Binary number system, Decimal number system, Octal numbersystem, Hexadecimal number systems, conversion decimal to binary, binary todecimal,octaltobinary*etc*,binaryaddition,binarysubtraction–One'scomplement,Two'scomplementmethod,binarymultiplication,binarydivision. **ConceptofInformationSystemsandSoftware:**Informationgathering,requirementandfeasibilityanalysis,dataflowdiagrams,processspecifications, input/output design,process lifecycle,planningandmanagingtheproject.	6
2	**Webtechnologies**:IntroductiontoHTML,XML,CSSandProgramming languages,introductiontowebserversandServerProductsIntroductiontodatabases,MYSQL,MSACCESS,PharmacyDrugdatabase.	6
3	**ApplicationofcomputersinPharmacy**– Druginformationstorageandretrieval,Pharmacokinetics,MathematicalmodelinDrugdesign,HospitalandClinicalPharmacy,ElectronicPrescribinganddischarge(EP)systems,barcodemedicine identification and automated dispensing of drugs, mobile technology andadherencemonitoring DiagnosticSystem,Lab-diagnosticSystem,PatientMonitoringSystem,PharmaInformationSystem.	6
4	**Bioinformatics:**Introduction,ObjectiveofBioinformatics,BioinformaticsDatabases, Conceptof Bioinformatics,Impactof BioinformaticsinVaccineDiscovery.	6
5	**ComputersasdataanalysisinPreclinicaldevelopment**: Chromatographicdadaanalysis(CDS),LaboratoryInformationmanagementSystem(LIMS) andTextInformationManagementSystem(TIMS).	6
	TOTAL	30

ReferenceBooks(LatestEditionstobe adopted):

1. Fassett,W.E.,ComputerApplicationinPharmacy, 1st edition, LeaandFebiger,Philadelphia,USA, 1986.
2. Sean E,Binghe W.,ComputerApplication in PharmaceuticalResearch and Development,1st edition,JohnWilleyandSons,Inc.,NewJersey,USA,2006.
3. Rastogi,S.C.,Mendiratta,N,Rastogi,P.,Bioinformatics(Concept,SkillsandApplications),2nd edition,CBSPublishersandDistributors,NewDelhi,2008.
4. Prague,C.N.,Irwin,M.R., Reardon,J.,Microsoftoffice Access- 2003, ApplicationDevelopmentUsingVBA,SQLServer,DAPandInfopath,WileyIndiaPvt.Ltd,NewDelhi.

BP206T

ENVIRONMENTALSCIENCES(Theory) 30hours

CourseObjectives:

Environmental Sciences is the scientific study of the environmental system and the status of its inherent orinduced changes on organisms. It includes not only the study of physical and biological characters of theenvironmentbutalsothesocialandculturalfactorsandtheimpactofmanonenvironment.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeableto**:**

1. Createtheawarenessabout environmentalproblemsamonglearners.
2. Impartbasicknowledgeabout theenvironmentanditsalliedproblems.
3. Developanattitudeofconcernfortheenvironment.
4. Motivatelearnertoparticipateinenvironmentprotectionandenvironmentimprovement.
5. Acquireskillstohelptheconcernedindividuals inidentifyingandsolvingenvironmentalproblems.
6. Strivetoattainharmonywithnature.

BP206T ***Course Outcomes***	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	3	3	2	1	2	1	3	2	**3**	3
CO2	3	3	2	1	1	2	1	2	1	**3**	3
CO3	3	3	3	1	1	2	1	2	2	**3**	3
CO4	3	3	3	1	2	2	1	3	1	**3**	3
CO5	3	3	3	3	2	2	1	3	2	**3**	3
CO6	3	3	2	1	1	1	1	2	1	**3**	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details	Hours

1	TheMultidisciplinarynatureofenvironmentalstudies.NaturalResources. Renewableandnon-renewableresources: Naturalresourcesandassociatedproblems. a) forest resources; b) water resources; c) mineral resources; d) food resources; e)energyresources;f) landresources:roleofanindividualinconservationofnaturalresources.	**10**
2	Ecosystems. -Conceptofanecosystem. -Structureandfunctionofanecosystem. -Introduction,types,characteristicfeatures,structure,andfunctionoftheecosystems: forest ecosystem; grassland ecosystem; desert ecosystem;Aquaticecosystems (ponds,streams,lakes,rivers,oceans,estuaries).	**10**
3	EnvironmentalPollution:airpollution;waterpollution;soilpollution.	**10**
	TOTAL	**30**

ReferenceBooks(LatestEditionstobeadopted):

1. SinghY.K., EnvironmentalScience, 1st edition,NewAgeInternationalPvt,Publishers,Bangalore,2006.
2. Agarwal,K.C.,EnvironmentalBiology, 2nd edition,NidhiPublishers,Bikaner,2008.
3. BharuchaE,TheBiodiversityofIndia,1st edition,MapinPublishingPvt.Ltd.,Ahmedabad,India,2002.
4. BrunnerC.R.,HazardousWasteIncineration,McGrawHillInc,USA,1989
5. ClarkR.S.,MarinePollution,ClandersonPressOxford
6. Cunningham,W.P.Cooper,T.H.Gorham,E&Hepworth,M.T.,EnvironmentalEncyclopedia,2ndedition,CengageGale,USA,2001.
7. DeA.K.,DeA.K.,EnvironmentalChemistry,NewAgeInternationalPublishersLtd,NewDelhi,1990.
8. NarainS,DowntoEarth-fortnightlymagazinefocusedonpoliticsofenvironmentanddevelopmentofCentreforScienceandEnvironment,NewDelhi,India,
9.

BP207P
Humananatomyand PhysiologyII(Practical)

CourseObjectives:

Togetthelearneradeptwithanatomy,physiologyandpathologyofbodysystems.

CourseOutcomes

Thelearnershouldbeableto:

1. Beproficientwiththeworkingofthesystemsofthebodyincludingtheprocessofhomeostasis.
2. Identifyanddescribethevariousbodytissuesandthepathologicalchangesindiseasedstates.

MappingCO-PO:

BP207P ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	2	2	3	3	2	3	-	3
CO2	3	3	3	2	2	3	3	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details

1	Studyofthesystemswiththehelpofmodels,charts,andspecimens: • Nervoussystem • Endocrinesystem • Digestive • Respiratory • Cardiovascular • Urinary • Reproductive
2	Todemonstratethegeneralneurologicalexamination.
3	Tostudytheintegumentaryandspecialsensesusingspecimen,models,etc.: • Touch • Olfaction • Taste • Visionandvisualacuity
4	Todemonstratethereflexactivity.
5	Recordingofbodytemperature.
6	Todemonstratepositiveandnegativefeedbackmechanism.
7	Determinationoftidalvolumeandvitalcapacity.
8	Recordingofbasalmassindex.
10	Studyoffamilyplanningdevicesandpregnancydiagnosistest.
11	Demonstration oftotalbloodcountbycellanalyser
12	Permanentslidesofvitalorgansandgonads: • Ovary,Testis,Liver,Pancreas,Thyroid,Tongue,Stomach,Intestine,Kidney,Lung,SpinalCord,Cerebrum,Artery,Vein
13	Discussiononsomecommoninvestigationalproceduresusedindiagnostics: 1) Electroencephalogram(EEG) 2) Positronemissiontomography(PET) 3) Computedtomographyscan(CTScan) 4) Flowcytometryasadiagnostictool 5) Polymerasechainreactionasadiagnostic tool 6) Electrocardiogram(ECG)indiagnosisofcardiacarrhythmia 7) Liver Functiontests 8) KidneyFunctiontests 9) BloodGlucose 10) SerumCholesterol/Triglycerides 11) SerumCalcium 12) ThyroidFunctiontests
	13) Diagnostictestsforinfectiousdiseaseslike-Malaria,Tuberculosis,Dengue,H1N1swineflu,TyphoidandCovid19.

ReferenceBooks(LatestEditionstobe adopted):

1. MackennaB.R.&CallanderR.,McNaught&Callander's,IllustratedPhysiology,5th editionChurchillLivingstone,NewYork,2012.
2. Kaplan,Jack,Opheim,Toivola,Lyon,ClinicalChemistry:Interpretation&Techniques,4th edition
3. Lippincott,WilliamsandWilkins,USA,1995.

4. GodkarP.B.,Godkar,D.P., TextbookofMedicalLaboratory Technology,3rdedition,BhalaniPublishingHouse,Mumbai,India,2014.
5. GhaiC.L.,TextbookofPracticalPhysiology,6thedition,JaypeeBrothersMedicalPublishersPvt.Ltd.,New Delhi,2005.
6. MohanH,TextbookofPathology,6thedition,JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi,201 0.
7. WaughA,andGrantA,Ross&Wilson,Anatomy&PhysiologyinHealth&Illness,9thedition,ChurchillLivi ngstone,NewYork,2001.
8. TortoraG.J.&DerricksonB,PrincipalsofAnatomy&Physiology,15thedition,John WileyandSons,Inc.,NewJersey,2016
9. GuytonA.C.,HallJ.E.,TextbookofMedical Physiology,12thedition,W.B.SaundersCompany,USA/PrismBooksLtd.India,2010.

BP208P
PHARMACEUTICALORGANICCHEMISTRY-I(Practical)

CourseObjectives:
Togetthelearnerintroducedtothebasicprinciplesofqualitativeorganicanalysis

CourseOutcomes

1. Identify the various classes of organic compounds by performing systematic qualitative analysis.
2. Construct the molecular models of simple organic compounds.
3. Outline the synthesis and purification of various classes of organic compounds with one step reaction.
4. Demonstrate and perform the melting and boiling points of organic compounds.
5. Remember/Understand the basic etiquettes of laboratory glassware, fire safety hazards and personal protection measures and follow good laboratory practices (GLP)

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP208P CO1	3	2	3	-	1	1	1	2	-	-	1
BP208P CO2	3	3	2	2	1	-	-	-	-	-	1
BP208P CO3	2	2	3	1	1	1	2	1	1	1	1
BP208P CO4	2	2	2	-	1	2	2	-	1	-	1
BP208P CO5	2	2	2	-	2	2	2	1	1	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details
1	Systematicqualitativeanalysisofunknownorganiccompoundslike 1. Preliminarytest:color,odour,aliphatic/aromaticcompounds,saturation,andunsaturation,etc. 2. Detectionofelementslikenitrogen,sulphur,andhalogenbyLassaigne'stest. 3. Solubilitytest. 4. Functionalgrouptestlikephenols,amides/urea,carbohydrates,amines,carboxylicacids, aldehydesandketones,alcohols,esters,aromaticandhalogenatedHydrocarbons,nitrocompoundsan danilides.

	5. Meltingpoint/boilingpointoforganiccompounds. 6. Identificationoftheunknowncompoundfromtheliteratureusingmeltingpoint/boilingpoint. 7. Preparationofthederivativesandconfirmationoftheunknowncompoundbymeltingpoint/boiling point. 8. Minimumfiveunknownorganiccompoundstobeanalyzedsystematically.
2	Preparationofsuitablesolidderivativesfromorganiccompounds.
3	Constructionofmolecularmodels.

ReferenceBooks(LatestEditionstobe adopted):

1. MorrisonR.T.,BoydR.N.,OrganicChemistry,6th edition,PrenticeHall,NewJersey,1992
2. FinarI.L., OrganicChemistry,Vol.1,4th edition,PearsonPublishingHouse,Longman,1963
3. BahlB.S.,BahlA.,TextbookofOrganicChemistry,22nd edition,S.Chandpublishing,Delhi,India,2017
4. SoniP.L.,OrganicChemistry,29th edition,S.Chandpublishing,Delhi,India,2007
5. MannF.G.,PracticalOrganicChemistry,4th Edition,Bernard CharlesSaunders,Longman,London,NewYorkandToronto,1960
6. Vogel A.I., Vogel's textbookofPracticalOrganicChemistry,5th edition,PearsonPublishingHouse,India,1989
7. VishnoiN.K.,AdvancedPracticalOrganicChemistry,1st edition,VikasPublishingHouse,Mumbai,1979
8. EngelR.G.,PaviaD.L.,LampmanG.N.,KrizG.S.,IntroductiontoOrganicLaboratoryTechniques, CengageLearning,India,2010
9. AhluwaliaV.K.,ParasharR.K.,OrganicReactionMechanisms,4th edition,NarosaPublishingHouse,2010

BP209P
BIOCHEMISTRY(Practical)

CourseObjectives:

Togetthelearnerintroducedtothebasicprinciplesofqualitativeandquantitativedeterminationofimportantbio molecules.

CourseOutcomes

Thelearnershouldbeableto:

1. **Explain** the preparation of buffers and measurement of pH and their significance in pharmacy.
2. **Identify** various classes of carbohydrates and proteins by performing the systematic qualitative analysis.
3. **Estimate** and **interpret** serum creatinine, blood glucose, cholesterol and urine (for abnormal constituents) and their disease correlation.
4. **Understand** the principle and factors affecting enzyme activity
5. **Remember/Understand** the basic etiquettes of laboratory glassware, fire safety hazards and personal protection measures and follow good laboratory practices (GLP)

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP209P CO1	2	2	2	1	1	2	1	1	1	-	2
BP209P CO2	3	3	2	-	1	-	-	1	2	-	2
BP209P CO3	3	2	3	2	1	2	2	2	2	-	2
BP209P CO4	2	1	2	2	-	1	1	2	1	-	2
BP209P CO5	2	2	2	-	2	2	2	1	1	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details
1	Qualitativeanalysis ofcarbohydrates(Glucose,Fructose,Lactose,Maltose,Sucroseandstarch)
2	Identificationtestsfor Proteins(albuminandCasein)
3	Quantitativeanalysisofreducingsugars (DNSAmethod)andProteins(Biuretmethod)
4	Qualitativeanalysisof urineforabnormalconstituents
5	Determinationofbloodcreatinine
6	Determinationofbloodsugar
7	Determinationofserumtotalcholesterol
8	PreparationofbuffersolutionandmeasurementofpH
9	Studyofenzymatichydrolysisof starch
10	DeterminationofSalivaryamylaseactivity
11	StudytheeffectofTemperatureonSalivaryamylaseactivity
12	Studytheeffectofsubstrateconcentrationonsalivaryamylaseactivity

ReferenceBooks(LatestEditionstobeadopted):

1LehningerAL,NelsonDL,CoxMM.LehningerPrinciplesofBiochemistry,7th edition,Macmillan,New York,2017.

2. MurryRK,GrannerDK,MayesPA,RodwellVW,Harper'sBiochemistry,23rdedition,Appleton&Lange, Connecticut,1993.

3. BergJM,TymoczkoJL, StryerL.Biochemistry,9th edition,WHFreeman,NewYork,2019.

4. Satyanarayan,UandChakrapani,U.Biochemistry,4th edition,Elsevier,NewDelhi,2013.

5. RaoAR.TextbookofBiochemistry,11th edition,UBSPublishersandDistributors,2009.

6. DebAC,FundamentalsofBiochemistry,7th edition, NewCentralBookAgency,Kolkatta,2001

7. ConnE,StumpfP,OutlinesofBiochemistry,5th edition,JohnWiley& Sons,Newyork,1987

8. GuptaRC andBhargavaS,Practical Biochemistry,5th edition,CBSPublishersandDistributors(P),Ltd,NewDelhi.

9. PlummerDT,IntroductionofPracticalBiochemistry(3rd Edition),TataMcGraw-HillEducationPvt.Ltd., 2004

10. Rajagopal,G.Ramakrishnan,PracticalBiochemistryforMedicalstudents,1st edition,K.K.Publications,NewDelhi,1983.

11. VarleyH,GowenlockAHMcMurrayJR;McLauchlanDM,PracticalBiochemistry,6th edition,CBSPublishersandDistributors,NewDelhi,2006.

BP210P
COMPUTERAPPLICATIONSINPHARMACY(Practical)

Course Objectives:

To equip students with hands-on experience in using computer tools for designing questionnaires, creating web pages, managing databases, and retrieving drug information, focusing on word processing, HTML, MS Access, and other relevant pharmacy-related applications.

Course Outcomes:

Upon completion of the course, the learner shall be able to:

1. Design forms, web pages, and questionnaires using various computer applications for gathering and presenting pharmacy-related information.

2. Develop, manage, and query databases for storing, modifying, and retrieving patient and drug information using MS Access.
3. Apply computer tools to retrieve drug information, generate reports, and create mailing labels, contributing to efficient pharmacy management practices.

BP210P ***CourseOutcomes***	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	3	2	2	1	3	1	2	2
CO2	3	2	2	3	1	2	1	2	1	2	2
CO3	3	2	2	3	1	2	1	3	1	2	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

Unit	Details
1	Designa questionnaireusinga wordprocessingpackagetogather informationabout adisease
2	CreateaHTMLwebpagetoshowpersonalinformation
3	Retrievetheinformationofadruganditsadverseeffectsusingonlinetools
4	Creating mailinglabelsUsingLabelWizard,generatinglabelinMSWORD
5	Creating mailinglabels UsingLabelWizard,generatinglabelinMSWORD
6	CreateadatabaseinMSAccesstostorethepatientinformationwiththerequiredfieldsUsingMSAccess
7	DesignaforminMSAccesstoview,add,delete,andmodifythepatientrecordinthedatabase
8	Generatingreportandprintingthereportfrompatientdatabase
9	Creatinginvoicetableusing– MSAccess
10	DruginformationstorageandretrievalusingMSAccess
11	CreatingandworkingwithqueriesinMS Access
12	ExportingTables,Queries,FormsandReportstowebpages
13	ExportingTables,Queries,FormsandReportstoXMLpages

ReferenceBooks(LatestEditionstobeadopted):

1. Fassett,W.E.,ComputerApplicationinPharmacy,1st edition,LeaandFebiger,Philadelphia,USA,1986.
2. Sean,E,BingheW.,ComputerApplicationinPharmaceuticalResearchandDevelopment,1st edition,John WilleyandSons,Inc.,NewJersey,USA,2006.
3. Rastogi,S.C.,Mendiratta,N,Rastogi,P.,Bioinformatics(Concept,SkillsandApplications),2nd edition,C BSPublishersandDistributors,NewDelhi,2008.
4. Prague,C.N.,Irwin,M.R.,Reardon,J.,MicrosoftofficeAccess-2003,ApplicationDevelopmentUsingVBA,SQLServer,DAPandInfopath,WileyIndiaPvt.Ltd,NewDelhi

SEMESTER
IIIBP301T
PHARMACEUTICALORGANICCHEMISTRY–II(Theory) 45Hours

CourseObjectives:To introduce the learner to the general methods of preparation and reactions of some organic compounds, reactivity of organic compounds, mechanisms, orientation of reactions.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeableto:

1. **Interpret and Solve** the nomenclature of aromatic compounds by analyzing chemical structure.
2. **Outline** the synthesis of aromatic compounds by different methods; and to predict reactivity/ stability of organic compounds.
3. **Explain** the mechanism and orientation of important reactions of aromatic compounds
4. **Understand** various theories to explain stability of cycloalkanes.
5. **Compare** angle strain / torsional strain of cycloalkanes and interpret their stability patterns.
6. **Explain** the chemistry of fats and oils; and to determine the analytical constants of fats and oils with their significance.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP301T CO1	1	1	2	2	-	-	1	-	-	-	1
BP301T CO2	2	2	2	1	-	1	1	1	1	-	1
BP301T CO3	1	1	3	-	-	1	1	1	-	-	1
BP301T CO4	2	-	3	-	-	1	-	-	-	-	2
BP301T CO5	2	-	3	-	-	1	-	-	-	-	2
BP301T CO6	2	2	2	1	-	1	1	2	2	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details ***General methods of preparation and reactions of compounds superscripted withasterisk(*)tobe explained. Toemphasizeondefinition, types,classification,principles/mechanisms,applications,examplesanddiff erences***.	Hours
1	**Benzeneanditsderivatives**	**10**
1.1	Analytical,synthetic,and otherevidence in the derivation of structure of benzene,Orbitalpicture,resonanceinbenzene,aromatic characters,Huckel'srule.	**3**
1.2	Reactions ofbenzene-nitration,sulphonation,halogenation-reactivity,Friedel-Craftsalkylation-reactivity, limitations,Friedel-Craftsacylation.	**3**
1.3	Substituents,effectofsubstituentsonreactivityand orientationofmonosubstitutedbenzenecompoundstowardselectrophilicsubstitutionreaction.	**3**
1.4	StructureandusesofDDT,Saccharin,BHCandChloramine.	**1**
2		**10**

2.1	**Phenols*-** Acidityofphenols,effectofsubstituentsonacidity,qualitativetests,Structureandusesofphenol,cresols,resorcinol,naphthols.	5
2.2	**AromaticAmines*-**Basicityofamines,effect ofsubstituentsonbasicity, andsyntheticusesofaryldiazoniumsalts.	3
2.3	Aromatic Acids* –Acidity, effect of substituents on acidity and important reactionsofbenzoicacid.	2
3	**FatsandOils**	10
3.1	Fattyacids –reactions.	4
3.2	Hydrolysis, Hydrogenation,SaponificationandRancidityofoils,Dryingoils.	3
3.3	Analyticalconstants– Acidvalue,Saponificationvalue,Estervalue,Iodinevalue,Acetylvalue,ReichertMeissl(RM)value–significanceandprincipleinvolvedin theirdetermination.	3
4	**Polynuclearhydrocarbons:**	08
4.1	Synthesis,reactions.	4
4.2	Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene,Diphenylmethane,Triphenylmethaneandtheirderivatives.	4
5	**Cycloalkanes**	07
	Stabilities –Baeyer's straintheory,limitationofBaeyer'sstraintheory,Coulson andMoffitt'smodification,SachseMohr'stheory(Theoryofstrainlessrings),reactionsofcyclopropaneandcyclobutaneonly.	
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. MorrisonR.T.,BoydR.N.,OrganicChemistry,6th edition,PrenticeHall,NewJersey,1992.
2. Pine,StanleyH.;Hendrickson,JamesB.;Cram,DonaldJ.;Hammond,GeorgeS.,OrganicChemistry,4thedition,McGrawHillPublications,USA,1982.
3. FinarI.L.,OrganicChemistry,Vol.1,4th edition,PearsonPublishingHouse,Longman,1963.
4. MarchJ.,SmithM.B.,AdvancedOrganicChemistry:Reactions,Mechanisms,Structures,6th edition,John WileyandSonspublication,USA,2007.
5. CareyF.A.,SundbergR.J.,OrganicChemistry,PartA:StructuresandMechanism,PartB:ReactionsandSynthesis,4th editionKluwerAcademicPublishers,USA,2002.
6. SykesP.,AGuidebooktoMechanisminOrganicChemistry,6thedition,PearsonEducation,India,1960.
7. DewickP.,EssentialsofOrganicchemistry,1st edition,JohnWileyandSons,NewJersey,2006.
8. WadeL.G.Jr.,MayaShankarSingh,AdvancedOrganicChemistry:ReactionsandMechanism,9th edition,PearsonEducation,India,2019.
9. ElielE.L.,WilenS.H.,Stereochemistry ofOrganicCompounds,1st edition,JohnWileyandSons,USA,1994.
10. SorrellT.N.,OrganicChemistry,2nd edition,UniversityScienceBooks,USA,2005.
11. KalsiP.S.,Stereochemistry:ConformationandMechanism,OrganicReactionsandTheirMechanisms,NewAgeInternationalPublishers,New Delhi,2017.
12. BrahmachariG.,OrganicChemistrythroughSolvedProblems,revisededition,AlphaScienceInternationalLtd.,Morgan&ClaypoolPublishers,2007.
13. Brahmachari G., Organic Name Reactions: A Unified Approach, Alpha Science International Ltd.,Morgan,andClaypoolPublications,2006.

BP302T

PHYSICALPHARMACEUTICS-I(Theory) 45Hours

Course Objectives:

The objective of the course is to train the learner for understanding the basic physical principles underlying pre-formulation testing, formulation development and finished product testing of drug delivery systems.

Course Outcomes:

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

1.Describe, compare, and correlate the states of matter with their corresponding physicochemical properties of drug molecules.

2.Comprehend the various theories of surface and interfacial phenomenon.

3.Apply knowledge of solubilization techniques, surface and interfacial phenomenon concepts in designing dosage form of drugs.

4.Comprehend and evaluate the influence of pH, diffusion and dissolution kinetics on drug in various dosage forms.

5.Understanding of the laws of thermodynamics and applications of thermochemistry.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP302T CO1	3	1	3	2	-	2	2	2	1	2	3
BP302T CO2	3	1	3	2	-	2	2	2	1	2	3
BP302T CO3	3	1	3	2	-	2	2	2	1	2	3
BP302T CO4	3	1	3	2	-	2	2	2	1	2	3
BP302T CO5	3	1	3	2	-	2	2	2	1	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT-I**	**10**
	StatesofMatterandpropertiesofmatter: Stateofmatter,changesinthestateofmatter, latentheats,vapourpressure,sublimationcriticalpoint,eutecticmixtures,gases, aerosols–inhalers,relative humidity,liquid complexes,liquidcrystals,glassystates,solidcrystalline,amorphous&polymorphism.	**6**
	Physicochemicalpropertiesofdrugmolecules: Additive,constitutive,andcolligativepropertieswithexamples;Conceptoftonicityinpharmacy,methodstoadjustisotonicity;Refractiveindexandmolar refraction,opticalrotation,dielectricconstant,dipolemoment,determinations,andapplications	**4**
2	**UNIT-II**	**8**
	Surfaceandinterfacialphenomenon: Liquidinterface,surface&interfacialtensions,surfacefreeenergy,measurementof surface&interfacialtensions,spreadingcoefficient, adsorption atliquidinterfaces,surface active agents,HLB Scale,solubilisation,detergency,adsorptionatsolidinterface.Adsorptionisotherms,Freundlich adsorptionisotherm,LangmuiradsorptionisothermWetting,wettingagentsandcontactangle	
3	**UNIT-III**	**14**

	Solubilityofdrugs: Solubility expressions,mechanismsofsolutesolventinteractions, ideal solubility parameters, solvation & association, quantitative approach to thefactors influencing solubility of drugs, Solubility of gas in liquids, solubility ofliquidsinliquids,(Binarysolutions,idealsolutions) Raoult'slaw,realsolutions.Partiallymiscibleliquids,Criticalsolutiontemperatureanda pplications.Distributionlaw,itslimitationsandapplications	**7**
	DiffusionandDissolution: Diffusion;diffusionthroughbiologicalmembranes,Fick'sLawsofdiffusion,Steadystate diffusion,drivingforcesfordiffusioninpharmaceuticalsystems,permeability.Measure mentof diffusion;Conceptofdissolution,dissolutionmechanism;NoyesWhitneyequation,facto rsaffectingdissolution;Intrinsic DissolutionRate,Hixson–CrowellLaw,measurementofdissolutionrates	**7**
4	**UNIT-IV**	**6**
	pH, buffersandIsotonicsolutions: Theoryofdissociation,dissociationconstant,Sorensen'spHscale,pHdetermination,(el ectrometricandcalorimetric),applicationsofbuffers,bufferequation,buffercapacity,b uffersinpharmaceuticalandbiologicalsystems,bufferedisotonic solutions.	
5	**UNIT-V**	**7**
	Complexationandproteinbinding: Introduction,ClassificationofComplexation,Applications,methodsofanalysis, proteinbinding,Complexationanddrugaction,crystallinestructuresofcomplexesandth ermodynamic treatmentof stabilityconstants	
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Martin A, Swarbrick. J, Cammarata A, Physical Pharmacy: Physical Chemical Principles in thePharmaceuticalSciences,3rdedition,BIWaverly.PvtLtd,NewDelhi,1993.
2. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical ChemicalandBiopharmaceuticalPrinciplesinthePharmaceuticalSciences,6thedition,WalterKluer,Phila delphia,2011.
3. ParrottE.L,SaskiW,ExperimentalPharmaceutics,4thedition,BurgessPublishing Company,Minneapolis,1971
4. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New Delhi,2005.
5. Stocklosa M.J.PharmaceuticalCalculations,6thedition, Lea &Febiger,Philadelphia,1974
6. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/editedby Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc.,Newyork,1990.
7. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3/editedby Herbert A. Lieberman, Martin, M., and Gilbert S. Banker, 2nd edition, Marcel Dekker Inc. NewYork,1998.
8. RamasamyC,andManavalanR,PhysicalPharmaceutics,1stedition,PharmaMedPress,2017
9. C.V.S.Subramanyam,J.Thimmasettee, LaboratoryManualofPhysicalPharmaceutics,2ndedition,VallabhPrakashan,Delhi,2014.
10. C.V.S.Subrahmanyam,TextbookofPhysicalPharmaceutics, 3rdedition, VallabhPrakashan,Delhi,2015

11. C.V.S.Subrahmanyam,EssentialsofPhysicalPharmaceutics,2nd edition,VallabhPrakashan,Delhi,2017
12. JainG,KharRK,AhmadFJ,TheoryandPracticeofPhysicalPharmacy,1st Edition,ElsevierIndia,2013
13. Bahl A, Bahl B. S, Tuli G. D, Essentials of Physical Chemistry, 28th edition, S Chand Publications,NewDelhi,2000.

BP303T

PHARMACEUTICAL MICROBIOLOGY(Theory) 45Hours

Course Objectives:

Study morphology, classification, and reproduction of all categories of microorganisms especially which cause diseases, microbiological tests, aseptic handling, and sterilization aspects.

Course Outcomes:

Upon completion of the subject student shall be able to:

1. Know the general microbiological aspects, describe techniques of identification, cultivation, and preservation of various bacteria.
2. Highlight the disease-causing microorganisms and their pathogenesis.
3. Recognize the source of contamination as well as spoilage and the role of disinfectants, antiseptics and sterility testing in pharmaceutical processing and industry.
4. Compare the different methods of sterilization & equipment and know the general design of aseptic area.
5. Comprehend techniques of preservation of pharmaceuticals and basic knowledge of cell culture technology.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP303T CO1	3	1	1	1	1	3	3	1	3	3	3
BP303T CO2	3	1	1	1	1	3	3	1	3	3	3
BP303T CO3	3	1	3	1	1	3	3	1	3	3	3
BP303T CO4	3	1	2	1	1	3	3	1	3	3	3
BP303T CO5	3	1	2	3	1	3	3	1	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	Introduction,historyofmicrobiology,itsbranches,scope,anditsimportance. IntroductiontoProkaryotesandEukaryotes Studyofultra-structureand morphologicalclassificationofbacteria, nutritionalrequirements,rawmaterialsusedforculturemediaandphysicalparametersforgrowth,growthcurve,isolationandpreservationmethodsforpurecultures,cultivationofanaerobes,quantitativemeasurementofbacterialgrowth(total &viable count).Study of the differenttypesof simple &compoundmicroscope,phasecontrastmicroscopy,darkfieldmicroscopyandelectron microscopy.	08

2	Studyofmorphology,classification,reproduction/replicationandcultivationof Bacteria, Fungi,VirusesandRickettsiaeandChlamydiae. Overview of bacterial diseases and pathogens causing them. Mycobacteria, shigella,pseudomonas,klebsiella,streptococcus,staphylococcus,clostridiumvibrio. Viraldiseasesincludingnewemergingviraldiseases-COVID,ZICA,SARS,EBOLA. Fungaldiseases. Protozoaldiseases- Amoeba,Paramecium,Trichomonas,Plasmodium.Rickettsial&Chlamy dial diseases. Protozoa-Morphologicalcharacteristicsandclassification,reproduction,pathogenicprot ozoalikeAmoeba,Paramecium,Trichomonas,Plasmodium. Algae - Classification, Morphological characteristics, reproduction, economicsignificance ofalgae. Patternofmicrobialdeath.	**13**
3	Identification of bacteria using staining techniques (simple, Gram's & Acid-faststaining) andbiochemical tests(IMViC). Principles and methods of different microbiological assay. Methods forstandardizationof antibiotics,vitamins,andaminoacids. Assessmentofanewantibiotic.	**06**
4	Classificationandmodeofactionofdisinfectants. Factors influencing disinfection, antiseptics, and their evaluation. For bacteriostaticand bactericidal actions, Evaluation of bactericidal & Bacteriostatic. Sterility testingof products (solids, liquids, ophthalmic and other sterile products) according to IP,BP and USP. Study of principle, procedure, merits, demerits and applications ofphysical,chemicalgaseousradiationandmechanicalmethodofsterilization.Evaluatio nof the efficiencyof sterilizationmethods. Equipmentemployedinlargescalesterilization.Sterilityindicators. Designing of aseptic area, laminar flow equipment; study of different sources ofcontaminationinanasepticareaandmethodsofprevention,cleanareaclassification.	**10**
5	Typesofspoilage,factorsaffectingthemicrobialspoilageof pharmaceuticalproducts,sources,andtypesofmicrobialcontaminants,assessmentofmicr obialcontaminationandspoilage. Preservationofpharmaceuticalproductsusingantimicrobialagents,evaluationofmicrobia lstabilityof formulations. Growthofanimalcellsinculture,generalprocedureforcellculture,Primary,	**08**
	establishedandtransformedcellcultures. Applicationofcellculturesinpharmaceuticalindustryandresearch.Disposalof Microbialwaste	
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. HugoW.B.andRussel A.D,PharmaceuticalMicrobiology,8th Edition,BlackwellScientificpublications,Oxford,London ,2013.
2. Reed G., Prescott, and Dunn's., Industrial Microbiology, 4th edition, CBS Publishers &Distributors,Delhi,2004.
3. PelczarMJ, Chan ECS,Kreig NR.Microbiology,6th Edition,Tata McGraw Hill Education Pvt.Ltd,Delhi,1993
4. HarrisM,TindallB,andCox,PharmaceuticalMicrobiology,1st edition,1964,TheWilliamsandWilkins, Baltimore,1964.

5. RoseAH,IndustrialMicrobiology,1st edition,Butterworths(Elsevier), Oxford,1961.
6. Frobisher M, HinsDill RD,CrabtreaKT,GoodHeartCR, FundamentalsofMicrobiology,9thedition,Japan,1974.
7. CarterS.J., Cooperand Gunn's.Tutorial Pharmacy,6th edition,CBS Publications,New Delhi,2005.
8. Peppler HJ, MicrobialTechnology,2nd Edition,AcademicPress(Elsevier),Massachusetts,1979.
9. I.P.,B.P.,U.S.P.-latesteditions.
10. RebaKanungo,AnanthnarayanandPaniker'sTextbookofMicrobiology,10th Edition,Orient-Longman,Chennai,2017.
11. Pommerville,J.C.,Alcamo'sFundamentals ofMicrobiology,3rd Edition,JonesandBartlett,Burlington,Massachusetts,2014.
12. JainN.K,PharmaceuticalMicrobiology,3rd Edition,VallabhPrakashan,Delhi,2001.
13. GarryG.M.,Bergey'sManualofSystematicBacteriology,2nd Edition,Springerpublishing,NewYork,2005.

BP304T

PHARMACEUTICALENGINEERING(Theory) 45 Hours

Course Objectives:

Study morphology, classification, and reproduction of all categories of microorganisms especially which cause diseases, microbiological tests, aseptic handling, and sterilization aspects.

Course Outcomes:

1. To understand mechanics of fluid, fluid flow and its measurements.
2. To know various unit operations used in pharmaceutical manufacturing and material handling systems.
3. To appreciate the various preventive methods used for corrosion control in pharmaceutical industries.
4. To define and categorize the different industrial hazards.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP304T CO1	3	2	1	2	1	2	1	1	1	2	3
BP304T CO2	3	2	2	3	1	1	1	1	1	2	3
BP304T CO3	3	1	1	2	1	1	1	1	1	2	3
BP304T CO4	3	2	3	1	1	2	1	2	1	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
	UNIT–I	**10**
1	**Flowoffluids:**Typesofmanometers,Reynoldsnumberanditssignificance,Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter,PitottubeandRotometer. **SizeReduction:**Objectives,Mechanisms&Lawsgoverningsizereduction,factors	

	affecting size reduction, principles, construction, working, uses, merits and demerits ofHammermill,ballmill,fluid energy mill,Edgerunnermill&endrunnermill. **Size Separation:** Objectives, applications & mechanism of size separation, officialstandards of powders, sieves, size separation Principles, construction, working, uses,merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter &elutriationtank. **Materialhandlingsystems**:ConveyersandPumps	
	UNIT–II	**10**
2	• **Heat and Mass Transfer:** Objectives, applications & Heat transfer mechanisms.Fourier'slaw,Heattransferbyconduction,convection&radiation.Heatinterchangers & heat exchangers. Temperature measurement-basic principles anddevices. Mass transfer in turbulent and laminar flow. Concept of interfacial masstransfer. • **Evaporation:**Objectives,applicationsandfactorsinfluencingevaporation,differences between evaporation and other heat process. principles, construction,working,uses,meritsanddemeritsofSteamjacketedkettle,horizontaltubeevaporator, climbing film evaporator, forced circulation evaporator, multiple effectevaporator&Economyofmultipleeffectevaporator. • **Distillation:**BasicPrinciplesandmethodologyofsimpledistillation,flashdistillation,fractionaldistillation,distillationunderreducedpressure,steamdistillation&moleculardistillation.	
3	**UNIT–III**	**10**
	• **Drying:** Objectives, applications & mechanism of drying process, measurements &applicationsofEquilibriumMoisturecontent,rateofdryingcurve.principles,construction, working, uses, merits and demerits of Tray dryer, drum dryer spraydryer,fluidizedbeddryer,vacuumdryer,freeze dryer. • **Mixing:** Objectives, applications & factors affecting mixing, Difference betweensolid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolidsmixing.Principles,Construction,Working,uses,MeritsandDemeritsofDouble cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetarymixers,Propellers,Turbines,Paddles&SilversonEmulsifier.	
4	**UNIT–IV**	**8**
	• **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filteraids, filter medias. Principle, Construction, Working, Uses, Merits and demerits ofplate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter,membranefiltersandSeidtz filter. • **Centrifugation:**Objectives,principle&applicationsofCentrifugation,principles, construction, working, uses,merits and demerits of Perforated basket centrifuge,Non-perforatedbasket centrifuge,semicontinuouscentrifuge& supercentrifuge.	
5	**UNIT–V**	**7**
	• **Materials of pharmaceutical plant construction, Corrosion, and its prevention:**Factors affecting during materials selected forpharmaceutical plant construction,Theoriesofcorrosion,typesofcorrosionandtheirprevention.Ferrousandnon ferrousmetals,inorganicandorganicnon-metals,basicofmaterialhandlingsystems. • Hazards:Sourcesofhazards inpharmaceuticalindustryandtheirprevention.	
	TOTAL	**45**

ReferenceBooks(LatestEditions tobeadopted):

1. BadgerW.L.&BancheroJ.,Introductiontochemicalengineering,PublishedbyTataMcGraw Hill,Internationaledition,NewDelhi,1955
2. PerryR.H.,GreenD.W.,MaloneyO,Perry'sChemicalEngineer'sHandbook-.7thEdition,McGrawHillInc.,NewYork,1998.
3. McCabe,Smith&Harriott.Unit OperationsofChemical Engineering,PublishedbyMcGrawHillInc.,5thedition,1993.
4. Subramanyam C.V.S., Pharmaceutical Engineering: Unit Operations - Principles andPractice,VallabhPrakashan,Delhi.,3rdedition,2019.
5. RemingtonA,TheScience&PracticeofPharmacy.Lippincott,Williams&WilkinsPhiladelphia.21stedition,2006.
6. LachmanL.,LiebermanH.A.&KanjigJ.L,TheTheory&PracticeofIndustrialPharmacy,3rdedition,VarghesePublishingHouse,Bombay,1990.
7. K.Sambamurthy,PharmaceuticalEngineering,NewAgeInternationalPublishers,Delhi,2005.
8. Subrahmanyam C.V.S.,Textbook of Physical Pharmaceutics,3rdedition,VallabhPrakashan,Delhi,2015.
9. Subrahmanyam C.V.S., Essentials of Physical Pharmaceutics, 2nd edition, VallabhPrakashan,Delhi,2017.
10. CarterS.J.,CooperandGunn's.Tutorial Pharmacy,6thedition,CBSPublications,NewDelhi,2005.
11. Sona P.S., A Practical Manual of Pharmaceutical Engineering,University Science Press,NewDelhi,India.
12. SimpsonN.J.K.,Solidphaseextraction,Principles,techniques,andapplications,MarcelDekkerInc.USA,2000.

BP305P
PHARMACEUTICALORGANICCHEMISTRY-II(Practical)

CourseObjectives:

Toget thelearnerintroducedtothebasicprinciplesoforganicsynthesis.

CourseOutcomes

Thelearnershouldbeableto:

1. Remember/Understand the basic etiquettes of laboratory glassware, fire safety hazards and personal protection measures and follow good laboratory practices (GLP)
2. Apply the knowledge for selection of the appropriate solvents for recrystallization of organic compounds.
3. Determine and justify the significance of the analytical constants for fats and oils by titrimetric analysis.
4. Demonstrate and perform the melting point of synthesized pure compounds.
5. Explain the basic principles & procedures involved in the green chemistry and traditional techniques to prepare medicinal organic compounds.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP305P CO1	2	2	2	-	2	2	2	1	1	1	2
BP305P CO2	2	2	3	-	1	1	1	2	-	-	1
BP305P CO3	2	2	2	1	-	1	1	2	2	1	2
BP305P CO4	2	2	2	-	1	2	2	-	1	-	1
BP305P CO5	2	2	3	1	1	1	1	1	1	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong),

2(Moderate) and1 (Weak). No relation -

I	**Experimentsinvolvinglaboratorytechniques.** • Recrystallization • Steamdistillation
II	**Determinationoffollowingoilvalues(includingstandardizationofreagents).** • Acidvalue • Saponificationvalue • Iodinevalue
III	**Preparationofcompounds.** • Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylationreaction. • 2,4,6-Tribromoaniline/Parabromoacetanilidefrom Aniline/ • Acetanilidebyhalogenation(Bromination)reaction. • 5-Nitrosalicylicacid/MetadinitrobenzenefromSalicylicacid/Nitrobenzenebynitrationreaction. • BenzoicacidfromBenzylchloridebyoxidationreaction. • Benzoicacid/Salicylicacidfromalkylbenzoate/alkylsalicylatebyhydrolysisreaction. • 1-Phenylazo-2-naptholfromAnilinebydiazotizationandcouplingreactions. • BenzilfromBenzoinbyoxidationreaction. • DibenzalacetonefromBenzaldehydebyClaisenSchmidtreaction. • Cinnamic acidfromBenzaldehydebyPerkinreaction. • *P*-Iodobenzoic acidfrom*P*-aminobenzoicacid.

ReferenceBooks(LatestEditionstobeadopted):

1. MorrisonR.T.,BoydR.N.,OrganicChemistry,6th edition,PrenticeHall,NewJersey,1992.
2. FinarI.L.,OrganicChemistry,Vol.1,4th edition,PearsonPublishingHouse,Longman,1963.
3. Bahl B. S., Bahl A., Textbook of Organic Chemistry, 22nd edition, S. Chand publishing, Delhi, India,2017.
4. SoniP.L.,OrganicChemistry,29th edition,S.Chandpublishing,Delhi,India,2007
5. MannF.G.,PracticalOrganicChemistry,4thEdition,BernardCharlesSaunders,Longman,London,NewYorkandToronto,1960.
6. VogelA.I.,
Vogel'stextbookofPracticalOrganicChemistry,5th edition,PearsonPublishingHouse,7.India,1989.
8. VishnoiN.K.,AdvancedPracticalOrganicChemistry,1st edition,VikasPublishingHouse,Mumbai, 1979.
9. EngelR.G.,PaviaD.L.,LampmanG.N.,KrizG.S.,Introduction to OrganicLaboratoryTechniques,CengageLearning,India,2010.

BP306P
PHYSICALPHARMACEUTICS–I(Practical)

CourseObjectives:

The objective of the course is to teach the learner the methods for the determination of differentphysical parameters underlying pre-formulation testing, formulation development and finished product testingof drugdeliverysystems.

CourseOutcomes:

Thelearnershouldbeableto:

1. Tounderstandtheprinciplesandmethodsforthedeterminationofvariousphysicalparametersofdrugs.
2. Tocarryoutvariousphysico-testsinvolvedincharacterizationofdrugs.

3. To demonstrate testing of various physicochemical parameters involved in pre-formulation and formulationdevelopmentandevaluation.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP306P CO1	3	1	2	1	1	2	1	1	1	1	3
BP306P CO2	3	2	2	1	1	2	2	2	1	1	3
BP306P CO3	3	2	2	1	1	2	2	2	1	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1	Determinationthesolubilityofdrugatroomtemperature.
2	DeterminationofpKavaluebyHalfNeutralization/HendersonHasselbalchequation.
3	DeterminationofPartitionco-efficientofbenzoicacidinbenzeneandwater.
4	DeterminationofPartitionco-efficientofIodineinCCl$_4$andwater(Demonstration).
5	DeterminationofCSTofphenolwatersystemand %compositionofNaClin asolutionusingphenol-watersystembyCSTmethod.
6	Determinationofsurfacetensionofgivenliquidsbydropcountanddropweightmethod.
7	DeterminationofHLBnumberofa surfactantbysaponificationmethod.
8	DeterminationofFreundlichandLangmuirconstants usingactivatedcharcoal.
9	Determinationofcriticalmicellarconcentrationofsurfactants.
10	Determinationofstabilityconstantanddonoracceptorratioof PABA-Caffeinecomplexbysolubilitymethod.
11	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pHtitrationmethod(Demonstration).
12	Todeterminetherefractiveindexofliquidsusing Abbe's Refractometer.
13	Todeterminethe concentrationofanunknownsolutionofanopticallyactive substanceusingpolarimeter.
14	Todeterminethemolecularweightofionizableandnonionizablesolutebyebullioscopy(LandsBerger Method).

RecommendedBooks(LatestEditionstobeadopted):

1. Martin A, Swarbrick.J, Cammarata A, Physical Pharmacy: Physical Chemical Principles inthePharmaceuticalSciences,3rd edition,BIWaverly.PvtLtd,NewDelhi,1993.
2. SinkoPJ,SinghY.Martin'sPhysicalPharmacyandPharmaceuticalSciences:PhysicalChemical and Biopharmaceutical Principles in the Pharmaceutical Sciences, 6th edition, WalterKluer,Philadelphia,2011.
3. Parrott E.L, Saski W, Experimental Pharmaceutics, 4th edition, Burgess Publishing Company,Minneapolis,1971
4. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New Delhi,2005.
5. StocklosaM.J.PharmaceuticalCalculations,6thedition,Lea&Febiger,Philadelphia,1974
6. LiebermanHA,LachmanL,SchwartzJB.Pharmaceuticaldosageforms—tablets,Vol.1,2,3/edited by Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition,MarcelDekkerInc.,Newyork,1990.
7. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1,

2,3/edited by Herbert A. Lieberman, Martin, M., and Gilbert S. Banker, 2nd edition, MarcelDekkerInc.NewYork,1998.
8. RamasamyC,andManavalanR,PhysicalPharmaceutics,1stedition,PharmaMedPress,2017
9. C.V.S.Subramanyam,J.Thimmasettee,LaboratoryManualofPhysicalPharmaceutics,2nd edition, VallabhPrakashan,Delhi,2014.
10. C.V.S.Subrahmanyam,TextbookofPhysicalPharmaceutics,3rd edition,VallabhPrakashan,Delhi,2 015
11. C.V.S.Subrahmanyam,EssentialsofPhysicalPharmaceutics,2nd edition,VallabhPrakashan,Delhi, 2017
12. Jain G, Khar RK, Ahmad FJ, Theory and Practice of Physical Pharmacy,1st Edition,ElsevierIndia,2013
13. BahlA, BahlB. S,TuliG. D, Essentials ofPhysicalChemistry, 28th edition, SChandPublications,NewDelhi,2000.

BP307PPHARMACEUTICAL MICROBIOLOGY(Practical)

CourseObjectives:
To introduce the learner to some of the common techniques used in microbiological techniques andexperiments.

CourseOutcomes:
Uponcompletionof thecoursethestudentwillbeable to:
1. Characterization andidentificationofbacteriausingvariousstaining techniques(morphologicalstudy),colonycharacterization,serologicalandbiochemicalcharacteristics.
2. Analyzequalityofrawmaterial,food andwaterandassessmentofextentofmicrobialcontaminationusingcountingtechniqueandEvaluates terilityofproducts.
3. Toimpartthe knowledgeofbioassayofantibioticandtestantibioticsensitivityoffewantibiotics.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP307P CO1	3	3	3	3	1	3	3	1	3	3	3
BP307P CO2	3	3	3	3	1	3	3	1	3	3	3
BP307P CO3	3	3	3	3	1	3	3	1	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1	Introductionandstudyofdifferentequipmentandprocessing,e.g.,B.O.D.incubator,laminarflow ,aseptichood,autoclave,hotairsterilizer,deepfreezer,refrigerator, microscopesusedinexperimentalmicrobiology.
2	Sterilizationofglassware, preparation,andsterilizationofmedia.
3	Subculturingofbacteriaandfungus.Nutrientstabsandslants preparations.
4	Stainingmethods-Simple, Gram'sstainingandacid-faststaining(Demonstrationwithpractical),negativestaining,capsulestaining,cellwallstaining.
5	Isolationofpureculture ofmicro-organismsbymultiplestreakplatetechniqueandothertechniques.
6	Microbiologicalassayofantibioticsbycupplatemethodandothermethods.

7	MotilitydeterminationbyHangingdropmethod.
8	Sterilitytestingofpharmaceuticals.
9	Bacteriologicalanalysisofwater.
10	Biochemicaltest.
11	MicrobialTotalcounts byBreedssmearmethod(Demo),MicrobialGrowthbyopticaldensity,totalplatecount(Demo).

RecommendedBooks(Latesteditiontobeadopted):

1. Hugo W.B.andRusselA.D,PharmaceuticalMicrobiology, 8thEdition,BlackwellScientificpublications,Oxford,London,2013.
2. Reed G.,Prescottand Dunn's.,Industrial Microbiology,4th edition,CBSPublishers &Distributors,Delhi,2004.
3. PelczarMJ,ChanECS,KreigNR.Microbiology,6thEdition,TataMcGrawHillEducationPvt.Ltd,Delhi,1 993.
4. HarrisM,TindallB,andCox,PharmaceuticalMicrobiology,1stedition,1964,TheWilliamsandWilkins,
5. RoseAH,IndustrialMicrobiology,1stedition,Butterworths(Elsevier),Oxford,1961.
6. Frobisher M, Hinsdill RD,CrabtreaKT, Good Heart CR, Fundamentalsof Microbiology,9thedition,Japan,1974.
7. CarterS.J.,CooperandGunn's.TutorialPharmacy,6thedition,CBSPublications,NewDelhi,2005.
8. PepplerHJ,Microbial Technology,2ndEdition,AcademicPress(Elsevier),Massachusetts,1979.
9. I.P.,B.P.,U.S.P.-latesteditions.
10. RebaKanungo,Ananthnarayan and Paniker's Textbook of Microbiology,10th Edition,Orient-Longman,Chennai,2017.
11. Pommerville,J.C.,Alcamo'sFundamentalsofMicrobiology,3rdEdition,JonesandBartlett,Burlington,M assachusetts,2014.
12. JainN.K,PharmaceuticalMicrobiology,3rdEdition, VallabhPrakashan,Delhi,2001.
13. Garry G.M., Bergey's Manual of SystematicBacteriology,2nd Edition,Springerpublishing,NewYork,2005.

BP308PPHARMACEUTICA LENGINEERING(Practical)

Courseobjectives:

To familiarize the learner with unit operations encountered in manufacturing of pharmaceuticals andprovide training in operating and handling of instruments and equipment and an understanding ofmanufacturingprocesses.

CourseOutcomes:

Thelearnershouldbeableto:

1. Understandtheconstructionandoperationofvariousmachinesandequipmentencounteredinpharmaceuti calmanufacturingunitoperations
2. Analyzevariousunitprocessesandfactorsinvolvedtodesignandapplyittosolveproblemsencounteredin manufacturing
3. Understandandapplythecalculationofvariouscoefficientsandvariablesthatgovernunitoperatio nsinordertomaximize efficiencyof theprocesses.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP308PCO1	3	3	3	3	3	3	3	3	2	3	3
BP308PCO2	3	3	3	3	3	3	3	3	2	3	3
BP308PCO3	3	3	3	3	3	3	3	3	2	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LIST OFEXPERIMENTS

1	Determinationofradiationconstantofbrass,iron,unpaintedandpaintedglass.
2	Simpledistillation–Tocalculatetheefficiency ofsimpledistillation.
3	Steamdistillation–(Demonstration).
4	Todeterminetheoverallheattransfercoefficient byheat exchanger.
5	Constructionofdryingcurves(forcalciumcarbonateandstarch).
6	Determinationofmoisturecontentandlossondrying.
7	Determinationofhumidityofair–i)Fromwetanddrybulb temperatures– useofDewpointmethod.
8	DescriptionofConstructionworkingandapplicationofpharmaceuticalmachinerysuchas
	fluidenergymill,dehumidifier.
9	Size analysis by sieving – To evaluate size distribution of tablet granulations – Constructionofvarioussizefrequencycurvesincludingarithmeticandlogarithmic probabilityplots.
10	Size reduction: To verify the laws of size reduction using ball mill anddeterminingKicks,Rittinger's,Bond's coefficients,powerrequirementand criticalspeedofBallMill.
11	Demonstrationofcolloidmill,planetarymixer,fluidizedbeddryer,freezedryerandsuch othermajorequipment.
12	FactorsaffectingRateofFiltrationandEvaporation(Surfacearea,Concentration andThickness/viscosity.
13	Tostudythe effectoftimeontheRateof Crystallization.
14	TocalculatetheuniformityIndexforgivensamplebyusingDoubleConeBlender.

RecommendedBooks:(LatestEditionstobeadopted):

1. BadgerW.L.&BancheroJ.,IntroductiontochemicalengineeringPublishedbyTataMcGraw Hill,Internationaledition,NewDelhi,1955
2. PerryR.H.,GreenD.W.,MaloneyO,Perry'sChemicalEngineer'sHandbook- .7thEdition,McGrawHillInc.,NewYork,1998.
3. McCabe, Smith & Harriott. Unit Operations of Chemical Engineering, Published byMcGrawHillInc.,5thedition,1993.
4. SubramanyamC.V.S., PharmaceuticalEngineering: Unit Operations - Principles andPractice,VallabhPrakashan,Delhi.,3rdedition,2019.
5. RemingtonA,TheScience&PracticeofPharmacy.Lippincott,Williams&WilkinsPhiladelphi a.21stedition,2006.
6. LachmanL.,LiebermanH.A.&KanjigJ.L,TheTheory&PracticeofIndustrialPharmacy ,3rdedition,VargheseePublishingHouse,Bombay,1990.
7. K.Sambamurthy,PharmaceuticalEngineering,NewAgeInternational Publishers,Delhi,2005.
8. C.V.SSubrahmanyam,Textbook of Physical Pharmaceutics,3rdedition,VallabhPrakashan,Delhi,2015.

9. C.V.S Subrahmanyam, Essentials of Physical Pharmaceutics, 2nd edition, VallabhPrakashan,Delhi,2017.
10. CarterS.J.,CooperandGunn's.Tutorial Pharmacy,6thedition,CBSPublications,NewDelhi,2005.
11. Sona P.S., A Practical Manual of Pharmaceutical Engineering,University Science Press,NewDelhi,India.
12. SimpsonN.J.K.,Solidphaseextraction,Principles,techniques,andapplications,MarcelDekkerInc.USA,2000.

SEMESTER
IVBP401T
PHARMACEUTICAL ORGANICCHEMISTRY–III(Theory) 45Hours

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

CourseOutcomes:
Attheendofthecourse,thestudentshallbeableto:
1. **Illustrate** the stereo-chemical features including conformation and stereo electronic effects of organic molecules.
2. **Explain** the basic nomenclature and principles of heterocyclic chemistry.
3. **Predict** and Assign E&Z, R&S nomenclature of organic compounds.
4. **Apply** the mechanisms of organic reactions and common naming reactions in the synthesis of drug molecules.
5. **Explain** the structures and synthesis of simple five and six membered heterocyclic organic compounds.
6. **Predict** the formation of organic products from the starting materials and reactants and vice versa.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP401T CO1	2	2	2	1	1	1	-	1	-	-	1
BP401T CO2	2	-	2	2	-	-	-	-	-	-	2
BP401T CO3	2	-	2	2	-	-	-	-	-	-	2
BP401T CO4	2	2	2	-	-	1	1	1	1	-	1
BP401T CO5	2	2	2	1	-	1	1	1	1	-	1
BP401T CO6	2	1	2	-	-	1	-	1	-	-	1

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
	Note: To emphasize on definition, types, mechanisms, examples,uses/applications.	
1		**10**

	Stereoisomerism Opticalisomerism– i. Opticalactivity,enantiomers,diastereoisomers,mesocompounds. ii. Elementsofsymmetry,chiralandachiralmolecules. iii. DLsystemofnomenclatureofopticalisomers,sequencerules,RSsystemofnomenclatureof optical isomers. iv. Reactionsof chiralmolecules(Stereospecificandstereoselectiveaspects). v. Racemicmodificationandresolutionofracemicmixture. vi. Asymmetricsynthesis:partialandabsolute.	
2		**10**
	Geometricalisomerism i. Nomenclatureofgeometricalisomers(CisTrans,EZ,SynAntisystems). ii. Methodsof determinationofconfigurationofgeometricalisomers. iii. ConformationalisomerisminEthane,n-ButaneandCyclohexane. iv. Stereoisomerisminbiphenylcompounds(Atropisomerism)andconditionsforoptic alactivity.	
3		**10**
	Heterocycliccompounds: Nomenclatureandclassification. Synthesis,reactions andmedicinaluses offollowingcompounds/derivatives.Pyrrole,Furan,andThiophene. RelativearomaticityandreactivityofPyrrole,FuranandThiophene.	
4		**08**
	Synthesis,reactionsand medicinalusesoffollowingcompounds/derivatives Pyrazole,Imidazole,OxazoleandThiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine.SynthesisandmedicinalusesofPyrimidine,Purine,azepinesandtheirderivatives.	
5	**Reactionsofsyntheticimportance**	**07**
5.1	Metalhydridereduction($NaBH_4$and$LiAlH_4$),Clemmensenreduction,Birchreduction,Wolff Kishnerreduction.	2
5.2	Oppenauer-oxidationandDakinreaction.	2
5.3	BeckmannrearrangementandSchmidtrearrangement.	2
5.4	Claisen-Schmidtcondensation.	1
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. FinarI.L.,OrganicChemistry,Vol.1,4th edition,PearsonPublishingHouse,Longman,1963
2. BahlB.S.,BahlA.,TextbookofOrganicChemistry,22nd edition,S.Chandpublishing,Delhi,India,2017
3. BansalR.K.,HeterocyclicChemistry,4th edition, AnshanLimited,India,2008
4. MorrisonR.T.,BoydR.N.,OrganicChemistry,6th edition,PrenticeHall,NewJersey, 1992
5. GilchristT.L.,HeterocyclicChemistry,3rd edition,PrenticeHall,NewJersey,1997

BP402T

MEDICINALCHEMISTRY–I(Theory) 45Hours

CourseObjectives:

Thissubjectisdesignedtoimpartfundamentalknowledgeonthestructure,chemistry,andtherapeutic value of drugs. The subjectemphasizeson structure activity relationships of drugs,importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizesonchemicalsynthesisof importantdrugsundereachclass.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeableto:

1. Understandthechemistryofdrugswithrespect totheirpharmacologicalactivity.
2. Understand and predictthedrugmetabolicpathways,adverseeffect,andtherapeuticvalueofdrugs.
3. Critically examine and evaluate the structure-activity relationships of selected classes of drugs specified in the course, demonstrating a deep understanding of how molecular structures influence drug interactions and effectiveness.
4. Know and analyze the Structural Activity Relationship (SAR) of different class of drugs
5. Outlinethechemicalsynthesisofsomedrugs.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP402T CO1	2	2	3	-	1	1	1	2	1	-	2
BP402T CO2	2	2	3	-	-	1	-	1	2	-	2
BP402T CO3	2	1	3	1	-	1	-	-	-	-	2
BP402T CO4	2	1	3	1	-	1	-	1	-	-	1
BP402T CO5	2	2	2	1	-	1	1	1	1	-	1

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
	Studyofthedevelopmentofthefollowingclassesofdrugs,Classification,mechanismofaction,usesofdrugsmentionedinthecourse,Structureactivity relationshipofselectiveclassofdrugsasspecifiedinthecourseandsynthesisofdrugssupers cripted*.	
1	**IntroductiontoMedicinalChemistry**	**10**
1.1	**Historyanddevelopmentofmedicinalchemistry**	**1**
1.2	**Physicochemicalpropertiesinrelationtobiological action** Ionization,Solubility,PartitionCoefficient,Hydrogenbonding,Proteinbinding,Chelation,Bioisosterism,OpticalandGeometricalisomerism.	**4**
1.3	**Drugmetabolism** • Drugmetabolismprinciples-PhaseI andPhaseII.	**5**
	• Factorsaffectingdrugmetabolismincludingstereochemicalaspects.	
2	**DrugsactingonAutonomicNervousSystem**	**10**
2.1	**AdrenergicNeurotransmitters:** • Biosynthesisandcatabolismofcatecholamine. • Adrenergicreceptors(Alpha &Beta)andtheirdistribution.	**2**
2.2	**Sympathomimeticagents:SAR ofSympathomimetic agents** • Directacting:Norepinephrine,Epinephrine,Phenylephrine*,Dopamine. • Methyldopa,Clonidine,Dobutamine,Isoproterenol,Terbutaline,Salbutamol*,Bitolterol,Naphazoline,OxymetazolineandXylometazoline. • Indirectactingagents:Hydroxyamphetamine,Pseudoephedrine,Propylhexedrine. • Agentswithmixedmechanism:Ephedrine, Metaraminol.	**4**

2.3	**AdrenergicAntagonists:** • **Alphaadrenergicblockers:**Tolazoline*,Phentolamine,Phenoxybenzamine,Prazosin,Dihydroergotamine,Methysergide. • **Betaadrenergicblockers:**SARofbetablockers,Propranolol*,Metibranolol,Atenolol,Betazolol,Bisoprolol,Esmolol,Metoprolol,Labetolol,Carvedilol.	4
3	**Cholinergicneurotransmitters**	10
3.1	Biosynthesisandcatabolismofacetylcholine. Cholinergicreceptors(Muscarinic&Nicotinic)andtheirdistribution	2
3.2	**Parasympathomimeticagents:SARofParasympathomimeticagents** • **Directactingagents:**Acetylcholine,Carbachol*,Bethanechol,Methacholine,Pilocarpine. • **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):**Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrinehydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide,Parathione,Malathion. • **Cholinesterasereactivator:**Pralidoximechloride.	4
3.3	**CholinergicBlockingagents:SARofcholinolyticagents** • **Solanaceousalkaloidsandanalogues:**Atropinesulphate,Hyoscyaminesulphate, Scopolaminehydrobromide,Homatropinehydrobromide,Ipratropiumbromide*. • **Syntheticcholinergicblocking agents:** Tropicamide,Cyclopentolatehydrochloride, Clidinium bromide, Dicyclomine hydrochloride*,Glycopyrrolate,Methanthelinebromide,Propanthelinebromide ,Benztropinemesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidinehydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazinehydrochloride.	4
4	**DrugsactingonCentralNervousSystem**	08
4.1	**SedativesandHypnotics:** • **Benzodiazepines:**SARofBenzodiazepines,Chlordiazepoxide,Diazepam*,Oxazepam,Chlorazepate,Lorazepam,Alprazolam,Zolpidem. • **Barbiturates:**SARofbarbiturates,Barbital*,Phenobarbital,Mephobarbital,Amobarbital,Butabarbital, Pentobarbital,Secobarbital. • **Miscellaneous**: Amidesandimides:Glutethimide. Alcohol&theircarbamatederivatives:Meprobamate,Ethchlorvynol.	3
	Aldehyde&theirderivatives:Triclofossodium,Paraldehyde.	
4.2	**Antipsychotics** • **Phenothiazines:** SAR of Phenothiazines - Promazine hydrochloride,Chlorpromazinehydrochloride*,Triflupromazine,Thioridazinehydrochloride,Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazinehydrochloride. • **RingAnaloguesofPhenothiazines:**Chlorprothixene,Thiothixene,Loxapinesuccinate,Clozapine. • **Flurobuterophenones:**Haloperidol,Droperidol,Risperidone. • **Betaaminoketones:**Molindonehydrochloride. • **Benzamides:**Sulpiride.	3

4.3	**Anticonvulsants:**SARofAnticonvulsants,mechanismofanticonvulsantaction • **Barbiturates**:Phenobarbitone, Methabarbital. • **Hydantoins:**Phenytoin*,Mephenytoin,Ethotoin. • **Oxazolidinediones:**Trimethadione,Paramethadione. • **Succinimides:**Phensuximide,Methsuximide,Ethosuximide* • **Ureaandmonoacylureas**:Phenacemide,Carbamazepine* • **Benzodiazepines**:Clonazepam. • **Miscellaneous:**Primidone,Valproicacid,Gabapentin,Felbamate.	2
5	**Drugs acting onCentralNervous System**	07
5.1	**Generalanesthetics:** • **Inhalationanesthetics:**Halothane*,Methoxyflurane,Enflurane,Sevoflurane,Iso flurane,Desflurane. • **Ultrashortactingbarbiturates:**Methohexitalsodium*,Thiamylalsodium,Thi opentalsodium. • **Dissociativeanesthetics:**Ketaminehydrochloride.*	3
5.2	• **Narcoticandnon-narcoticanalgesics** • **Morphine and related drugs:** SAR of Morphine analogues, Morphinesulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride,Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*,Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine,Levorphanoltartarate. • **Narcoticantagonists:**Nalorphinehydrochloride,Levallorphantartarate,Na loxonehydrochloride.	2
5.3	**Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*,Meclofenamate,Indomethacin,Sulindac,Tolmetin,Zomepirac,Diclofenac, Ketorolac,Ibuprofen*,Naproxen,Piroxicam,Phenacetin,Acetaminophen,A ntipyrine, Phenylbutazone.	2
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. Beale J.M., Block J.H., Wilson and Gisvold's Textbook of Organicmedicinal and PharmaceuticalChemistry,20th edition,LippincottWilliams&WilkinsPublishers,2004.
2. LemkeT.L.,WilliamsD.A.,RocheV.F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry,7thedition,L ippincottWilliamsandWilkinsPublishers,2001.
3. AbrahamD.J.,Burger'sMedicinalChemistryandDrugDiscovery,VolItoIV,6thedition,JohnWileyandSon s,Inc.,Publication,2003.
4. SmithH.J.,SmithandWilliams'IntroductiontoPrinciplesofDrugDesignandAction,4thedition,TaylorandFrancisPubli cations,CRCPress,2005.
5. Remington, The Science and Practice of Pharmacy, 21st edition, Lippincott Williams and WilkinsPublication,2005.
6. RobertBuckingham,Martindale:TheExtraPharmacopoeia,40thedition,PharmaceuticalPress,2020.
7. FinarI.L.,OrganicChemistry,Vol.II,4thedition,PearsonPublishingHouse,Longman,1963
8. LednicerD.,TheOrganicChemistry ofDrugSynthesis,Vol.1-7,Wiley-Blackwell,2007
9. IndianPharmacopoeia.
10. VogelA.I., Vogel'stextbookofPracticalOrganicChemistry, 5thedition, PearsonPublishingHouse,India,1989.

BP403T

PHYSICALPHARMACEUTICS-II(Theory) 45 Hours

Courseobjectives:

The course deals with the various physical and physicochemical properties, and principles involved indosage forms/formulations. Theory and practical components of the subject help the student to get a betterinsight into various areas of formulation research and development, and stability studies of pharmaceuticaldosageforms.

Course Outcomes:

The learner should be able to:

1.**Describe**, compare, and correlate the laws of thermodynamics, Concept of enthalpy, entropy and free energy, Gibbs equation, thermochemistry.

2.**Understand** the concept of Suspension, Emulsions, Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

3.**Apply** knowledge of dispersed systems & their general characteristics, Optical, kinetic & electrical properties as well as effect of electrolytes, coacervation, peptization & protective action.

4.**Understanding** of Newtonian system and non-Newtonian system, Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus.

5.**Understanding** of the concept of micromeritics, methods for determining particle size by different methods and derived properties of powders.

6.**Understanding** of the concept of Reaction kinetics, zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP403T CO1	3	2	3	3	-	2	3	2	3	3	3
BP403T CO2	3	2	3	3	-	2	3	2	3	3	3
BP403T CO3	3	2	3	3	-	2	3	2	3	3	3
BP403T CO4	3	2	3	3	-	2	3	2	3	3	3
BP403T CO5	3	2	3	3	-	2	3	2	3	3	3
BP403T CO6	3	2	3	3	-	2	3	2	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT-I**	**5**
	Thermodynamics: Firstlawandsecondlawofthermodynamics;Conceptofenthalpy,entropyandfreeenergy,Gibbsequation,thermochemistry.	
2	**UNIT-II**	**8**
	Coarsedispersion: Suspension, interfacial properties of suspended particles, settling in suspensions,formulationoffflocculatedanddeflocculatedsuspensions.Emulsionsandtheoriesofemulsification,microemulsionandmultipleemulsions;Stabilityofemulsions, preservation of emulsions, rheological properties of emulsions and emulsionformulationbyHLBmethod.	

3	**UNIT-III**	**7**
	Colloidaldispersions: Classificationofdispersedsystems&theirgeneralcharacteristics,size&shapesofcolloidalparticles,classificationofcolloids&comparativeaccountoftheir generalproperties.Optical,kinetic&electricalproperties.Effectofelectrolytes,coacervation, peptization& protectiveaction.	
4	**UNIT-IV**	**7**
	Rheology: Newtoniansystems, lawofflow,kinematicviscosity,effectoftemperature, non-	
	Newtoniansystems,pseudoplastic,dilatant,plastic,thixotropy,thixotropyinformulation, determination of viscosity, capillary, falling Sphere, rotationalviscometers. **Deformationofsolids:** Plasticandelasticdeformation, Heckelequation,Stress,Strain, ElasticModulus	
5	**UNIT-V**	**8**
	Micromeritics: 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 fordetermining surface area, permeability, adsorption, derived properties of powders,porosity,packingarrangement,densities,bulkiness&flowproperties.	
6	**UNIT-VI**	**10**
	Drugstability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rateconstants, determination of reaction order. Physical and chemical factorsinfluencing the chemical degradation of pharmaceutical product: temperature,solvent, ionic strength, dielectric constant, specific & general acid base catalysis,Simplenumericalproblems. Stabilizationof medicinalagentsagainstcommonreactions likehydrolysis& oxidation.Acceleratedstabilitytestinginexpirationdatingofpharmaceuticaldosageforms.Photolyticdegradationanditsprevention.	
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Martin A, Swarbrick. J, Cammarata A, Physical Pharmacy: Physical Chemical Principles in thePharmaceuticalSciences,3rdedition,BI Waverly.PvtLtd,NewDelhi,1993.
2. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical ChemicalandBiopharmaceuticalPrinciplesinthePharmaceuticalSciences,6thedition,WalterKluer,Philadelphia,2011.
3. ParrottE.L,SaskiW,ExperimentalPharmaceutics,4thedition,BurgessPublishingCompany,Minneapolis,1971
4. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New Delhi,2005.
5. StocklosaM.J.PharmaceuticalCalculations,6thedition, Lea&Febiger, Philadelphia,1974
6. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/editedby Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc.,Newyork,1990.
7. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3/editedby Herbert A. Lieberman, Martin, M., and Gilbert S. Banker, 2nd edition, Marcel Dekker Inc. NewYork,1998.

8. RamasamyC,andManavalanR,PhysicalPharmaceutics,1stedition,PharmaMedPress,2017
9. Bahl A, Bahl B. S, Tuli G. D, Essentials of Physical Chemistry, 28th edition, S Chand Publications,NewDelhi,2000.
10. C.V.S. Subrahmanyam, Textbook of Physical Pharmaceutics, 3rd edition, Vallabh Prakashan, Delhi,2015
11. C.V.S. Subrahmanyam,Essentialsof PhysicalPharmaceutics,2nd edition,VallabhPrakashan,Delhi,2017

BP404T

PHARMACOLOGY-I(Theory) 45Hours

CourseObjectives:

The main purpose of the subject is to understand what drugs do to the living organisms and how theireffectscan be applied to therapeutics. The subjectwill impartinformation aboutthe drugslike,mechanismofaction,physiologicalandbiochemicaleffects(pharmacodynamics)aswellasabsorption, distribution, metabolism, and excretion (pharmacokinetics), routes of administration ofdifferentclasses ofdrugsalongwiththeadverseeffects,clinicaluses,interactions,dosesandcontraindicationsthatcanbridgedto theclinical settings.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto

1. Understandthepharmacologicalactionsofdifferentcategoriesofdrugsandcomprehendthepharmacokineticandpharmacodynamicprinciples.
2. Explainthemechanismofdrugactionat organsystem/sub cellular/macromolecularlevels.
3. UnderstandautonomictransmissionanddiscussthepharmacologyofdrugsactingonANSandrationalizetheirtherapeutic applications.
4. Applythebasicpharmacologicalknowledgeinthepreventionandtreatmentofvariousdiseases.
5. Explainthefeaturesofadversedrugreactionsanddruginteractionsandappreciatecorrelationofpharmacologyinbiomedicaldisciplineslike drugdiscoveryandpharmacovigilance.

MappingCO-PO:

BP404T ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	3	2	3	3	2	3	-	3
CO2	3	2	3	3	2	3	3	2	3	-	3
CO3	3	2	3	3	2	3	3	2	3	-	3
CO4	3	2	3	3	2	3	3	2	3	-	3
CO5	3	2	3	3	2	3	3	2	3		3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**GeneralPharmacology**	8

1.1	Introduction to Pharmacology- Definition, historical landmarks and scope ofpharmacology,natureandsourceofdrugs,essentialdrugsconceptandroutesofdrugadministration, Agonists,antagonists(competitiveandnon-competitive), sparereceptors,addiction,tolerance,dependence,tachyphylaxis,idiosyncrasy,allergyandteratogenicity.	4
1.2	Pharmacokinetics- Membrane transport, absorption, distribution,metabolism,andexcretionofdrugs.Enzymeinduction,enzymeinhibition, kineticsofelimination.	4
2	**GeneralPharmacology**	12
2.1	Pharmacodynamics- Principles and mechanisms of drug action. Receptor theoriesandclassificationofreceptors,regulationofreceptors.drugreceptorsinteractionssignal transduction mechanisms, G-protein–coupled receptors, ion channelreceptor, transmembrane enzyme linked receptors, transmembrane JAK-STATbindingreceptorandreceptorsthatregulatetranscriptionfactors,doseresponse relationship,therapeuticindex,combinedeffectsofdrugsandfactorsmodifyingdrugaction.	6
2.2	Adversedrugreactions.	2
2.3	Druginteractions(pharmacokineticandpharmacodynamic).	2
2.4	Drugdiscoveryandclinicalevaluationofnew drugs-Drugdiscoveryphase, preclinicalevaluationphase,clinicaltrialphase, phasesofclinicaltrialsandpharmacovigilance.	2
3	**Pharmacologyofperipheralnervoussystem**	10
3.1	OrganizationandfunctionofANS, Neurohumoraltransmission,co-transmissionandclassificationofneurotransmitters.	1
3.2	Parasympathomimetics,Parasympatholytics,Sympathomimetics,sympatholytics.	3
3.3	Neuromuscularblockingagentsandskeletalmusclerelaxants(peripheral).	2
3.4	Localanestheticagents.	3
3.5	Drugsusedinmyastheniagravis andglaucoma.	1
4	**Pharmacology ofcentralnervoussystem**	08
4.1	NeurohumoraltransmissionintheC.N.S.specialemphasisonimportanceof variousneurotransmitterslikewithGABA,Glutamate,Glycine,serotonin,dopamine.	1
4.2	Generalanesthetics andpre-anesthetics**.**	2
4.3	Sedatives,hypnoticsandcentrallyactingmusclerelaxants.	2
4.4	Anti-epileptics.	2
4.5	Alcoholsanddisulfiram.	1
5	**Pharmacologyofcentralnervoussystem**	07
5.1	Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxietyagents, anti-manicsandhallucinogens.	2
5.2	DrugsusedinParkinson'sdiseaseandAlzheimer'sdisease.	1
5.3	CNSstimulantsandnootropics.	1
5.4	Opioidanalgesicsandantagonists.	2
5.5	Drugaddiction,drugabuse,toleranceanddependence.	1
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. RitterJ.M.,FlowerR.J.,HendersonG,LokeY,MacEwanD,RangH.,RangandDale'sPharmacology ,9th edition,ElsevierHealth,London2019.
2. Katzung B.G.,MastersS.B.,TrevorA.J.,BasicandClinicalPharmacology,14th edition,TataMcGraw-

HillEducation,Pvt.Ltd,2017
3.Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisof Therapeutics;13thedition,McGraw-HillEducation,NewYork,2017.
4. Marry Anne K. K.,Lloyd Yee Y.,Brian K. A., Robbin L.C., Joseph G.B., Wayne A.K., BradleyR.W.,AppliedTherapeutics,TheClinicaluseofDrugs,ThePointLippincottWilliams&Wilkins
5. ZeindC.S,CarvahloM.G.,AppliedTherapeutics:TheClinicalUseofDrugs,11th edition,WoltersKluwer, Philadelphia,2018
6. HarveyR,ClarkMA,FinkelR.,Rey,J.A.,Whalen,K.,Lippincott'sIllustratedReviews-Pharmacology,5th edition,Wolter'sKruwer,2011.
7. TripathiK.D.,EssentialsofMedicalPharmacology,8th edition,JaypeeBrothers MedicalPublishers (P)Ltd,NewDelhi,2019.
8. SharmaH.L.,SharmaK.K.,PrinciplesofPharmacology,1st edition,ParasMedicalPublisher,2017.
9. Craig C.R., Stitzel,R.E, Modern Pharmacologywith clinical Applications,1st edition,LippincottWilliamsandWilkins,Philadelphia,2004
10. GhoshMN.FundamentalsofExperimentalPharmacology,6th edition,Hilton&Company,Kolkata,2015.
11. Kulkarni SK. Handbook of experimental pharmacology, 4th edition, Vallabh Prakashan,
2012.12.WalkerR,Edwards,ClinicalPharmacyandTherapeutics,3rd edition;ChurchillLivingstone Edinburgh,NewYork,2003.
13. TipnisandBajaj,ClinicalPharmacy, 3rd edition,CareerPublications,Nasik,2017.
14. BennettPN,BrownMJ,ClinicalPharmacology,12th edition, Elsevier, Edinburg, 2019.
15. Parthisarathi G.,Nyfort-Hansen K.,NahataM. C.,1st edition,TextbookofClinical Pharmacy
16. Practice;EssentialSkillsandConcepts,OrientLongmanPvt,Ltd,Hyderabad,2004.

BP405T

PHARMACOGNOSYANDPHYTOCHEMISTRYI(Theory) 45Hours

CourseObjectives:

Thesubject involvesthefundamentalslikescope,classificationofcrudedrugs,theiridentificationandevaluation,phytochemicalspresentinthemandtheirmedicinalproperties.

CourseOutcomes:

Uponcompletionof thecourse,thestudentshallbeable:

1. Understand the scope and relevance of Pharmacognosy in various systems of medicine
2. Evaluate the significance of various sources and methods of classification of drugs of natural origin
3. Apply the various evaluation techniques in quality control of drugs of natural origin
4. Understand the techniques involved in and factors affecting conventional and modern techniques of cultivation and production of crude drugs
5. Understand the chemistry of various phytoconstituent classes and connect it to their physical properties and identification tests
6. Understand chemistry and physical properties of drugs containing primary metabolites and evaluate their therapeutic applications.

MappingCO-PO:

BP405T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11
CO1	3	1	1	1	3	3	2	3	3	3	3
CO2	3	2	3	2	1	3	1	3	2	3	3
CO3	3	2	3	3	1	3	3	3	3	3	3

CO4	3	1	3	3	2	3	2	3	3	3	3
CO5	3	1	3	3	1	3	2	3	2	3	3
CO6	3	1	3	3	2	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1		**10**
1.1	**IntroductiontoPharmacognosy:** (a) Definition, history,scopeanddevelopmentofPharmacognosy, (b) SourcesofDrugs–Plants,Animals,Marine& Tissueculture, (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts,gumsandmucilages,oleoresinsandoleo-gum-resins).	**3**
1.2	**Classificationofdrugs:** Alphabetical,morphological,taxonomical,chemical,pharmacological,chemoandserotaxonomicalclassificationofdrugs.	**2**
1.3	**Quality controlofDrugsofNaturalOrigin:** Adulteration ofdrugsofnatural origin.Evaluation by organoleptic,microscopic,physical,chemical,andbiologicalmethodsandproperties. Quantitativemicroscopyofcrudedrugsincludinglycopodiumsporemethod,leaf constants,cameralucidaanddiagramsofmicroscopicobjectstoscalewithcameralucida.	**5**
2		**12**
2.1	**Cultivation, Collection,Processing,andstorageofdrugs ofnaturalorigin:** CultivationandCollectionofdrugsofnaturalorigin,Factors influencing cultivation of medicinal plants.Planthormonesandtheirapplications. Polyploidy,mutation,andhybridizationwithreferencetomedicinalplants,	**10**
2.2	**Conservationofmedicinalplants**	**2**
3		**7**
	Planttissueculture: Historicaldevelopmentofplanttissueculture,typesofcultures,Nutritionalrequirements,growth,andtheirmaintenance.	
	Applicationsofplanttissueculture inpharmacognosy.Edible vaccines.	
4		**10**
4.1	**Pharmacognosyinvarioussystemsofmedicine:** Role of Pharmacognosy in allopathy and traditional systems of medicine namely,Ayurveda,Unani,Siddha,HomeopathyandChinesesystemsofmedicine.	**3**
4.2	**Introductiontosecondarymetabolites:** Definition,classification,properties,andtestforidentificationofAlkaloids,Glycosides,Flavonoids,Tannins,VolatileoilandResins.	**7**
5	**Studyofbiologicalsource,chemicalnatureandusesofdrugsofnaturaloriginincontaining followingdrugs**	**08**
	(a)**PlantProducts:** Fibers-Cotton,Jute, Hemp. Hallucinogens,Teratogens,Naturalallergens.	**3**

	(b) Primarymetabolites: Generalintroduction,detailedstudywithrespecttochemistry,sources,preparation, evaluation, preservation, storage, therapeutic used and commercialutilityasPharmaceuticalAidsand/orMedicinesforthe followingPrimarymetabolites: **(c) Carbohydrates:**Acacia,Agar,Tragacanth,Honey. **(d) ProteinsandEnzymes:**Gelatin,casein,proteolyticenzymes(Papain,bromelain,serratiopeptidase,urokinase,streptokinase,pepsin).	**3**
	(e) **Lipids(Waxes,fats,fixedoils)**:Castoroil,Chaulmoograoil,WoolFat,BeesWax **(f) MarineDrugs:** Novelmedicinalagents frommarinesources.	**2**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy,16th edition,W.B.Sounders&Co.,London,2009.
2. Tyler,V.E,Brady,L.R.andRobbers,J.E.,Pharmacognosy,9thEdn.,LeaandFebiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J& AChurchillLtd,London,2005.
4. MohammadAli,PharmacognosyandPhytochemistry,1stedition,CBSPublishers&Distributors,NewDelhi,2018reprint.
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, NiraliPrakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1stedition,EasternPublishers,NewDelhi.1996
7. AnsariS.H.,Essentials ofPharmacognosy,2ndedition,BirlaPublications,NewDelhi, 2007
8. KokateC.K.,PurohitA.P.,GokhaleS.B,PracticalPharmacognosy,13thedition,NiraliPrakashan,NewDelhi,2009.
9. IyengarM.AandNayakS.G.K,AnatomyofCrudeDrugs,12thedition,PharmaMedPress,Aunitof BSPbooksPvt.Ltd,Hyderabad,2011.
10. KhandelwalK.R.andVrundaSethi,PracticalPharmacognosy:TechniquesandExperiments,24thedition,NiraliPrakashan,2014.
11. VasudevanT.N.LaddhaK.S,PracticalPharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987.
12. Shah B.A.,SethA,Textbook ofPharmacognosy and Phytochemistry,1stedition,ElsevierPublications,Adivisionof ReedElsevierIndiaPvt.Ltd,NewDelhi,2010.

BP406P
MEDICINALCHEMISTRY–I(Practical)

CourseObjectives:

Toget thelearnerintroducedtothebasicprinciplesoforganicsynthesis.

CourseOutcomes

Thelearnershouldbeableto:

1. Remember/Understand the basic etiquettes of laboratory glassware, fire safety hazards and personal protection measures and follow good laboratory practices (GLP)
2. Analyze and determine the purity of drugs present in the bulk and dosage forms.
3. Determine the partition coefficient of pharmaceutical agents.
4. Outline the synthesis ofIntermediate compounds and drugs of medicinal importance.
5. Explain the basic principles, mechanisms and procedures involved in green chemistry and traditional techniques

to prepare medicinal organic compounds.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP406P CO1	2	2	2	-	2	2	2	1	1	1	2
BP406P CO2	2	2	3	1	-	1	1	1	-	-	2
BP406P CO3	2	1	3	1	1	1	1	1	-	-	2
BP406P CO4	2	2	2	1	-	1	1	1	1	-	1
BP406P CO5	2	2	3	1	1	1	1	1	1	1	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

A.Preparationofdrugs/intermediates
1,3-pyrazole.
1,3-oxazole.
Benzimidazole.
Benztriazole.
2,3-diphenylquinoxaline.
Benzocaine.
Phenytoin.
Phenothiazine.
Barbiturate.
B.Assay ofdrugs
Chlorpromazine.
Phenobarbitone.
Atropine.
Ibuprofen.
Aspirin.
Furosemide.
C.DeterminationofPartitioncoefficientforanytwodrugs

ReferenceBooks(LatestEditionstobe adopted):

1. BealeJ.M.,BlockJ.H.,WilsonandGisvold'sTextbookofOrganicmedicinaland PharmaceuticalChemistry,20th edition,LippincottWilliams&WilkinsPublishers,2004.
2. LemkeT.L.,WilliamsD.A.,RocheV.F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry,7th edition, LippincottWilliamsandWilkinsPublishers,2001
3. AbrahamD.J.,Burger'sMedicinalChemistryandDrugDiscovery,VolItoIV,6th edition,JohnWileyandSons,Inc.,Publication,2003
4. SmithH.J.,SmithandWilliams'IntroductiontoPrinciplesofDrugDesignandAction,4th edition,TaylorandFrancisPublications,CRCPress,2005
5. Remington,TheScienceandPracticeofPharmacy,21st edition,LippincottWilliamsandWilkinsPublication,2005
6. RobertBuckingham,Martindale:TheExtraPharmacopoeia,40th edition,PharmaceuticalPress,2020.
7. FinarI.L., OrganicChemistry,Vol. II,4th edition,PearsonPublishingHouse,Longman,1963
8. LednicerD.,TheOrganicChemistryofDrugSynthesis,,Vol.1-7,Wiley-Blackwell,2007
9. IndianPharmacopoeia
10. VogelA.I., Vogel'stextbookofPracticalOrganicChemistry, 5th edition, PearsonPublishingHouse,India,1989

BP407P
PHYSICALPHARMACEUTICS-II(Practical)

CourseObjectives:

To familiarize the learner with methods to evaluate particle size, and flow properties, shelf life andphysicalstabilityofsolutionsandsuspensionsandteachthelearnercharacterizationmethodsandprotocolsfor determinationof physicalparameters.

CourseOutcomes:

Thelearnershouldbeableto:

1. Determinereactionrateconstant,orderofareactionfordifferentreactions.
2. Predictshelflifebycarryingoutacceleratedstabilitystudies.
3. Calculatephysicalparameterssuchasstabilityconstants,particlesize,density,flowproperties,molecul arweight,viscosity,andsedimentationrate.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP407P CO1	3	3	3	3	3	3	2	3	2	3	3
BP407P CO2	3	3	3	3	3	3	2	3	2	3	3
BP407P CO3	3	3	3	3	3	3	2	3	2	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

LISTOFEXPERIMENTS

1	Determinationofparticlesize,particlesizedistributionusingsievingmethod.
2	Determinationofparticlesize,particlesizedistributionusingmicroscopicmethod.
3	Determinationofbulkdensity,truedensity,andporosity.
4	Determinetheangleof reposeandinfluence oflubricantonangleof repose.
5	DeterminationofviscosityofliquidandconcentrationofunknownusingOstwald'sviscometer.
6	Determinationsedimentationvolumewitheffectofdifferent suspendingagent.
7	Determination sedimentation volume with effect of different concentration ofsinglesuspendingagent.
8	DeterminationofviscosityofsemisolidbyusingBrookfieldviscometer(Demonstration).
9	Determinationofreactionrateconstantfirstorderanddeterminerelativestrengthofacids.
10	Determinationofreactionrateconstantsecond order(botha=banda≠b).
11	Acceleratedstabilitystudiesanddeterminationofshelf life.
12	DeterminationoforderofreactionusingOstwaldIsolationMethod(Demonstration).
13	Determinationofmolecularweightofapolymerusing Intrinsicviscosity.

ReferenceBooks(LatestEditionstobeadopted):

1. Martin A, Swarbrick. J, Cammarata A, Physical Pharmacy: Physical Chemical Principles in thePharmaceuticalSciences,3rdedition,BI Waverly.PvtLtd,NewDelhi,1993.
2. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical ChemicalandBiopharmaceuticalPrinciplesinthePharmaceuticalSciences,6thedition,WalterKluer,Phil adelphia,2011.
3. Parrott E.L, Saski W, Experimental Pharmaceutics, 4th edition, Burgess Publishing Company,Minneapolis,1971
4. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New

Delhi,2005.
5. StocklosaM.J.PharmaceuticalCalculations, 6th edition, Lea&Febiger,Philadelphia,1974
6. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3 editedby Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc.,Newyork,1990.
7. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3/editedby Herbert A. Lieberman, Martin, M., and Gilbert S. Banker, 2nd edition, Marcel Dekker Inc. NewYork,1998.
8. RamasamyC,andManavalanR,PhysicalPharmaceutics,1stedition,PharmaMedPress,2017.
9. BahlA,BahlB. S,TuliG.D, EssentialsofPhysicalChemistry,28th edition, SChandPublications,NewDelhi,2000.
10. C.V.S.Subrahmanyam, Textbookof PhysicalPharmaceutics, 3rd edition, VallabhPrakashan,Delhi,2015
11. C.V.S. Subrahmanyam, Essentials of Physical Pharmaceutics, 2nd edition, Vallabh Prakashan,Delhi,2017

BP408P
PHARMACOLOGYI(Practical)

CourseObjectives:
The course will impart training in basic laboratory techniques, instruments, and regulatory and ethicalguidelines applicable in experimental pharmacology. The students will be appraised on animal handlingtechniques,routesofadministration,anesthesiaandpharmacologicaleffectsofvariousdrugsusingsimulat edaudio-visualtechniques.

CourseOutcomes:
Uponcompletionof thiscoursethestudentshouldbeableto:
1. Possess theknowledgeofanimalsandinstrumentsusedpharmacology.
2. Relatetoandapplytheregulatoryand ethicalguidelinesindrug/leadtestingusingpreclinicalanimals.
3. Describetheanimalhandlingtechniquesandproceduresusedinanimalexperimentation.
4. Observetheeffectofdrugsonanimalsbysimulatedexperimentsandinterpretthepharmacologicalactions.

MappingCO-PO:

BP408P ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	3	3	3	3	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Introductiontoexperimentalpharmacology.
2. Commonlyusedinstrumentsinexperimentalpharmacology.
3. Studyofcommonlaboratoryanimals.
4. MaintenanceoflaboratoryanimalsasperCPCSEAguidelines.
5. Common laboratory techniques. Blood withdrawal, serum, and plasma separation, anesthetics

andeuthanasiausedforanimalstudies.
6. Studyofdifferent routesofdrugsadministrationinmice/rats.
7. Studyofeffectofhepaticmicrosomalenzymeinducersonthephenobarbitonesleepingtimeinmice.
8. Effect ofdrugs onciliarymotilityoffrogoesophagus
9. Effectofdrugsonrabbiteye.
10. Effectsof skeletalmusclerelaxantsusingrota-rodapparatus.
11. Effectof drugsonlocomotoractivityusingactophotometer.
12. Anticonvulsanteffectofdrugs byMESandPTZmethod.
13. Studyofstereotypeandanti-catatonicactivityofdrugs onrats/mice.
14. Studyofanxiolyticactivityofdrugsusingrats/mice.
15. Studyoflocalanestheticsbydifferentmethods

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

ReferenceBooks(LatestEditionstobe adopted):

1. RitterJ.M.,FlowerR.J.,HendersonG,LokeY,MacEwanD,RangH.,RangandDale'sPharmacology,9th edition,ElsevierHealth,London2019.
2. KatzungB.G.,MastersS.B.,TrevorA.J.,BasicandClinicalPharmacology,14thedition,TataMc Graw-HillEducation,Pvt.Ltd,2017
3. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisof Therapeutics;13thedition,McGraw-HillEducation,NewYork,2017.
4. MarryAnneK.K.,LloydYeeY.,BrianK.A.,Robbin L.C.,JosephG.B.,WayneA.K.,BradleyR.W.,AppliedTherapeutics,TheClinicaluseofDrugs,ThePoin tLippincottWilliams & Wilkins
5. ZeindC.S.,CarvahloM.G.,Applied Therapeutics:TheClinicalUseofDrugs, 11thedition,WoltersKluwer,Philadelphia,2018
6. Harvey R,Clark MA,FinkelR.,Rey,J.A.,Whalen,K.,Lippincott'sIllustratedReviews-Pharmacology,5thedition,Wolter'sKruwer,2011.
7. TripathiK.D.,EssentialsofMedicalPharmacology,8thedition,JaypeeBrothersMedicalPublishe rs(P) Ltd,NewDelhi,2019.
8. SharmaH.L.,SharmaK.K.,PrinciplesofPharmacology,1stedition,ParasMedicalPublisher,2017.
9. Craig C.R., Stitzel, R.E, Modern Pharmacology with clinical Applications,1st edition, LippincottWilliamsandWilkins,Philadelphia,2004
10. GhoshMN. FundamentalsofExperimentalPharmacology,6thedition,Hilton&Company,Kolkata, 2015.
11. KulkarniSK. Handbookofexperimentalpharmacology,4thedition,VallabhPrakashan,2012.
12. SatoskarR.S.BhandarkarS.D.,Tripathi,R.K.,RegeN.N.,25thedition,Pharmacology&Therape utics,Elsevierco-publishedwithPopularPrakashan,2017.
13. Kasture,S.B.,AhandbookofExperimentsinPre-ClinicalPharmacology,1stedition,CareerPublications,Nasik,2009.
14. Perry W. L. M., Pharmacological Experiments on isolated preparations, 1st edition, E & SLivingstone,Edinburg&London,1968.

BP409P
PHARMACOGNOSYANDPHYTOCHEMISTRYI(Practical)

CourseObjectives:

Thesubjectinvolves identificationandevaluationofcrudedrugs,phytochemicals presentinthemandtheirmedicinalproperties.

CourseOutcomes:

Uponcompletion ofthecourse,thestudentshallbeable:

1. Analyzethecrudedrugs,by chemical tests.
2. Assess quality of crude drugs by qualitative and quantitative microscopic techniques.
3. Evaluate crude drugs by physical tests.

CO-PO Mapping

BP409P *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Analysisofcrudedrugs bychemicaltests:(i)Tragacanth(ii)Acacia(iii)Agar(iv)Gelatin(v)starch (vi)Honey(vii)Castoroil.
2. Determinationofstomatalnumberandindex.
3. Determinationofveinisletnumber,veinisletterminationandpalisaderatio.
4. Determinationofsizeofstarchgrains,calciumoxalatecrystalsbyeyepiecemicrometer.
5. DeterminationofFiberlengthandwidth.
6. DeterminationofnumberofstarchgrainsbyLycopodiumsporemethod.
7. DeterminationofAshvalue.
8. DeterminationofExtractivevaluesofcrudedrugs.
9. Determinationofmoisturecontentofcrudedrugs.
10. Determinationofswellingindexandfoaming.

ReferenceBooks(LatestEditions tobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy, 16th edition, W.B. Sounders&Co.,London, 2009.
2. Tyler,V.E,Brady,L.R. and Robbers,J.E., Pharmacognosy,9thEdn.,Leaand Febiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J&AChurchillLtd,London,2005.
4. MohammadAli,PharmacognosyandPhytochemistry,1stedition,CBSPublishers&Distributors,NewDelhi.2018reprint.
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, NiraliPrakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1stedition,EasternPublishers,NewDelhi.1996
7. AnsariS.H.,EssentialsofPharmacognosy,2ndedition,BirlaPublications,NewDelhi,2007
8. Kokate C.K., Purohit A. P., Gokhale S.B, Practical Pharmacognosy, 13th edition, Nirali Prakashan,NewDelhi,2009.
9. IyengarM.AandNayakS.G.K,AnatomyofCrudeDrugs,12thedition,PharmaMedPress,Aunitof BSPbooksPvt.Ltd,Hyderabad,2011.
10. Khandelwal K.R.andVrundaSethi,Practical Pharmacognosy:TechniquesandExperiments,24thedition,NiraliPrakashan,2014.

11. VasudevanT.N.LaddhaK.S,Practical Pharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987
12. ShahB.A.,SethA,TextbookofPharmacognosyandPhytochemistry,1stedition,ElsevierPublications,AdivisionofReedElsevierIndiaPvt.Ltd,NewDelhi,2010.

SEMESTERV

BP501T

MEDICINAL CHEMISTRY –II(Theory) 45Hours

CourseObjectives:

This course is designed to impart fundamental knowledge on the structure, chemistry, and therapeuticvalueofdrugs.Thecourseisdesignedtoincludethestructureactivityrelationshipsofdrugs,importance of physicochemical properties of drugs, metabolism of drugs, and chemical synthesis ofimportantdrugsundereachclass.

CourseOutcomes:

Uponcompletionofthecoursethestudentshallbeable to:

1. Understandthechemistryofdrugsandtherelationtotheirpharmacologicalactivities.
2. Become proficient in the classification and mechanisms of action of drugs used as antineoplastics, antihistamines, antianginals, antihypertensive, anti-hyperlipidemics and steroidal molecules.
3. Predict the drug metabolic pathways, adverse effect, and therapeutic value of drugs
4. Analyze and evaluate the Structural Activity Relationship of different class of drugs.
5. Demonstrate proficiency in outlining the chemical synthesis of selected drugs.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP501T CO1	2	2	3	-	1	1	1	2	1	-	2
BP501T CO2	2	1	3	-	-	1	-	1	1	-	2
BP501T CO3	2	2	3	-	-	1	-	1	2	-	2
BP501T CO4	2	1	3	1	-	1	-	1	-	-	1
BP501T CO5	2	2	2	1	-	1	1	1	1	-	1

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
	Study of thedevelopmentof the following classesof drugs,Classification,mechanismofaction,usesofdrugsmentionedinthecourse,Structure activity relationshipofselectiveclassofdrugsasspecifiedinthecourseandsynthesisofdrugssuperscripted(*).	
1	**UNIT–I**	**10**

1.1	**Antihistaminic agents:** Histamine, receptors, and their distribution in the humanbody. **H_1–antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylaminesuccinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelennaminehydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizinehydrochloride,Chlorpheniraminemaleate,Triprolidinehydrochloride*,Phenidaminetartarate,Promethazinehydrochloride*,Trimeprazinetartrate,Cyproheptadinehydrochloride,Azatidinemaleate,Astemizole,Loratadine,Cetirizine,Levocetirizine,Cromolynsodium **H_2-antagonists:**Cimetidine*,Famotidine,Ranitidine.	4
1.2	**Gastricprotonpumpinhibitors:**Omeprazole,Lansoprazole,Rabeprazole,Pantoprazole	1
1.3	**Anti-neoplasticagents:** **Alkylating agents:** Mechlorethamine*, Cyclophosphamide, Melphalan,Chlorambucil,Busulfan,Thiotepa,Cisplatin **Antimetabolites:** Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine,Cytarabine,Methotrexate*,Azathioprine. **Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin, Mitoxantrone,Bleomycin. **Plant products:** Etoposide,Vinblastine sulphate, Vincristine sulphate, Taxol,Camptothecin. **TyrosineKinaseInhibitorsandHDACinhibitors**	5
2	**UNIT–II**	10
2.1	**Anti-anginal**: **Vasodilators:** Amyl nitrite, Nitroglycerine*, Pentaerythritol tetranitrate,Isosorbidedinitrate*,Dipyridamole. **Calciumchannelblockers:**Verapamil,Bepridilhydrochloride,Diltiazemhydrochloride,Nifedipine,Amlodipine,Felodipine,Nicardipine,Nimodipine.**Diuretics:** Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide,Dichlorphenamide. Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide,Cyclothiazide. Loop diuretics:Furosemide*,Bumetanide,Ethacrynicacid.Potassium sparing diuretics: Spironolactone, Triamterene, Amiloride.OsmoticDiuretics:Mannitol.	7
2.2	**Anti-hypertensive Agents**: Timolol,Captopril,Lisinopril,Enalapril,Benazeprilhydrochloride,Quinaprilhydrochloride,Methyldopatehydrochloride,*Clonidine hydrochloride,Guanethidine monosulphate,Guanabenz acetate,Sodiumnitroprusside,Diazoxide,Minoxidil,Reserpine,Hydralazinehydrochloride.	3
3	**UNIT–III**	10
3.1	**Anti-arrhythmic Drugs**: Quinidine sulphate, Procainamidehydrochloride,Disopyramidephosphate*,Phenytoinsodium,Lidocainehydrochloride,Tocainide hydrochloride,Mexiletinehydrochloride,Lorcainidehydrochloride,Amiodarone,Sotalol.	4

3.2	**Anti-hyperlipidemic agents**: Clofibrate, Lovastatin, Cholestyramine andColestipol.	2
3.3	**Coagulant & Anticoagulants**: Menadione, Acetomenadione, Warfarin*,Anisindione, Clopidogrel.	2
3.4	**Drugsused in Congestive Heart Failure:** DigoxinDigitoxin, Nesiritide, Bosentan, Tezosentan.	2
4	**UNIT–IV**	08
4.1	**DrugsactingonEndocrinesystem** Nomenclature,Stereochemistry,and metabolismofsteroids.	2
4.2	**Sexhormones**:Testosterone,Nandralone,Progesterone,Estriol,Estradiol,Estrione,Diethylstilbestrol.	1
4.3	**Drugsforerectiledysfunction:**Sildenafil,Tadalafil.	1
4.4	**Oralcontraceptives:**Mifepristone,Norgestrel,Levonorgestrel.	1
4.5	**Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone,Dexamethasone.	2
4.6	**Thyroidandantithyroiddrugs**:L-Thyroxine,L-Thyronine,Propylthiouracil,Methimazole.	1
5	**UNIT–V**	07
5.1	**Antidiabeticagents:** Insulinanditspreparations. Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.Biguanides:Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone.Meglitinides:Repaglinide,Nategli nide.	2
	Glucosidase inhibitors: Acarbose, Voglibose.GLPagonists,DPPIVinhibitors	
5.2	**LocalAnaesthetics:** **BenzoicAcidderivatives**;Cocaine,Hexylcaine,Meprylcaine,Cyclomethycaine,Piperocaine. **AminoBenzoicacidderivatives**:Benzocaine*,Butamben,Procaine*,Butacaine,Propoxycaine,Tetracaine,Benoxinate. **Lidocaine/Anilidederivatives**:Lignocaine, Mepivacaine,Prilocaine,Etidocaine. **Miscellaneous**:Phenacaine, Diperodon,Dibucaine.*	5
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. BealeJ. M., BlockJ.H., WilsonandGisvold'sTextbookofOrganicmedicinalandPharmaceuticalChemistry,20th edition ,Lippincott Williams&Wilkins Publishers,2004.
2. LemkeT.L., WilliamsD. A.,RocheV. F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry,7th edition,LippincottWilliamsandWilkinsPublishers,2001.
3. AbrahamD.J.,Burger'sMedicinalChemistryandDrugDiscovery,VolItoIV,6th edition,JohnWileyandSons,Inc.,Publication,2003.
4. SmithH.J.,Smithand Williams'Introductionto PrinciplesofDrugDesignandAction,4th edition,TaylorandFrancisPublications,CRCPress,2005.
5. Remington,TheScienceandPracticeofPharmacy,21st edition,LippincottWilliamsandWilkinsPublication,2005.
6. RobertBuckingham,Martindale:TheExtraPharmacopoeia,40th edition,PharmaceuticalPress,2020.

7. FinarI.L.,OrganicChemistry,Vol. II, 4th edition, PearsonPublishingHouse,Longman,1963.
8. LednicerD.,TheOrganicChemistryofDrugSynthesis,Vol.1-7,Wiley-Blackwell,2007.
9. IndianPharmacopoeia.
10. VogelA.I.,Vogel'stextbookofPracticalOrganicChemistry,5th edition,PearsonPublishingHouse,India, 1989.

BP502T

INDUSTRIALPHARMACYI(Theory) 45Hours

Course Objective:

This course is designed to prepare the students for career in the pharmaceutical industry by providing them with comprehensive understanding of industrial operations, quality control, regulatory compliance and the scientific principles behind dosage form development and manufacturing.

Course Outcomes:

The learner should be able to:

1.Understand and apply the knowledge of preformulation in development of pharmaceutical dosage forms.

2.Apprise the formulation aspects of tablets, coating and liquid orals and demonstrate their quality of finished dosage forms.

3.Know and apply the manufacturing, formulation and packaging aspects of hard, soft gelatin capsules and pellets.

4. Describe the preformulation and formulation aspects of parenteral and ophthalmic preparations, large scale production procedures, production facilities and quality control.

5. Summarize the formulation and quality control of cosmetic products and aerosols and know the packaging aspects of pharmaceutical products.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP502T CO1	3	3	3	1	-	2	3	2	3	3	3
BP502T CO2	3	3	3	3	-	2	3	2	3	3	3
BP502T C03	3	3	3	2	-	2	3	2	3	3	3
BP502TCO4	3	3	3	2	-	2	3	2	3	3	3
BP502TCO5	3	3	3	2	-	2	3	2	3	3	3
BP403T CO6	3	2	3	3	-	2	3	2	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT -I-PreformulationStudies**	**7**
1.1	Introductiontopreformulation, goalsandobjectives,studyofphysicochemicalcharacteristicsof drugsubstances.	**1**
1.2	***Physical properties:***Solidstateproperties– crystallineandamorphous, polymorphism,particlesize,shape,flowproperties,solubilityprofile(pKa,pH,partitionco efficient),lipophilicity.	**2**

1.3	***Stability–Chemical:*** ***a)*** Hydrolysis,oxidation,reduction,decarboxylation,racemisation,polymerization,Hygroscopicity,Lossofmoisture,Lossofvolatilecomponents,Excipientcompatibility,Package(container&closure)compatibility. ***b)*** Biopharmaceuticalconsiderations-Dissolution&Permeation;BCSclassificationofdrugs.	2
1.4	Applicationofpreformulationconsiderations inthedevelopmentofsolid,liquidoralandparenteraldosageformsanditsimpactonstability ofdosageforms.	2
2	**UNIT-II**	10
2.1	**Tablets** **a.** Introduction,idealcharacteristicsoftablets,classificationoftablets.Excipients,Formulationoftablets,granulation methods,compression,andprocessingproblems.Equipmentandtablettooling.Packaging of tablets. **b.** Tablet coating: Types of coating, coating materials, formulation of coatingcomposition, methodsofcoating,equipmentemployedanddefectsincoating. **c.** Qualitycontroltests:Inprocessandfinishedproducttests. **d.** Layoutoftabletsection.	8
2.2	**Liquid orals:** Formulation and large-scale manufacturing consideration ofsolutions, suspensions and emulsions; Filling and packaging; evaluation of liquidoralsofficialinpharmacopoeia.Layoutof liquidsection	2
3	**UNIT-III**	8
3.1	***Hard gelatin capsules:*** Introduction, Extraction of gelatin and production of hardgelatin capsule shells. size of capsules, Types of Capsule fill formulations; Fillingoperation,finishingandspecialtechniques offormulationofhardgelatincapsules.Other polymers used for Hard Capsule shells - like HPMC, Carageenan andAlginates Packagin, Storage and In process and final product quality control tests for rawmaterialsandcapsules.Layoutof capsulesection.	3
3.2	***Soft gelatincapsules:***Definitionanduses.Natureofshellandcapsulecontent,sizeofcapsules,formulationconsiderationsandimportanceofbaseadsorptionand minimum/gram factors, production, in process and final product quality controltests.Packing,storageandstabilitytestingof softgelatincapsules.	3
3.3	**Pellets:** Introduction, formulation requirements, pelletization process, equipmentformanufactureofpellets.	2
4	**UNIT-IV**	10
4.1	**Parenteral Preparations**: Definition, types, routes of administration, advantagesandlimitations.Preformulationfactorsand essentialrequirements,vehicles, additives, importance of isotonicity. Preparation of water for injection and pyrogencontrol.	2
4.2	Large-scaleProductionprocedure,productionfacilitiesandcontrols.Layout andcontrols;HVAC;ClassificationofCleanRoomsandasepticprocessing	1
4.3	Formulation of injections, sterile powders, emulsions, suspensions, large volumeparenterals andlyophilizedproducts,Sterilizationmethods(revision).	3
4.4	Containersandclosuresselection, fillingandsealingofampoules,vialsandinfusionfluids.InprocessandQualitycontroltestsforinjectables.	1

4.5	**Ophthalmic Preparations:**Introduction, formulationconsiderations;formulation ofeyedrops, eyeointmentsandeyelotions;methodsofpreparation;labeling,containers;evaluationofophthalmicpreparations.	**3**
5	**UNIT-V**	**10**
5.1	**Cosmetics:**Formulationandpreparationofthefollowingcosmeticpreparations: Lipsticks, nail lacquers, shampoos, cold cream and vanishing cream, tooth pastes,hairdyesandsunscreens.	3
5.2	**PharmaceuticalAerosols:**Definition,propellants,containers,valves,actuators, typesofaerosolsystems;formulationandmanufactureofaerosols; Evaluationofaerosols;Qualitycontrolandstabilitystudies.	3
5.3	**Packaging Materials Science:** Materials used for packaging of pharmaceuticalproducts, factorsinfluencingchoiceofcontainers, legalandofficialrequirements forcontainers,stabilityaspectsofpackagingmaterials,qualitycontroltests.	4
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/edited byHerbertA.Lieberman,Leon Lachman,Joseph B.Schwartz,2nd edition,Marcel DekkerInc.,NewYork,1990.
2. LibermanH.A,LachmanL,Pharmaceuticaldosageforms.ParenteralMedications,volume1,2,3/edited by Avis K, Herbert A. Lieberman H. A. and Lachman L, Martin, M., 3nd edition, MarcelDekkerInc.NewYork.1993.
3. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3/edited byHerbertA.Lieberman,Martin,M., and GilbertS. Banker,2nd edition,Marcel DekkerInc.NewYork,1998.
4. ModernPharmaceuticsbyGilbert S.Banker& C.T.Rhodes,4rdEdition.MarcelDekker,2002.
5. Remington,TheScienceandPracticeofPharmacy,21stedition,LippincottWilliamsandWilkinsPublication, 2005.
6. Lachman, L, Lieberman H.A., Kanig, J.L., The Theory and Practice of Industrial Pharmacy, 1st edition, Lea&Febiger,Philadelphia,1986.
7. Taylor, K., Aulton M.E., Pharmaceutics: The Science of Dosage Form Design, 2nd edition,ChurchillLivingstone,Edinburgh,2001.
8. AnselH.C.,AllenL.V., PharmaceuticalDosageFormsandDrugDeliverySystems,10thedition,LippincottWilliamsandWalkins,USA,2014.
9. Drugstability-PrinciplesandpracticebyCartensen&C.J.Rhodes,3rdEdition,MarcelDekkerSeries,Vol107.
10. SalvatoreJ.Turco,Steriledosageforms:theirpreparationandclinical applications,4thedition,WoltersKluwerIndiaPvt.Ltd,2011.
11. R.G.Harry,J.B.WilkinsonandR.J.Moore,Harry's Cosmeticology,7thedition,LongmanScientific&TechnicalPublishers,1994.
12. M.S.Balsam,E.Sagarin,S.D.Gerhon,S.J.StrianseandM.M.Rieger,CosmeticsScienceandTechnology,,Volumes1,2and3.Wiley-Interscience,WileyIndiaPvt.Ltd.
13. HildaButler,Poucher'sPerfumes,cosmetics&Soaps,10thedition,KlewerAcademicPublishers,Netherlands ,2000.
14. BISGuidelinesfordifferentcosmeticproducts.
15. HanlonJ.,RobertJ.Kelsey,"HandbookofPackageEngineering"2ndEdition,McGraw-Hill,NewYork.1984.
16. PaineA.,PackagingUser'sHandbook,1stedition,Springer,2019.

BP503T

PHARMACOLOGY-II(Theory) 45Hours

CourseObjectives:

Thiscourseisintendedtoimpartthefundamentalknowledgeonvariousaspects(classification,mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs actingondifferentsystemsof bodyandinadditionexplainthebasic conceptsofbioassay.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Understandthemechanismofdrugactionandits relevanceinthetreatmentofdifferentdiseases.
2. Demonstrateisolationofdifferentorgans/tissuesfromthelaboratoryanimalsbysimulatedexperiments.
3. Demonstratethevariousreceptoractionsusingisolatedtissuepreparation.
4. Appreciatethe correlationofpharmacology withrelatedmedicalsciences.

MappingCO-PO:

BP503T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	2	3	3	2	3	3	2	3		3
CO2	3	2	3	3	2	3	3	2	3		3
CO3	3	2	3	3	2	3	3	2	3		3
CO4	3	2	3	3	2	3	3	2	3		3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

Unit	Details	Hours
1	**UNIT–I**	**10**
	Pharmacologyofdrugsactingoncardiovascularsystem a. Introductiontohemodynamicandelectrophysiologyofheart. b. Drugsusedincongestiveheart failure. c. Anti-hypertensivedrugs. d. Anti-anginaldrugs. e. Anti-arrhythmicdrugs. f. Anti-hyperlipidemicdrugs.	
2	**UNIT–II**	**10**
2.1	**Pharmacologyofdrugs acting oncardiovascular system** a. Drugusedinthetherapyof shock. b. Haematinics,coagulantsandanticoagulants. c. Fibrinolyticsandanti-plateletdrugs. d. Plasmavolumeexpanders.	**6**
2.2	**Pharmacology ofdrugs actingonurinarysystem** a. Diuretics. b. Anti-diuretics.	**4**
3	**UNIT–III**	**10**

	Autocoidsandrelateddrugs a. Introductiontoautacoidsandclassification. b. Histamine,5-HTandtheirantagonists. c. Prostaglandins,Thromboxanes andLeukotrienes. d. Angiotensin,BradykininandSubstanceP.	
	e. Non-steroidalanti-inflammatoryagents. f. Anti-goutdrugs. g. Cytokines h. Histamine,5-HTandtheirantagonists. i. Prostaglandins,ThromboxanesandLeukotrienes. j. Angiotensin,BradykininandSubstanceP. k. Non-steroidalanti-inflammatoryagents. l. Antirheumaticdrugs.	
4	**UNIT–IV**	**08**
	Pharmacology ofdrugsactingonendocrinesystem a. Basicconceptsinendocrinepharmacology. b. Anterior Pituitaryhormones-analoguesandtheirinhibitors. c. Thyroidhormones-analoguesandtheirinhibitors. d. Hormones regulating plasma calcium level - Parathormone, calcitonin andVitamin-D. e. Insulin,OralHypoglycemicagentsandglucagon. f. ACTHandcorticosteroids.	
5	**UNIT–V**	**07**
5.1	**Pharmacology ofdrugsactingonendocrinesystem** a. AndrogensandAnabolicsteroids. b. Estrogens,progesteroneandoralcontraceptives. c. Drugsactingontheuterus.	4
5.2	**Bioassays** a. Principlesandapplicationsofbioassays. b. Typesofbioassays. c. Bioassayofinsulin,oxytocin,vasopressin,ACTH,d-tubocurarine,digitalis,histamineand5-HT.	3
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, 9th edition,ChurchillLivingstoneElsevier.,2019.
2. RitterJ.M.,FlowerR.J.,HendersonG,LokeY,MacEwanD,RangH.,RangandDale'sPharmacology,9thedition,ElsevierHealth,London2019.
3. KatzungB.G.,MastersS.B.,TrevorA.J.,BasicandClinicalPharmacology,14thedition,TataMcGraw-HillEducation,Pvt.Ltd,2017
4. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisofTherapeutics;13thedition,McGraw-HillEducation,New York,2017.
5. MarryAnneK.K.,LloydYeeY.,BrianK.A.,RobbinL.C.,JosephG.B.,WayneA.K.,BradleyR.W.,AppliedTherapeutics,TheClinicaluseofDrugs,ThePointLippincottWilliams&Wilkins
6. ZeindC.S.,CarvahloM.G.,AppliedTherapeutics:TheClinicalUseofDrugs,11thedition,WoltersKluwer,Philadelphia,2018
7. HarveyR,ClarkMA,FinkelR.,Rey,J.A.,Whalen,K.,Lippincott'sIllustratedReviews-Pharmacology,5th edition,Wolter'sKruwer,2011.
8. TripathiK.D.,EssentialsofMedicalPharmacology,8thedition,JaypeeBrothersMedicalPublishers

(P)Ltd,NewDelhi,2019.
9. SharmaH.L.,SharmaK.K.,PrinciplesofPharmacology,1st edition, ParasMedicalPublisher,2017.
10. CraigC.R.,Stitzel,R.E,ModernPharmacologywithclinicalApplications,1st edition,LippincottWilliamsandWilkins, Philadelphia,2004
11. Ghosh MN. Fundamentals of Experimental Pharmacology, 6th edition, Hilton & Company, Kolkata,2015.
12. KulkarniSK.Handbookofexperimentalpharmacology,4thedition,VallabhPrakashan,2012.
13. SatoskarR.S.BhandarkarS.D.,Tripathi,R.K.,RegeN.N.,25thedition,Pharmacology&Therapeutics, Elsevierco-publishedwithPopularPrakashan,2017.
14. Kasture,S.B.,AhandbookofExperimentsinPre-ClinicalPharmacology,1stedition,CareerPublications,Nasik,2009.

BP504T

PHARMACOGNOSYANDPHYTOCHEMISTRYII(Theory) 45Hours

CourseObjectives:

The aim of this course is to impart students the knowledge of how secondary metabolites are produced in plants, how to isolate them, identify them, and produce them on an industrial scale. The course will also impart in-depth knowledge of various chemical classes of phytoconstituents and their biosources and therapeutic applications.

CourseOutcomes:

Uponcompletionofthecourse,thestudentshallbeable:

1. Understand the biosynthetic pathways involved in production of secondary metabolites in plants.
2. Evaluate the physical and chemical properties of various chemical classes of secondary metabolites and appraise the therapeutic applications of crude drugs containing these
3. Evaluate the modern techniques of extraction, isolation and identification of phytoconstituents.
4. Apply the advances in extraction and isolation of phytoconstituents and design protocols for industrial scale application.

MappingCO-PO:

BP504T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11
CO1	3	1	2	2	1	1	1	2	1	3	3
CO2	3	2	3	3	2	3	2	3	3	3	3
CO3	3	3	3	3	2	3	2	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT -I-Metabolicpathways inhigherplants andtheirdetermination.**	7
1.1	Brief studyofbasicmetabolicpathwaysand formation ofdifferentsecondarymetabolites through these pathways- Shikimic acid pathway, Acetate pathway andAminoacidpathways.	4
1.2	Studyofutilizationofradioactiveisotopesintheinvestigationof Biogeneticstudies.	3

2	**UNIT-II–Generalintroduction,composition,chemistry&chemical classes, generalmethodsof extraction & analysis,biosources,therapeuticusesandcommercialapplicationsoffollowingsecondarymetabolites.**	**14**
2.1	**Alkaloids:**Vinca,Rauwolfia,Belladonna,Opium,Cinchona	**2**
2.2	**PhenylpropanoidsandFlavonoids:**Lignans-Podophyllum, Tea,Ruta.	**2**
2.3	**Steroids,CardiacGlycosides&Triterpenoids**:Liquorice,Dioscorea, Digitalis.	**2**
2.4	**Volatileoils**:Mentha,Clove, Cinnamon,Fennel,Coriander.	**2**
2.5	**Tannins:**Catechu,Pterocarpus,Galls	**1**
2.6	**Resins:**Benzoin,Guggul,Ginger,Asafoetida,Myrrh,Colophony.	**2**
2.7	**Glycosides:**Senna, Aloes,Cascara,Rhubarb,Bitter Almond,Mustard	**1**
2.8	**Iridoids-**Gentian**,Otherterpenoids -**Diterpenes**:**Taxus**,Sesquiterpenes:** Artemesia**,Tetraterpenes-carotenoids-**Carotene,Lutein&**Naphthaquinones:** Plumbago,Henna	**2**
3	**UNIT-III**	**6**
	Isolation,identification,andanalysisofphytoconstituents 1. Terpenoids:Menthol,Citral,Artemisinin. 2. Glycosides:GlycyrrhetinicacidandRutin. 3. Alkaloids:Atropine,Quinine,reserpine,Caffeine. 4. Resins:Podophyllotoxin,curcumin.	
4	**UNIT-IV**	**6**
	Industrialproduction,estimation,andutilizationofthefollowingphytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin,Caffeine,Taxol,VincristineandVinblastine.	
5	**UNIT-V-Basics ofPhytochemistry**	**10**
	Modernmethodsofextraction,applicationoflatesttechniqueslike Spectroscopy, chromatographyandelectrophoresisintheisolation,purificationandidentificationof crudedrugs.	
	TOTAL	**45**

ReferenceBooks(LatestEditions tobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy,16th edition, W.B.Sounders &Co.,London,2009.
2. Tyler,V.E,Brady,L.R.andRobbers, J.E.,Pharmacognosy,9thEdn.,LeaandFebiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J&AChurchillLtd,London,2005.
4. Mohammad Ali, Pharmacognosy and Phytochemistry, 1st edition, CBS Publishers & Distributors, NewDelhi,2018reprint
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, Nirali Prakashan,NewDelhi,2007.
6. ChoudharyR.D,HerbalDrugIndustry,1st edition,EasternPublishers,NewDelhi.1996.
7. AnsariS.H.,EssentialsofPharmacognosy,2ndedition,BirlaPublications,NewDelhi, 2007.
8. KokateC.K.,PurohitA.P.,GokhaleS.B,PracticalPharmacognosy,13thedition,NiraliPrakashan,NewDelhi, 2009.
9. Iyengar M.A and Nayak S.G.K, Anatomy of Crude Drugs, 12th edition, PharmaMed Press, A unit ofBSPbooksPvt.Ltd,Hyderabad,2011.
10. KhandelwalK.R.andVrundaSethi,PracticalPharmacognosy:TechniquesandExperiments,24thedition,NiraliPrakashan,2014.
11. VasudevanT.N.LaddhaK.S,PracticalPharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987.
12. ShahB.A.,SethA,TextbookofPharmacognosyandPhytochemistry,1stedition,ElsevierPublications ,Adivisionof ReedElsevierIndiaPvt.Ltd,NewDelhi,2010.
13. Remington, The Science and Practice of Pharmacy, 21st edition, Lippincott Williams and

WilkinsPublication,2005.
14. Pharmacognosy&Pharmacobiotechnology.Eds.BobbersJE,SpeedieMK,andTylerVE,WilliamsandWikins,1996.
15. VyasSPandDixitVK,TextBookofBiotechnology,1st edition,CBSPublishers,2012.
16. DubeyRC,ATextbookofBiotechnology,5th edition,S ChandPublishers,2014.
17. AppelL,Theformulationandpreparationofcosmetic,fragrancesandflavours,2nd edition,MicellePress,1994.
18. PandaH,HerbalCosmetics,3rd revisededition,AsiaPacificBusiness Press,2015.
19. REndress,Plant cellBiotechnology,1st edition, Springer-VerlagBerlinHeidelberg,1994.

BP505T

PHARMACEUTICALJURISPRUDENCE(Theory) 45hours

CourseObjectives:

Thiscourseisdesignedtoimpartbasicknowledgeonimportantlegislationsrelatedtotheprofessionofpharmacyin India.

CourseOutcomes:

Uponcompletionof thecourse,thestudentshallhaveknowledgeof:

1. Recall different pharmaceuticallegislationsandtheirimplicationsinthedevelopment, manufacturing, pricing, saleandmarketingofpharmaceuticals.
2. Know the administrative authorities and agencies governing the pharmaceutical education in India and Code of ethics for pharmaceutical practice.
3. Know the regulations outlined in the Right to Information Act and Medical Termination of Pregnancy Act.
4. Know the regulations outlined in the Right to Information Act and Medical Termination of Pregnancy Act.
5. Understand the CPSCEA guidelines for Prevention of Cruelty to Animals Act.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP505T CO1	3	1	1	1	1	3	3	2	3	2	3
BP505T CO2	3	1	1	1	1	3	3	2	3	2	3
BP505T C03	3	1	1	1	1	2	3	1	3	3	3
BP505T C04	3	1	1	1	1	2	3	1	3	2	3
BP505T C05	3	1	1	1	1	3	3	1	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT-I-Drugs andCosmeticsAct,1940andits rules 1945**	**10**
1.1	Objectives,Definitions,Legaldefinitionsofschedulestotheactandrules.	**3**
1.2	Importof drugs – Classesofdrugs and cosmeticsprohibited from import,Importunderlicenseorpermit.Offencesandpenalties**.**	**2**
1.3	Manufactureofdrugs–Prohibitionofmanufactureand saleofcertain drugs.Regulationspertainingtomanufacture,Sale,LabellingandPackagingof **Allopathic,**AyurvedicandHomeopathicdrugs	**2**

1.4	Conditionsforgrantoflicenseandconditionsoflicenseformanufactureofdrugs, Manufacture of drugs fortest, examination and analysis,manufacture of new drug,loanlicenseandrepackinglicense.	3
2	**UNIT-II-Drugs andCosmetics Act,1940 andits rules 1945.**	10
2.1	DetailedstudyofScheduleG,H,M,N,P,T,U,V,X,Y,PartXIIB,ScheduleF&DMR(OA).	4
2.2	SaleofDrugs–Wholesale,RetailsaleandRestrictedlicense.Offencesandpenalties.	1
2.3	Labeling &Packing ofdrugs- General labeling requirementsand specimenlabelsfordrugs andcosmetics,Listof permittedcolours.Offences andpenalties.	2
2.4	AdministrationoftheactandrulesDrugsTechnicalAdvisoryBoard,Central drugs Laboratory,Drugs Consultative Committee,Governmentdrug analysts,Licensingauthorities,controllingauthorities,DrugsInspectors.	3
3	**UNIT-III**	10
3.1	**Pharmacy Act–1948**:Objectives,Definitions,PharmacyCouncilofIndia;itsconstitutionandfunctions,EducationRegulations,StateandJointstatepharmacy councils;constitutionandfunctions,RegistrationofPharmacists,OffencesandPenalties.	3
3.2	**MedicinalandToiletPreparationAct–1955**:Objectives,Definitions,Licensing, ManufactureInbondandOutsidebond,Exportofalcoholicpreparations,ManufactureofAyurvedic,Homeopathic,Patent&ProprietaryPreparations.	3
	OffencesandPenalties.	
3.3	**Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives,Definitions,Authoritiesand Officers,Constitution and Functionsof narcotic &PsychotropicConsultativeCommittee,NationalFundforControllingtheDrugAbuse,Prohibition,ControlandRegulation,opiumpoppycultivationand production of poppy straw, manufacture, sale and export of opium, Offences andPenalties.	4
4	**UNIT-IV**	08
4.1	**StudyofSalientFeaturesofDrugsandmagicremediesActanditsrules:** Objectives,Definitions,Prohibitionofcertainadvertisements,ClassesofExemptedadvertisements,OffencesandPenalties.	2
4.2	**Prevention ofCrueltytoanimalsAct-1960:**Objectives,Definitions,InstitutionalAnimalEthics Committee,BreedingandStockingofAnimals, Performanceof Experiments,Transferandacquisitionofanimalsforexperiment,Records,Powertosuspendorrevokeregistration,OffencesandPenalties.	3
4.3	**NationalPharmaceuticalPricingAuthority:**DrugsPriceControlOrder(DPCO)-2013. Objectives, Definitions, Saleprices ofbulk drugs, Retailprice of formulations, Retail price and ceiling price of scheduled formulations, National ListofEssentialMedicines(NLEM).	3
5	**UNIT-V**	07
5.1	**PharmaceuticalLegislations**–Abriefreview,Introduction,Studyofdrugs enquirycommittee,Healthsurveyanddevelopmentcommittee,HathicommitteeandMudaliarcommittee.	1
5.2	**CodeofPharmaceuticalethics**Definition,Pharmacistinrelationtohisjob,trade,medicalprofessionandhisprofession,Pharmacist'soath.	1
5.3	**MedicalTerminationofPregnancy Act**	1
5.4	**RighttoinformationAct**	1

5.5	IntroductiontoIntellectualPropertyRights(IPR)	3
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. SureshB,AtextbookofForensicPharmacy,1st edition,BirlaPublicationsPvtLtd,2010.
2. MithalBM,TextbookofForensicPharmacy,10th edition,VallabhPrakashan,1999.
3. Mehra ML,Handbookofdruglaw, 9th edition, UniversalBookAgency,1997.
4. JainNK,AtextbookofForensicPharmacy,VallabhPrakashan,2017.
5. DrugsandCosmeticsAct1940andRules1945byGovt.ofIndiaPublications.
6. MedicinalandToiletriesPreparationsAct1955byGovt.ofIndiaPublications.
7. NarcoticDrugsandPsychotropicSubstancesActbyGovt.ofIndiaPublications.
8. DrugsandMagicRemediesAct 1954byGovt. ofIndiaPublications.
9. BareActsofthesaidlawspublishedbyGovernmentofIndia.

BP506P
INDUSTRIALPHARMACY(Practical)

CourseObjectives:

This course is designed to impart the student skills to understand and apply the preformulation and formulation principles andtechniques of solid, parenteral, ophthalmic, and cosmetic formulations. The course also aims at providingthestudentsknowledgeoftesting of vehicles, packaging material and test for sterility.

CourseOutcomes:

Uponcompletionofthecoursethestudentshallbeable to:

1.Gain and apply knowledge on analytical techniques for determination of physicochemical characteristics of active pharmaceutical ingredients.

2.Understand formulation and quality control aspects of solid orals, parenteral and ophthalmic and cosmetic products.

3.Explain the steps involved in tablet coating.

4.Implement quality control testing of tablets, capsules, water for injection, glass containers and rubber closures as per pharmacopeial specifications.

CO-PO mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP506P CO1	3	2	2	2	1	1	3	1	1	1	3
BP506P CO2	3	2	3	1	1	1	3	1	1	1	3
BP506P CO3	3	1	1	1	1	1	2	1	1	2	3
BP506P CO4	3	2	3	1	1	1	3	1	1	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Preformulationstudiesonparacetamol/aspirin/oranyother drug.
2. PreparationandevaluationofParacetamoltablets.
3. PreparationandevaluationofAspirintablets.

4. Coatingoftablets-filmcoatingoftables/granules.(Demonstration)
5. PreparationandevaluationofTetracyclinecapsules/Ampicillintrihydratecapsules
6. PreparationofCalciumGluconateinjection.
7. PreparationofAscorbicAcidinjection.
8. Qualitycontroltest of(as perIP)marketedtabletsandcapsules.
9. PreparationofEyedrops/andEyeointments.
10. PreparationofCreams(cold/ vanishingcream).
11. EvaluationofGlasscontainersandrubbers (asperIP).
12. Evaluationofwaterforinjectionasper IP

RecommendedBooks:(LatestEditions tobeadopted):

1. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/edited byHerbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc., New York,1990.
2. Liberman H.A, Lachman L, Pharmaceutical dosage forms. Parenteral Medications, volume 1, 2,3/editedby Avis K, Herbert A. Lieberman H. A.and Lachman L, Martin, M., 3nd edition, Marcel Dekker Inc.New York.1993.
3. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3/edited byHerbertA.Lieberman,Martin,M.,andGilbertS.Banker,2ndedition,MarcelDekkerInc.NewYork,1998.
4. ModernPharmaceuticsbyGilbert S.Banker& C.T.Rhodes,4rdEdition.MarcelDekker,2002.
5. Remington, TheScienceandPracticeofPharmacy, 21st edition, Lippincott Williams andWilkinsPublication,2005.
6. Lachman,L,LiebermanH.A.,Kanig,J.L.,TheTheory and PracticeofIndustrialPharmacy,1stedition,Lea&Febiger,Philadelphia,1986
7. Taylor,K.,AultonM.E.,Pharmaceutics:TheScienceofDosageFormDesign,2ndedition,ChurchillLivingstone,Edinburgh,2001.
8. Ansel H.C.,Allen L.V.,PharmaceuticalDosageFormsand DrugDeliverySystems,10thedition,LippincottWilliamsandWalkins,USA,2014.
9. Drug stability-Principlesand practiceby Cartensen&C.J.Rhodes,3rdEdition,MarcelDekkerSeries,Vol107.

BP507P

PHARMACOLOGY-II(Practical)

CourseObjectives:

This course aims to provide a fundamental understanding of the isolation of organs and tissues from laboratory animals. It also covers preclinical models related to pharmacological activities such as anti-inflammatory, diuretic, and analgesic effects through simulated experiments. Additionally, the course also explores the concepts of drug-receptor interactions and the mechanisms of drug actions, employing various bioassay techniques like the three-point method, interpolation method, and more.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.
2. Demonstrate the various receptor actions using isolated tissue preparation.
3. Understand the pre-clinical drug screening models of inflammation, diuresis and analgesia.

MappingCO-PO:

BP507P *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Introductionto*in-vitro* pharmacologyandphysiologicalsaltsolutions.
2. Effectofdrugsonisolatedfrogheart.
3. Effectofdrugsonbloodpressureandheartrateofdog.
4. Studyof diureticactivityofdrugsusingrats/mice.
5. DRCofacetylcholineusingfrogrectusabdominismuscle.
6. Effectofphysostigmineandatropineon DRCofacetylcholineusingfrogrectusabdominismuscleandratileumre spectively.
7. Bioassayofhistamineusingguineapigileumbymatchingmethod.
8. Bioassayofoxytocinusingratuterinehornbyinterpolation method.
9. Bioassayofserotoninusingrat fundusstrip bythree-point bioassay.
10. Bioassayofacetylcholineusingratileum/colonbyfour-point bioassay.
11. Determination of PA_2 valueofprazosinusingratanococcygeusmuscle(bySchild'splotmethod).
12. Determination of PD_2 valueusingguineapigileum.
13. Effectofspasmogensandspasmolyticsusingrabbitjejunum.
14. Anti-inflammatoryactivityof drugsusingcarrageenaninducedpaw-edemamodel.
15. Analgesicactivityofdrugusingcentralandperipheralmethods.

Note:Alllaboratorytechniquesandanimalexperimentsaredemonstratedbysimulatedexperimentsusingsoftwaresandvideos

RecommendedBooks(LatestEditionstobeadopted):

1. Rang H.P.,Dale M.M., RitterJ.M., FlowerR. J., Rang and Dale'sPharmacology,9th edition, ChurchillLivingstoneElsevier.,2019.
2. RitterJ.M.,FlowerR.J.,Henderson G,LokeY,MacEwanD,Rang H.,Rang andDale's
3. Pharmacology,9th edition,ElsevierHealth,London2019.
4. KatzungB.G.,Masters S.B.,TrevorA.J.,BasicandClinicalPharmacology,14th edition,TataMcGraw-HillEducation,Pvt.Ltd,2017
5. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisofTherapeutics;13thedition, McGraw-HillEducation,NewYork,2017.
6. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., BradleyR.W.,AppliedTherapeutics,TheClinicaluseofDrugs,ThePointLippincottWilliams&Wilkins
7. ZeindC.S.,CarvahloM.G.,AppliedTherapeutics:TheClinicalUseofDrugs,11th edition,WoltersKluwer,Philadelphia,2018
8. Harvey R, Clark MA, Finkel R., Rey, J.A., Whalen, K., Lippincott's Illustrated Reviews-Pharmacology,5th edition,Wolter'sKruwer,2011.
9. TripathiK.D.,EssentialsofMedicalPharmacology,8th edition,JaypeeBrothersMedicalPublishers (P)Ltd,NewDelhi,2019.
10. SharmaH.L.,SharmaK.K.,PrinciplesofPharmacology,1st edition,ParasMedicalPublisher, 2017.

11. Craig C.R., Stitzel,R.E,Modern Pharmacology with clinicalApplications,1st edition,LippincottWilliamsandWilkins,Philadelphia,2004
12. GhoshMN.FundamentalsofExperimental Pharmacology,6th edition,Hilton &Company,Kolkata,2015.
13. KulkarniSK.Handbookofexperimentalpharmacology,4th edition,VallabhPrakashan,2012.
14. SatoskarR.S.BhandarkarS.D.,Tripathi,R.K.,RegeN.N.,25th edition,Pharmacology&Therapeuti cs,Elsevierco-publishedwithPopularPrakashan,2017.
15. Kasture,S. B., AhandbookofExperimentsinPre-ClinicalPharmacology, 1st edition, CareerPublications,Nasik,2009.

BP508P
PHARMACOGNOSY ANDPHYTOCHEMISTRYII(Practical)

CourseObjectives:
Thecourseisdesignedtoimpartbasicskillsofcrudedrugidentification,extraction,isolationandevaluationbyte chniquesincludingchromatography.

CourseOutcomes:
Uponcompletionofthecourse,thestudentshallbeableto:
1. Evaluate organized crude drugs by microscopic techniques.
2. Design and execute extraction and isolation protocols for phytoconstituents.
3. Evaluate crude drugs by chromatographic techniques
4. Analyze unorganized crude drugs by chemical tests

MappingCO-PO:

BP508P *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon,Senna,Clove,Ephedra,Fennel andCoriander.
2. Exerciseinvolvingisolation& detectionofactiveprinciples.Caffeine-fromteadust.

DiosgeninfromDioscorea
Atropine from Belladonna
SennosidesfromSenna

3. SeparationofsugarsbyPaperchromatography.
4. TLCof herbalextract.
5. Distillationofvolatileoilsanddetectionofphytoconstitutentsby TLC.
6. Analysisofcrudedrugsbychemicaltests:(i)Asafoetida(ii)Benzoin(iii)Colophony(iv)Aloes(v)Myrrh.

RecommendedBooks:(LatestEditionstobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy,16th edition,W.B.Sounders&Co., London,2009.

2. Tyler,V.E,Brady,L.R.andRobbers, J.E.,Pharmacognosy, 9thEdn., Lea andFebiger, Philadelphia,1988.
3. WallisT.E,Textbookof Pharmacognosy,5thedition,J&AChurchillLtd,London,2005.
4. MohammadAli,PharmacognosyandPhytochemistry,1stedition,CBSPublishers&Distributors,NewDelhi.2018reprint.
5. KokateC.K.,PurohitA.P.,GokhaleS.B.,Textbook ofPharmacognosy,37thEdition,NiraliPrakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1stedition,EasternPublishers,NewDelhi.1996
7. AnsariS.H.,EssentialsofPharmacognosy,2ndedition, BirlaPublications,NewDelhi, 2007
8. Kokate C.K., Purohit A. P., Gokhale S.B, Practical Pharmacognosy, 13th edition, Nirali Prakashan, NewDelhi,2009.
9. IyengarM.A and Nayak S.G.K,Anatomy of Crude Drugs,12th edition,PharmaMed Press,A unitofBSPbooksPvt.Ltd,Hyderabad,2011.
10. VasudevanT.N.andLaddhaK.S,PracticalPharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987.
11. Shah B.A., Seth A, Textbook of Pharmacognosy and Phytochemistry, 1st edition, Elsevier Publications,AdivisionofReedElsevierIndiaPvt.Ltd,NewDelhi,2010.
12. Remington,The Science andPracticeofPharmacy, 21stedition,LippincottWilliamsandWilkinsPublication,2005.
13. Pharmacognosy & Pharmacobiotechnology.Eds.BobbersJE, Speedie MK,and TylerVE,WilliamsandWikins,1996.
14. VyasSPandDixitVK,TextbookofBiotechnology,1stedition,2012,CBSPublishers.
15. DubeyRC,ATextbookofBiotechnology,5thedition,S ChandPublishers,2014.
16. Appel L,The formulation and preparation ofcosmetic,fragrancesand flavours,2ndedition,MicellePress,1994.
17. PandaH,HerbalCosmetics,3rdrevisededition, AsiaPacificBusinessPress, 2015
18. REndress,PlantcellBiotechnology,1stedition, Springer-VerlagBerlinHeidelberg, 1994.

SEMESTER
VIBP601T
MEDICINALCHEMISTRY–III(Theory) 45Hours

CourseObjectives:
Thiscourseisdesignedtoimpartfundamentalknowledgeonthestructure,chemistry,andtherapeutic value of drugs. Modern techniques of rational drug design like quantitative structureactivity relationship (QSAR), prodrug concept, combinatorial chemistry and computer aided drugdesign (CADD) are part of the scope of the course. The course also emphasizes on the chemistry,mechanismofaction,metabolism,adverseeffects,StructureActivityRelationships(SAR),therapeuticusesandsynthesisofimportantdrugs.

CourseOutcomes:
Uponcompletionofthecoursethestudentshallbeable to:
1. **Understand** the fundamental chemical principles underlying the biological activity of drugs and **analyze** how specific chemical properties contribute to or affect their biological activity with the help of structure-

activity relationships (SAR) analysis.

2. **Become proficient** in the fundamental concepts of drug metabolism, potential adverse effects, and therapeutic applications. **Apply** this knowledge to current medication administration, and **analyze** the intricate drug metabolism pathways, potential adverse effects, and the overall therapeutic benefits in specific medical situations.

3. **Understand and grasp** the significance of drug design, prodrug approach and various methodologies employed in the process of drug design. **Understand and apply** the concepts and principles of QSAR studies and analyses. **Understand and apply** the concepts of pharmacophore modeling and docking techniques in drug design and discovery.

4. **Apply** the concepts of combinatorial chemistry, including the principles and practical applications of both solid phase and solution phase synthesis techniques.

5. **Demonstrate proficiency** in outlining the chemical synthesis of drugs from the specified class, showcasing their ability to apply theoretical knowledge to practical synthesis techniques.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP601T CO1	2	1	2	-	-	-	-	-	1	-	2
BP601T CO2	2	1	3	-	-	1	-	1	-	-	1
BP601T CO3	2	2	3	3	2	1	-	1	-	-	1
BP601T CO4	2	2	3	2	2	1	1	-	-	-	2
BP601T CO5	2	2	2	1	-	1	1	1	1	-	1

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
	Studyofthedevelopmentofthefollowingclassesofdrugs,Classification,mechanism ofaction,usesofdrugsmentionedinthecourse,Structureactivity relationshipofselectiveclassofdrugsasspecifiedinthecourseandsynthesisofdrugss uperscriptedby(*).	
1	**UNIT–I**	**12**

	Antibiotics Historicalbackground,Nomenclature,Stereochemistry,Structureactivityrelationship, Chemical degradation classification and important products of thefollowingclasses. (a) **β-Lactamantibiotics:**Penicillin,Cephalosporins,βLactamaseinhibitors,Monobactams,Carbapenams,Imipenam. (b) **Aminoglycosides:**Streptomycin,Neomycin,Kanamycin. (c) **Tetracyclines:** Tetracycline,Oxytetracycline,Chlortetracycline,Minocycline,Doxycycline. (d) **Macrolide:**ErythromycinClarithromycin,Azithromycin. (e) **Miscellaneous:**Chloramphenicol*,Clindamycin.	
2	**UNIT–II**	**08**
	Historicalbackground,Nomenclature,Stereochemistry,Structureactivityrelationship, Chemical degradation classification and important products of thefollowingclasses. **Antimalarials:** Etiologyofmalaria.**Quinolines:**SAR,Quininesulphate,Chloroquine*,Amodiaquine, Primaquinephosphate,Pamaquine*,Quinacrinehydrochloride,Mefloquine. **Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil.**Miscellaneous:** Pyrimethamine,Artesunete,Artemether,Atovoquone.	
3	**UNIT–III**	**10**
3.1	**Anti-tubercularAgents:** (a) **Syntheticantitubercularagents:**Isoniazid*,Ethionamide,Ethambutol, Pyrazinamide,Paraaminosalicylicacid.* (b) **Anti-tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine,Streptomycin,Capreomycinsulphate.	**3**
3.2	**Urinarytractanti-infectiveagents:** (a) **Quinolones:**SARofquinolones,NalidixicAcid,Norfloxacin,Enoxacin,Ciprofloxacin*,Ofloxacin,Lomefloxacin,Sparfloxacin,Gatifloxacin,Moxifloxacin. (b) **Miscellaneous:**Furazolidine,Nitrofurantoin*,Methanamine.	**3**
3.3	**Antiviralagents:** Amantadine hydrochloride,Rimantadinehydrochloride,Idoxuridinetrifluoride,Acyclovir*,Ganciclovir,Zidovudine,Didanosine,Zalcitabine,Lamivudine,Loviride,Delavirdine,Efavirenz,Ribavirin,Saquinavir,Indinavir,Ritonavir.	**4**
4	**UNIT–IV**	**08**
4.1	**Antifungalagents:** (a) **Antifungalantibiotics:**Amphotericin-B,Nystatin,Natamycin,Griseofulvin. (b) **SyntheticAntifungalagents:**Clotrimazole,Econazole,Butoconazole,OxiconazoleTioconozole,Miconazole*,Ketoconazole,Terconazole,Itraconazole,Fluconazole,Naftifinehydrochloride,Tolnaftate*.	**2**
4.2	**Anti-protozoalAgents:**Metronidazole*,Tinidazole,Ornidazole,Diloxanide,Iodoquinol, PentamidineIsethionate,Atovaquone, Eflornithine.	**1**
4.3	**Anthelmintics:**Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole,Niclosamide,Oxamniquine, Praziquantel,Ivermectin	**1**

4.4	**SulfonamidesandSulfones:** Historical development, chemistry, classification, and SAR of Sulfonamides:Sulfamethizole,Sulfisoxazole,Sulfamethazine,Sulfacetamide*,Sulphapyridine,Sulfamethoxaole*,Sulfadiazine,Mefenideacetate,Sulfasalazine. **Folatereductaseinhibitors:**Trimethoprim*,Cotrimoxazole **Sulfones:**Dapsone*.	**4**
5	**UNIT–V**	**07**
5.1	**IntroductiontoDrugDesign** Various approachesusedindrugdesign. **Prodrugs:**Basicconceptsandapplicationofprodrugsdesign. Physicochemicalparametersusedinquantitativestructureactivityrelationship(QSAR) such as partition coefficient, Hammet's electronic parameter, Taft's stericparameterandHanschanalysis. Pharmacophoremodelinganddockingtechniques	5
5.2	**CombinatorialChemistry:** Concept and applications ofCombinatorialchemistry:Solidphaseandsolutionphasesynthesis.	2
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. BealeJ.M.,BlockJ.H.,WilsonandGisvold'sTextbookofOrganicmedicinalandPharmaceuticalChemistry ,20th edition,LippincottWilliams&WilkinsPublishers,2004.
2. LemkeT.L.,WilliamsD.A.,RocheV.F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry,7th edition,LippincottWilliamsandWilkinsPublishers,2001.
3. Abraham D. J., Burger's Medicinal Chemistry and Drug Discovery, Vol I to IV, 6th edition, JohnWileyandSons,Inc.,Publication,2003.
4. SmithH.J.,SmithandWilliams'Introductionto PrinciplesofDrugDesignandAction,4th edition,TaylorandFrancisPublications,CRCPress,2005.
5. Remington,TheScienceandPracticeofPharmacy,21st edition,LippincottWilliamsandWilkinsPublication,2005.
6. Robert Buckingham, Martindale: The Extra Pharmacopoeia, 40th edition, PharmaceuticalPress,2020.
7. FinarI.L.,OrganicChemistry,Vol.II,4th edition,PearsonPublishingHouse,Longman,1963
8. LednicerD.,TheOrganicChemistryofDrugSynthesis,Vol.1-7,Wiley-Blackwell,2007
9. IndianPharmacopoeia.
10. VogelA.I.,Vogel'stextbook of PracticalOrganicChemistry,5th edition,PearsonPublishingHouse,India,1989.

BP602T
PHARMACOLOGY-III(Theory) 45Hours

CourseObjectives:

This course is intended to impart the fundamental knowledge on various aspects (classification, mechanismof action, therapeutic effects, clinical uses, side effects and contraindications) of drugs used for respiratoryand gastrointestinal diseases, infectious diseases, as part of immuno-pharmacology with emphasis on theprinciplesof toxicologyandChronopharmacology.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Understandthemechanismofdrugactionanditsrelevanceinthetreatmentofdifferentinfectiousdiseases.
2. Comprehendtheprinciplesoftoxicologyandtreatment ofvariouspoisonings.

3. Appreciatethe correlationofpharmacologywithrelatedmedicalsciences.

MappingCO-PO:

BP602T *CourseOutcomes*	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	2	3	3	2	3	3	2	3		3
CO2	3	2	3	3	2	3	3	2	3		3
CO3	3	2	3	3	2	3	3	2	3		3
CO4	3	2	3	3	2	3	3	2	3		3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**10**
1.1	**PharmacologyofdrugsactingonRespiratorysystem** a. Anti-asthmaticdrugs. b. DrugsusedinthemanagementofCOPD. c. Expectorantsandantitussives. d. Nasaldecongestants. e. Respiratorystimulants.	**5**
1.2	**PharmacologyofdrugsactingontheGastrointestinalTract** a. Antiulceragents. b. Drugsfor constipationanddiarrhoea. c. Appetitestimulantsandsuppressants. d. Digestantsandcarminatives. e. Emeticsandanti-emetics.	**5**
2	**UNIT–II**	**10**
	Chemotherapy	
	a. Generalprinciplesofchemotherapy. b. Sulfonamidesandcotrimoxazole. c. Antibiotics - Penicillins, cephalosporins, chloramphenicol,macrolides,quinolones and fluoroquinolones, tetracyclines and aminoglycosides,Linezolid, fusidicacid, Clindamycin.	
3	**UNIT–III**	**10**
	Chemotherapy a. Antitubercularagents. b. Antileproticagents. c. Antifungalagents. d. Antiviraldrugs. e. Anthelmintics. f. Antimalarialdrugs. g. Antiamoebicagents.	
4	**UNIT–IV**	**08**

4.1	**Chemotherapy** a. Urinarytractinfections andsexuallytransmitteddiseases. b. Chemotherapyof malignancy.	**3**
4.2	**Immunopharmacology** a. Immunostimulants. b. Immunosuppressant. c. Proteindrugs,monoclonalantibodies. d. Antigen,biosimilars.	**5**
5	**UNIT–V**	**07**
5.1	**Principlesoftoxicology** a. Definitionandbasicknowledgeofacute,subacuteandchronictoxicity. b. Definition and basic knowledge of genotoxicity, hepatotoxicity,nephrotoxicity,carcinogenicity,teratogenicityandmutagenicity. c. Generalprinciplesoftreatmentofpoisoning. d. Clinical symptoms and management of barbiturates, morphine,organophosphoruscompoundandlead,mercuryandarsenicpoisoning.	6
5.2	**Chronopharmacology** a. Definitionofrhythmandcycles. b. Biologicalclockandtheirsignificanceleadingtochronotherapy.	1
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. RangH.P.,DaleM.M.,RitterJ.M.,FlowerR.J.,RangandDale'sPharmacology,9th edition,ChurchillLivingstoneElsevier.,2019.
2. RitterJ. M., FlowerR.J.,Henderson G,Loke Y,MacEwan D,Rang H., Rang and Dale'sPharmacology,9th edition,ElsevierHealth,London2019.
3. KatzungB.G.,MastersS.B.,TrevorA.J.,BasicandClinicalPharmacology,14th edition,TataMcGraw-HillEducation,Pvt.Ltd,2017
4. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisofTherapeutics;13thedition,McGraw-HillEducation,NewYork,2017.
5. MarryAnneK.K.,LloydYeeY.,BrianK.A.,Robbin L.C.,JosephG.B.,WayneA.K.,BradleyR.W.,AppliedTherapeutics,TheClinicaluseof Drugs, ThePointLippincottWilliams&Wilkins
6. ZeindC.S.,CarvahloM.G.,AppliedTherapeutics:TheClinicalUseofDrugs,11th edition,WoltersKluwer,Philadelphia,2018
7. Harvey R, Clark MA, Finkel R., Rey, J.A., Whalen, K., Lippincott's IllustratedReviews-Pharmacology,5th edition,Wolter'sKruwer,2011.
8. TripathiK.D.,EssentialsofMedicalPharmacology,8th edition,JaypeeBrothersMedicalPublishers(P)Ltd,NewDelhi,2019.
9. SharmaH.L.,SharmaK.K.,Principles ofPharmacology,1st edition,ParasMedicalPublisher, 2017.
10. CraigC.R.,Stitzel, R.E,ModernPharmacology withclinicalApplications, 1st edition, LippincottWilliamsandWilkins,Philadelphia,2004
11. Ghosh MN. Fundamentals of Experimental Pharmacology, 6th edition, Hilton & Company, Kolkata,2015.
12. KulkarniSK.Handbookofexperimentalpharmacology, 4th edition,VallabhPrakashan,2012.
13. Satoskar R.S. Bhandarkar S.D., Tripathi, R.K., Rege N. N., 25th edition, Pharmacology & Therapeutics,Elsevierco-publishedwithPopularPrakashan,2017.
14. Kasture,S.B.,AhandbookofExperimentsinPre-ClinicalPharmacology,1st edition,CareerPublications,Nasik,2009.

15. UdupaNandGuptaPD,ConceptsinChronopharmacology,1st edition,ShyamPrakashan,2009.

BP603T

HERBALDRUGTECHNOLOGY(Theory) 45Hours

CourseObjectives:

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

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Understand significance of sourcing and cultivation in ascertaining quality of herbs as raw material in herbal and ASU&H products
2. Extrapolate application of herbs as nutraceuticals, excipients and cosmetics
3. Develop conventional and novel dosage herbal formulations and assess their interactions with food and other drugs
4. Apply prevalent regulatory provisions in developing herbal products and securing intellectual property rights
5. Apply GMP in design of herbal industry and infrastructure

MappingCO-PO:

BP603T *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	1	3	3	2	3					3
CO2	3	3	3	2	2						3
CO3	3	3	3	3	2						3
CO4	3	2	3	2	2						3
CO5	3	3	3	3	3						3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**11**
1.1	**Herbsasrawmaterials** Definitionofherb,herbalmedicine,herbalmedicinalproduct,herbaldrug preparationSourceofHerbsSelection,identificationandauthenticationofherbalmaterials, Processingof herbalrawmaterial.	**3**
1.2	**BiodynamicAgriculture** GoodagriculturalpracticesincultivationofmedicinalplantsincludingOrganicfarming. PestandPestmanagementinmedicinalplants:Biopesticides/Bioinsecticides.	**3**
1.3	**IndianSystemsofMedicine**	**5**
	BasicprinciplesinvolvedinAyurveda,Siddha,UnaniandHomeopathy PreparationandstandardizationofAyurvedicformulationsvizAristasandAsawas, Gjutika,Churna, LehyaandBhasma.	
2	**UNIT–II**	**07**

2.1	**Neutraceuticals** General aspects, Market,growth,scope and typesofproductsavailable in themarket. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVSdiseases,Cancer,Irritablebowelsyndromeandvariousgastrointestinaldiseases.	**2**
2.2	Studyoffollowingherbsashealthfood:Alfaalfa,Chicory,Ginger,Fenugreek,Garlic,Honey,Amla,Ginseng,Ashwagandha, Spirulina.	**2**
2.3	**Herbal-Drugand Herb-Food Interactions:**General introduction to interactionand classification.Study of following drugs and theirpossible side effects andinteractions:Hypercium,kava-kava,Ginkobiloba,Ginseng,Garlic,Pepper& Ephedra.	**3**
3	**UNIT–III**	**10**
3.1	**HerbalCosmetics** Sourcesand description of raw materialsof herbalorigin used via,fixed oils,waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants inproductssuchasskincare,haircareandoralhygieneproducts.	**4**
3.2	**Herbalexcipients:** HerbalExcipients–Significanceofsubstancesofnaturaloriginasexcipients– colorants,sweeteners,binders,diluents,viscositybuilders,disintegrants,flavors&perfumes.	**3**
3.3	**Herbalformulations:** Conventionalherbalformulationslikesyrups,mixturesandtabletsandNoveldosageforms likephytosomes.	**3**
4	**UNIT–IV**	**10**
4.1	**EvaluationofDrugs**WHO&ICHguidelinesfortheassessmentofherbaldrugs.Stabilitytestingofherbaldrugs.	**2**
4.2	**PatentingandRegulatoryrequirementsofnaturalproducts:** 1. Definition of the terms: Patent, IPR, Farmers right, Breeder's right,BioprospectingandBiopiracy 2. PatentingaspectsofTraditionalKnowledgeandNaturalProducts.CasestudyofCurcuma&Neem.	**5**
4.3	**RegulatoryIssues-** RegulationsinIndia(ASUDTAB,ASUDCC),RegulationofmanufactureofASUdrugs-ScheduleZofDrugs&CosmeticsActforASUdrugs	**3**
5	**UNIT–V**	**07**
5.1	**GeneralIntroductiontoHerbalIndustry** Herbaldrugsindustry:Presentscopeandfutureprospects. A brief account of plant-based industries and institutions involved in work onmedicinalandaromaticplantsinIndia.	3
5.2	**ScheduleT–GoodManufacturingPracticeofIndiansystemsofmedicine** ComponentsofGMP(Schedule–T)anditsobjectives. Infrastructural requirements, working space, storage area,machineryandequipment,standard operating procedures,health and hygiene,documentation andrecords.	4
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy,16th edition, W.B. Sounders &Co.,London, 2009.
2. Tyler,V.E,Brady,L.R. and Robbers,J.E., Pharmacognosy,9thEdn.,Leaand Febiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J& AChurchillLtd,London,2005.

4. MohammadAli,PharmacognosyandPhytochemistry,1st edition,CBSPublishers&Distributors,NewDelhi,2018reprint.
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, NiraliPrakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1st edition,EasternPublishers,NewDelhi.1996
7. AnsariS.H.,EssentialsofPharmacognosy,2nd edition, BirlaPublications,NewDelhi,2007
8. Kokate C.K., Purohit A. P., Gokhale S.B, Practical Pharmacognosy, 13th edition, Nirali Prakashan, NewDelhi,2009.
9. IyengarM.AandNayak S.G.K,AnatomyofCrudeDrugs,12th edition,PharmaMed Press,Aunitof BSPbooksPvt.Ltd,Hyderabad,2011.
10. Khandelwal K.R.andVrundaSethi,PracticalPharmacognosy:Techniquesand Experiments,24th edition,NiraliPrakashan,2014.
11. VasudevanT.N.LaddhaK.S, Practical Pharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987.
12. ShahB.A.,SethA,TextbookofPharmacognosyandPhytochemistry,1stedition,ElsevierPublications,AdivisionofReedElsevierIndiaPvt.Ltd,NewDelhi,2010.
13. Remington,TheScienceand PracticeofPharmacy,21st edition,LippincottWilliamsandWilkinsPublication,2005.
14. Pharmacognosy&Pharmacobiotechnology.Eds.BobbersJE,SpeedieMK,andTylerVE,William sandWikins,1996.
15. VyasSPandDixitVK,TextbookofBiotechnology,1st edition,2012,CBSPublishers
16. DubeyRC,ATextbookofBiotechnology,5th edition,S ChandPublishers,2014.
17. AppelL, Theformulationandpreparationof cosmetic, fragrances andflavours, 2nd edition,MicellePress,1994.
18. Panda H,HerbalCosmetics,3rd revisededition,AsiaPacificBusinessPress, 2015.
19. REndress,PlantcellBiotechnology1st edition,Springer-VerlagBerlinHeidelberg, 1994.
19. PharmacopeialstandardsforAyurvedicFormulation(CouncilofResearchinIndianMedicine&Homeopathy).
20. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals, 1st edition,BusinessHorizonsPublishers,NewDelhi,India,2012.

BP604T

BIOPHARMACEUTICSANDPHARMACOKINETICS(Theory) 45Hours

CourseObjectives:

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

CourseObjectives:

Uponcompletionof thecoursestudentshallbeableto:

1. To Introduce the routes of administration, sampling rates, definitions of Absorption, distribution, Metabolism and excretion of drugs.
2. Learn the factors that affect the Absorption, distribution, Metabolism and excretion of drugs and concept of compartmental modelling.
3. Learn the Mathematical equations that describe the plasma concentration versus time profiles of drugs administered through iv bolus, iv infusion and intramuscular dose.
4. Learn how to calculate different pharmacokinetic parameters from blood and urine data and calculating bioavailability/ bioequivalence.
5. Learn the concepts of non-linear pharmacokinetics behaviour

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP604T CO1	3	1	2	-	-	1	1	2	1	-	2
BP604T CO2	3	-	2	-	-	1	1	2	2	-	1
BP604T C03	3	-	3	-	-	2	-	2	2	-	1
BP604T CO4	3	-	2	-	-	2	2	1	2	-	1
BP604T C05	3	2	2	-	-	2	2	2	1	-	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

Unit	Details	Hours
1	**UNIT–I**	10
1.1	**IntroductiontoBiopharmaceutics**	1
1.2	**Absorption**:Mechanismsofdrugabsorption throughGIT,factorsinfluencingdrugabsorptionthoughGIT, absorptionofdrugfromNonperoralextra-vascularroutes.	5
1.3	**Distribution**:Tissuepermeabilityofdrugs,bindingofdrugs,apparent,volumeof drugdistribution,proteinbindingofdrugs,factorsaffectingprotein-drugbinding.Kineticsof proteinbinding,Clinicalsignificanceof proteinbindingof drugs.	4
2	**UNIT-II**	10
2.1	**DrugElimination:**Metabolismofdrugsandfactorsaffectingmetabolism,hepatic clearance,Renalexcretionofdrugs,factorsaffectingrenalexcretionofdrugs,renalclearance,Non-renalroutesofdrugexcretionofdrugs.	3
2.2	**Bioavailability and Bioequivalence:** Definition and Objectives of bioavailabilitystudies,absoluteandrelativebioavailability,measurementofbioavailability,methods of dissolution measurement, factors affecting dissolution, comparison ofdissolutionprofiles,in-vitrodrugdissolutionmodels,in-vitro,in-vivocorrelations, bioequivalence studies,methods to enhance the bioavailability of poorly solubledrugs.BCS classification.	7
3	**UNIT -III-Pharmacokinetics**	22
	Definitionandintroductionofpharmacokinetics,compartmentmodels,Non-compartmentalmodels,physiologicalmodels. Onecompartmentopenmodel.a.IntravenousInjection(Bolus)b.Intravenousinfusion. c. Extra vascular administrations. Calculations of Ka, K_E, t1/2, Vd, AUC,CLt,CLr, Fabs,F relandotherparameters. Methods of elimination, understanding of their significance and application (UrineData–RatemethodandSigmaMinusMethod). Kinetics of Multiple dosing, steady state drug level,calculation of loading andmaintenancedoseandtheirsignificanceinclinical setting. Twocompartmentopenmodel(IVbolus).	
4	**UNIT-IV**	03
	Nonlinear Pharmacokinetics: a. Introduction, b. Factors causingNonlinearity.c.Michaelis-Menten methodofestimatingparameters.	

	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted)

1. GibaldiMilo,BiopharmaceuticsandClinicalPharmacokinetics.4th Edition,2005,PharmaBookSyndicate,Hyderabad.
2. Biopharmaceutics andPharmacokinetics,RobertFNotariEds,1975,MarcelDekker.
3. AppliedBiopharmaceuticsandPharmacokinetics,LeonShargelandAndrewB.C.Yu, 7thedition,2016,McGrawHillEducation.USA.
4. BiopharmaceuticsandPharmacokinetics-ATreatise,ByD.M. BrahmankarandSunilB.Jaiswal,2015,VallabhPrakashan,Pitampura,Delhi.
5. Pharmacokinetics:ByMiloGibaldiDonald,R.MercelDekkerInc.
6. Handbook of Clinical Pharmacokinetics,By Milo Gibaldi and Laurie Prescott by ADIS Health SciencePress.
7. Rowland and Tozer'sClinical Pharmacokineticsand Pharmacodynamics-ConceptsandApplications,DerendorfHandSchmidtSeds.,5th edition,2019,WaltersKluver.
8. ClinicalPharmacokinetics,ConceptsandApplications:ByMalcolmRowlandandThomas,N.Tozer,LeaandFeibeger,Philadelphia,1995.
9. Abdou H.M, Dissolution, Bioavailability and Bioequivalence, Mack, Publishing Company,Pennsylvania1989.
10. BiopharmaceuticsandClinicalPharmacokinetics-Anintroduction4theditionRevisedandexpandedbyRobertFNotari,MarcelDekkerInn,NewYorkandBasel,1987.
11. Remington'sPharmaceuticalSciences,ByMackPublishingCompany,Pennsylvania
12. HandbookofBasicPharmacokineticsincludingclinicalapplications,RitschelWAandKearnsGL,7th edition, APhA,2009,
13. BasicPharmacokinetics,Jambhekar SSandBreenPJ,2nd edition,PharmaceuticalPress,2012.
14. BiopharmaceuticsandPharmacokinetics,VenkateshwarluV,PharmaBookSyndicate,2010.
15. Drug Bioavailability- Estimation of solubility, permeability, absorption and bioavailability, van derWaterbeemd H, Lennernas H and Artursson P, 2nd completely revised edition, Wiley VCH verlag,GmBH andCo,2009.

BP605T

PHARMACEUTICALBIOTECHNOLOGY(Theory) 45Hours

CourseObjectives:

This course isdesigned to introduce to the student the application of biotechnology in the field ofgenetic engineering, fermentation technology, diagnosis/prevention/cure of diseases, and for productionofnewerpharmaceuticaldrugs.Thecoursewillalsointroducetransgeniccrops/animalsandthecontributiontohealthcare.

Course outcomes:

Uponcompletionofthestudentshallbeableto.

1. UnderstandtheimportanceofrDNAtechnologyinhealthcareanddrug development.
2. Importanceoffermentationandimmobilisedcells/enzymes inproductionofpharmaceuticals.
3. ImportanceofMonoclonalantibodiesinIndustries.
4. Appreciatetheconcepts of immunologyandvaccineproduction.

CO-PO Mapping

Course code &	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11

CO number											
BP605T CO1	3	3	3	3	-	3	1	3	-	1	3
BP605T CO2	3	3	3	3	-	3	1	1	-	2	3
BP605T C03	3	2	3	3	-	3	1	1	-	1	3
BP605T CO4	3	2	3	3	-	3	1	-	-	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**08**
1.1	BriefintroductiontoBiotechnologywithreferencetoPharmaceuticalSciences	**1**
1.2	Methodsofenzyme/cellimmobilizationandapplications.	**2**
1.3	Biosensors-WorkingandapplicationsofbiosensorsinPharmaceuticalIndustries.	**1**
1.4	BriefintroductiontoProteinEngineering.	**2**
1.5	Useofmicrobesinindustry.ProductionofEnzymes-Generalconsideration-Amylase,Catalase,Peroxidase,Lipase,Protease,Penicillinase.	**2**
2	**UNIT -II-Basicprinciplesofgeneticengineering**.	**12**
2.1	StudyofcloningvectorS,restrictionendonucleasesandDNAligase.	**2**
2.2	RecombinantDNAtechnology.Application ofgeneticengineeringinmedicine.	**2**
2.3	Application ofrDNAtechnologyandgeneticengineeringintheproducts:	**2**
2.4	Interferonb)Vaccines-hepatitis-Bc)Hormones-Insulin.	**2**
2.5	BriefintroductiontoPCR.	**2**
3	**UNIT–III**	**10**
	Typesofimmunity-humoralimmunity,cellular immunity a. StructureofImmunoglobulins. b. StructureandFunctionof MHC. c. Hypersensitivityreactions,ImmunestimulationandImmunesuppressions. d. General method of the preparation of bacterial vaccines, toxoids, viral vaccine,antitoxins,serum-immunebloodderivativesandotherproductsrelativetoimmunity. e. Storageconditionsandstabilityofofficialvaccines. f. Hybridomatechnology-Production,PurificationandApplications. g. Bloodproducts andPlasmaSubstitutes.	
4	**UNIT–IV**	**08**
4.1	Immunoblottingtechniques-ELISA,Westernblotting,Southernblotting.	**2**
4.2	GeneticorganizationofEukaryotesandProkaryotes.	**1**
4.3	Microbialgeneticsincludingtransformation,transduction,conjugation,plasmidsandtransposons.	**2**
4.4	IntroductiontoMicrobialbiotransformationandapplications.	**2**
4.5	Mutation.:Typesofmutation/mutants.	**1**
5	**UNIT–V**	**07**
5.1	Fermentationmethodsandgeneralrequirements,studyofmedia,equipment,sterilizationmethods,aerationprocess,stirring.	**2**
5.2	Largescaleproductionfermenterdesignanditsvariouscontrols.	**1**

5.3	Studyoftheproductionof-Penicillins,citricacid,VitaminB12,Glutamicacid,Griseofulvin.	**2**
5.4	Blood productcollection,Processingandstorageofwholevolumeblood,driedhumanplasma,plasmasubstituents.	**2**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobe adopted):

1. B.R.GlickandJ.J.Pasternak:MolecularBiotechnology:PrinciplesandApplicationsofRecombinantDNA:5th edition,2017,TaylorandFrancis
2. KubyImmunology,Punt J etaleds,8thedition,WHFreeman,2018.
3. J.W.Goding:MonoclonalAntibodies –PrinciplesandPractice,3rdedition,AcademicPress, 1996.
4. J.M.WalkerandE.B.Gingold:MolecularBiologyandBiotechnology,4thedition,RoyalSocietyofChemistry,2000.
5. ZaborskyO,ImmobilizedEnzymes,1973,CRCPress,Cleveland,Ohio.
6. S.B.Primrose:MolecularBiotechnology(2ndEdition),1992,WileyBlackwell.
7. StanburyF.,P.,WhitakarA.,andHallS.J.,Principlesoffermentationtechnology,2ndedition,AdityabooksLtd.,NewDelhi,1995.

BP606T
PHARMACEUTICALQUALITYASSURANCE(Theory) 45Hours

CourseObjectives:

Thiscourse dealswith the variousaspectsof quality control and quality assurance in pharmaceuticalindustries. It deals with important aspectslike cGMP, QC tests, documentation, quality certificationsandregulatoryaffairs.

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeableto:

1. Understand the concepts of Quality assurance and learn the strategic planning, total Quality management and QbD and will know the ICH, ISO and NABL guidelines in a pharmaceutical industry.
2. Identify the organization and personnel responsibility and know the procedural and qualification aspects of procurement of raw materials and equipment.
3. Comprehend the responsibilities and significance of quality control and Good Laboratory practices.
4. Understand and apply the calibration and validation practices in pharmaceutical industry.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP606T CO1	3	2	1	3	2	3	3	3	2	3	3
BP606T CO2	3	2	1	2	2	3	3	2	1	2	3
BP606T C03	3	1	1	1	2	3	3	2	3	1	3
BP606T CO4	3	2	2	2	2	3	3	3	2	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**10**

1.1	**QualityAssuranceandQualityManagementconcepts:**Definitionandconcept ofQualitycontrol,QualityassuranceandcGMP,Qualityagreements,SiteMasterfiles	4
1.2	**TotalQualityManagement(TQM):**Definition,elements,philosophies.	2
1.3	**ICHGuidelines**:purpose,participants,processofharmonization,Briefoverview ofQSEM,withspecialemphasisonQ-seriesguidelines,ICHstabilitytestingguidelines.Pharmaceuticalaudit.	2
1.4	**QbD**:Definition, overview, elements ofQbDprogram, tools. Designofexperiments(DOE) **ISO9000&ISO14000**:Overview, Benefits,Elements,stepsforregistration.	1
1.5	**NABLaccreditation**:Principlesandprocedure.	1
2	**UNIT–II**	10
2.1	**Organizationandpersonnel:**Personnelresponsibilities,training,hygiene andpersonalrecords. **Premises:**Design,constructionandplantlayout,maintenance,sanitation, environmentalcontrol,utilitiesandmaintenanceofsterileareas,controlofcontamination.	5
2.2	**Equipmentandrawmaterials:**Equipmentselection,purchasespecifications,maintenance,Purchasespecificationsandmaintenanceofstoresforrawmaterials. vendorselectionandqualification	5
3	**UNIT–III**	10
3.1	**Quality Control:**Qualitycontroltestforrawmaterials,primary(Containers,closures)andsecondarypackingmaterials.Microbiologicaltesting.	5
3.2	**GoodLaboratoryPractices:**GeneralProvisions,OrganizationandPersonnel,Facilities,Equipment,TestingFacilitiesOperation,TestandControlArticles, ProtocolforConductofaNonclinicalLaboratoryStudy,RecordsandReports,DisqualificationofTestingFacilities.	5
4	**UNIT–IV**	08
4.1	**Complaints:**Complaintsandevaluationofcomplaints,Handlingofreturngood,recalling andwastedisposal.	2
4.2	**Documentmaintenanceinpharmaceuticalindustry:**BatchFormulaRecord,Master Formula. Record,SOP,Qualityaudit,QualityReviewandQualitydocumentation,Reports anddocuments,distributionrecords.Data Integrity.	6
5	**UNIT–V**	07
5.1	**Calibration and Validation:** Introduction, definition and general principles ofcalibration, qualification and validation, importance and scope of validation, typesof validation, validation master plan. Calibration of pH meter, Qualification ofUV-Visiblespectrophotometer,GeneralprinciplesofAnalyticalmethod Validation.,Cleaningvalidation,Sterilizationprocessvalidation.	6
5.2	**Warehousing:**Goodwarehousingpractice,materialsmanagement.	1
	TOTAL	45

ReferenceBooks(LatestEditionstobeadopted):

1. QualityAssuranceGuidebyorganizationofPharmaceuticalProductsofIndia.
2. Sandy Weinberg ,Good Laboratory Practice Regulations,in Drugs and The PharmaceuticalSciences,Vol.69.3rdeditionrevisedandexpanded,MarcelDekker,Inc.,2002.
3. QualityAssuranceofPharmaceuticals-AcompendiumofGuidelinesandRelatedmaterialsVolI,1stedition,WHO,Geneva,1997

4. KushikMaitraandSedhanK Ghosh,AguidetoTotalQualityManagement.
5. P.P.Sharma,HowtoPracticeGMP's,7th edition,VandanaPublications,Delhi,2015.
6. Sadhank G Ghosh., Introduction to ISO 9000 and Total Quality Management, 4th edition, OxfordPublishingHouse,2007
7. The International Pharmacopoeia– Vol I,II,III,IV-General MethodsofAnalysisand QualityspecificationforPharmaceuticalSubstances,ExcipientsandDosageforms.
8. A.F. Hirsch, Good laboratory Practices, Drugs and the Pharmaceutical Sciences, 1st edition, MarcelDekkerInc,1989
9. ICH guidelines,ISO9000and14000 guidelines.
10. Cole Graham, Pharmaceutical Production Facilities, Design and Applications, 2nd edition, CRCPress,2019.
11. Nash Robert A., Berry Ira R , Pharmaceutical Process Validation, Drugs and The PharmaceuticalSciences, Volume 129, International 3rd edition revised and expanded, Marcel Dekker Inc, NewYork,2003.

BP607P
MEDICINALCHEMISTRY-III(Practical)

Course Objectives: To make the learner understand

a. Methods and precautions used for setting up single and multi step synthetic reactions.
b. Monitoring the chemical reaction using TLC.
c. Purification of the crude products.
d. Quantify the purity of the synthesized compounds.
e. Application of green chemistry principles using microwave reactions.
f. Learn to visualize the 3D structures and their interactions with proteins / peptides using chemdraw software.
g. Learn the calculation of physicochemical parameters using computational tools.

CourseOutcomes:

Uponcompletionof thelaboratorytrainingthelearnershouldbeableto:

1. Remember/Understand the basic etiquettes of laboratory glassware, fire safety hazards and personal protection measures and follow good laboratory practices (GLP)
2. Analyze and determine the purity of drugs present in the API and tablets
3. Outline the synthesis of intermediate compounds and drugs of medicinal importance
4. Understand the Microwave assisted synthesis of organic compounds and their significance.
5. Evaluate the suitability of TLC as a technique for monitoring specific chemical reactions, considering its advantages and limitations in various contexts.
6. Build the chemical structures and predict the physico- chemical parameters by using Chem draw software.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP607P CO1	2	2	2	-	2	2	2	1	1	1	2
BP607P CO2	2	2	3	1	-	1	1	1	-	-	2
BP607P CO3	2	2	2	1	-	1	1	1	1	-	1
BP607P CO4	2	2	3	1	1	1	1	1	1	1	2
BP607P CO5	2	1	2	2	-	-	-	-	-	-	2
BP607P CO6	1	1	2	2	-	-	-	-	-	-	2

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong),

2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

I. Preparationofdrugsandintermediates

Sulphanilamide
7-Hydroxy, 4-methyl
coumarinChlorobutanol
Triphenyl
imidazoleTolbutami
deHexamine

II. Assay of
drugsIsonicotinic acid
hydrazideChloroquineMet
ronidazole
DapsoneChlorpheniramin
e maleateBenzylpenicillin

III. Preparationof medicinallyimportantcompoundsor intermediatesbyMicrowaveirradiationtechnique.

IV. Drawingstructuresandreactions usingChemdraw®.

V. Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogenbonddonorsand acceptorsforclassofdrugscoursecontentusingdrugdesignsoftwareDruglikelinessscreening(Lipinski'sRO 5).

RecommendedBooks(LatestEditionstobeadopted):

1. BealeJ.M.,BlockJ.H.,WilsonandGisvold'sTextbookofOrganicmedicinalandPharmaceuticalChemistry,20th edition,LippincottWilliams&WilkinsPublishers,2004.
2. LemkeT.L.,WilliamsD.A.,RocheV.F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry,7th edition,Lippincott WilliamsandWilkinsPublishers,2001.
3. AbrahamD.J.,Burger'sMedicinalChemistryandDrugDiscovery,VolItoIV,6th edition,JohnWileyandSons,Inc.,Publication,2003.
4. Smith H.J.,Smith and Williams'Introduction to PrinciplesofDrug Design and Action,4th edition,TaylorandFrancisPublications,CRCPress,2005.
5. Remington,The Science andPracticeofPharmacy, 21st edition,LippincottWilliamsandWilkinsPublication,2005..
6. RobertBuckingham,Martindale:TheExtraPharmacopoeia,40th edition,PharmaceuticalPress,2020.
7. FinarI.L.,OrganicChemistry,Vol.II,4th edition,PearsonPublishingHouse,Longman,1963
8. LednicerD.,TheOrganicChemistryofDrugSynthesis,,Vol.1-7,Wiley-Blackwell,2007
9. IndianPharmacopoeia.
10. VogelA.I.,Vogel'stextbookofPracticalOrganicChemistry,5th edition,PearsonPublishingHouse,India,1989 .

BP608PPHARMACOLOGY-III(Practical)

CourseObjectives:

This course intends to impart basic understanding of dose calculations in pre-clinical studies and to elucidate the pharmacological effects of drugs on different organ systems. The statistical skills acquired will enable students to apply statistical methods to a range of preclinical data. Additionally, the course highlights the interconnection between pharmacology with other medical sciences.

CourseOutcomes:

Uponcompletionofthiscoursethestudentshouldbeableto:

1. Describedosecalculationsinpharmacologicalexperiments.
2. Comprehend the effects of drugs on different organs of the body.
3. Apply statistical methods to data for its analysis.
4. Appreciate the correlation of pharmacology with related medical sciences.

CO-PO Mapping

BP608P *CourseOutcomes*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	3	3	3	3	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Dosecalculationinpharmacologicalexperiments.
2. Antiallergicactivitybymastcellstabilizationassay.
3. Studyofanti-ulceractivityofadrugusingpylorusligand(SHAY)ratmodelandNSAIDSinducedulcermodel.
4. Studyofeffectofdrugsongastrointestinal motility.
5. Effectofagonist andantagonistsonguineapigileum.
6. Estimation ofserumbiochemicalparametersbyusingsemiautoanalyzer.
7. Effect of salinepurgativeonfrogintestine.
8. Insulinhypoglycemiceffect inrabbit.
9. Test for pyrogens(rabbitmethod).
10. Determination ofacuteoraltoxicity(LD50)ofadrugfromagivendata.
11. Determinationofacuteskinirritation/ corrosionofatest substance.
12. Determinationofacuteeyeirritation/corrosionofatest substance.
13. Calculationofpharmacokineticparametersfromagivendata.
14. Biostatistics methodsinexperimentalpharmacology(Student'sttest,ANOVA).
15. Biostatisticsmethods inexperimentalpharmacology(Chisquaretest,WilcoxonSignedRanktest).

**Experimentsaredemonstratedbysimulatedexperiments/videos*

RecommendedBooks(LatestEditionstobeadopted):

1. RangH.P.,DaleM.M.,RitterJ.M.,FlowerR.J.,RangandDale'sPharmacology,9th edition,ChurchillLivingstoneElsevier.,2019.
2. RitterJ.M.,FlowerR.J.,HendersonG,LokeY,MacEwanD,RangH.,RangandDale'sPharmacology,9th edition,ElsevierHealth,London2019.
3. KatzungB.G.,MastersS.B.,TrevorA.J.,BasicandClinicalPharmacology,14th edition,TataMcGraw-HillEducation,Pvt.Ltd,2017
4. Brunton,L.L.,Hilal-DandanR,Knollman,B.,GoodmanandGilman'sThePharmacologicalBasisofTherapeutics;13thedition,McGraw-HillEducation,New York,2017.
5. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robin L.C., Joseph G. B., Wayne A. K., Bradley

R.W.,AppliedTherapeutics,TheClinicaluseofDrugs,9th edition,LippincottWilliams &Wilkins,2009.
6. ZeindC.S.,CarvahloM.G.,AppliedTherapeutics:TheClinicalUseofDrugs,11th edition,WoltersKluwer,Philadelphia,2018
7. HarveyR,ClarkMA,FinkelR.,Rey,J.A.,Whalen,K.,Lippincott'sIllustratedReviews-Pharmacology,5th edition,Wolter'sKruwer,2011.
8. TripathiK.D.,EssentialsofMedicalPharmacology,8th edition,JaypeeBrothersMedicalPublishers (P)Ltd,NewDelhi,2019.
9. SharmaH.L.,SharmaK.K.,PrinciplesofPharmacology,1st edition,ParasMedicalPublisher, 2017.
10. CraigC.R.,Stitzel,R.E,ModernPharmacologywithclinicalApplications,1st edition,LippincottWilliamsand Wilkins,Philadelphia,2004
11. Ghosh MN. Fundamentals of Experimental Pharmacology, 6th edition, Hilton & Company, Kolkata,2015.
12. KulkarniSK. Handbookofexperimentalpharmacology,4th edition,VallabhPrakashan,2012.
13. SatoskarR.S.BhandarkarS.D.,Tripathi,R.K.,RegeN.N.,25th edition,Pharmacology&Therapeutics, Elsevierco-publishedwithPopularPrakashan,2017.
14. Kasture,S.B.,AhandbookofExperimentsinPre-ClinicalPharmacology,1st edition,Career
15. Publications,Nasik,2009.
16. UdupaNandGuptaPD,ConceptsinChronopharmacology,1st edition,ShyamPrakashan,2009.

BP609P
HERBALDRUGTECHNOLOGY(Practical)

CourseObjectives:

Thecourseequipsthestudentwithskillstodevelopherbalformulationsandevaluatethemasper Pharmacopeials pecifications.

CourseOutcomes:

Uponcompletionof thecourse,thestudentshallbeableto:

1. Evaluate excipients and finished formulations of herbal origin, as per Pharmacopeial specifications
2. Develop solid and liquid formulations of herbal origin, for oral and topical use.
3. Perform quantitative estimation of select phytoconstituents in herbal materials.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP609P CO1	3	3	3	3	3	3	3	3	3	3	3
BP609P CO2	3	3	3	3	3	3	3	3	3	3	3
BP609P CO3	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Toperformpreliminaryphytochemicalscreeningofcrudedrugs.
2. Determinationofthealcoholcontentof AsavaandArista
3. Evaluationofexcipients ofnaturalorigin
4. Incorporationofpreparedandstandardizedextractincosmeticformulationslikecreams,lotionsandshampoosa ndtheirevaluation.
5. Incorporationofpreparedand standardizedextractin formulationslike syrups,mixturesand tabletsandtheirevaluationasperPharmacopoeial requirements.

6. MonographanalysisofherbaldrugsfromrecentPharmacopoeias
7. DeterminationofAldehydecontent
8. DeterminationofPhenolcontent
9. Determinationoftotalalkaloids

RecommendedBooks:(LatestEditionstobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy, 16th edition, W.B.Sounders & Co.,London, 2009.
2. Tyler,V.E,Brady,L.R.andRobbers, J.E.,Pharmacognosy,9thEdn., Lea andFebiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J&AChurchillLtd,London,2005.
4. MohammadAli,Pharmacognosy andPhytochemistry,1stedition,CBSPublishers&Distributors,NewDelhi.2018reprint.
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, Nirali Prakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1st edition,EasternPublishers,NewDelhi.1996
7. AnsariS.H.,EssentialsofPharmacognosy,2ndedition, Birla Publications,NewDelhi, 2007
8. KokateC.K.,PurohitA.P.,GokhaleS.B,PracticalPharmacognosy,13thedition,NiraliPrakashan,NewDelhi, 2009.
9. Iyengar M.A and Nayak S.G.K, Anatomy of Crude Drugs, 12th edition, PharmaMed Press, A unit ofBSPbooksPvt.Ltd,Hyderabad,2011.
10. KhandelwalK.R.andVrundaSethi,PracticalPharmacognosy:TechniquesandExperiments,24thedition,Nir aliPrakashan,2014.
11. VasudevanT.N.andLaddhaK.S,PracticalPharmacognosy,NewVrindaPublishingHouse,Jalgaon,1987.
12. ShahB.A.,SethA,TextbookofPharmacognosyandPhytochemistry,1stedition,ElsevierPublications ,Adivisionof ReedElsevierIndiaPvt.Ltd,NewDelhi,2010.
13. Remington, The Science and Practice of Pharmacy, 21st edition, Lippincott Williams and WilkinsPublication,2005.
14. Pharmacognosy&Pharmacobiotechnology.Eds.BobbersJE,SpeedieMK,andTylerVE,WilliamsandWiki ns,1996.
15. VyasSPandDixitVK,TextbookofBiotechnology,1stedition,2012,CBSPublishers.
16. DubeyRC,ATextbookofBiotechnology,5th edition,SChandPublications,2014.
17. Appel L, The formulation and preparation of cosmetic, fragrances and flavours, 2nd edition, MicellePress,1994.
18. Panda H,HerbalCosmetics,3rdrevisededition,Asia PacificBusinessPress, 2015.
19. REndress,PlantcellBiotechnology,1stedition, Springer-VerlagBerlinHeidelberg, 1994.
20. PharmacopeialstandardsforAyurvedicFormulation(CouncilofResearchin Indian Medicine&Homeopathy).
21. Mukherjee,P.W.QualityControlofHerbalDrugs:AnApproachtoEvaluationofBotanicals,1stedition,Busin essHorizonsPublishers,NewDelhi,India,reprint2012.

SEMESTER VIIBP701T

INSTRUMENTAL METHODSOFANALYSIS(Theory) 45Hours

CourseObjectives:

This course deals with the application of instrumental methods in qualitative andquantitative analysisofdrugs.Thiscourseisdesignedtoimpartfundamentalknowledgeontheprinciplesandinstrumentation ofspectroscopicandchromatographictechniques.Emphasiswillbeplacedontheoreticalandpracticalknowled geofmodernanalyticalinstrumentsthatareusedfordrugtesting.

CourseOutcomes:

Thestudentswillbeableto:

1. Comprehendunderlyingprinciple,instrumentation,applicationandlimitationsininstrumentaltechniques involving molecular absorption and emission techniques such as UV-Visible, Fluorescence,andInfra-Redspectroscopy.
2. Comprehendunderlyingprinciple,instrumentation,applicationandlimitationsininstrumentaltechniquesinvolvingatomicabsorptionandemissiontechniquessuchasatomicabsorptionspectroscopy,atomicemissionspectroscopy,andnephloturbidimetrytechnique.
3. Describeandevaluatethechromatographytechniquesandelectrophoresistechniquesusedfortheseparation,identification,andquantificationof analytes.
4. ApplyknowledgeofspectroscopyandchromatographictechniquesforqualitativeandquantitativeanalysisandcomprehendICHguidelinesforanalyticalmethodvalidation.

CO-PO Mapping for BP701 INSTRUMENTAL METHODS OF ANALYSIS(THEORY)											
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO1	3	1	3	3	-	3	3	2	3	1	3
CO2	3	1	2	3	-	3	3	2	3	1	3
CO3	3	2	3	3	1	3	3	2	3	1	3
CO4	3	3	3	3	1	3	3	2	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1.	**UNIT–I**	**10**
1.1	**UVVisiblespectroscopy**:IntroductiontoElectromagneticradiationsandabsorptionspectroscopy,Electronictransitions,chromophores,auxochromes,spectralshifts,Wavelengthmaxima,solventeffectonabsorptionspectra, Beer and Lambert's law, derivation and deviations, Chemical derivatizationtechniques	**3**
1.2	Instrumentation - Sources of radiation, wavelength selectors, sample cells,detectors-Phototube,Photomultipliertube, Photo voltaic cell, SiliconPhotodiode,Singleanddoublebeaminstruments	**2**
1.3	**PharmaceuticalApplications-SpectrometrictitrationsSinglecomponentandMulticomponentanalysisbyUVSpectroscopy(**Assayasasinglecomponentsample,Correctedinterference,Assayaftersolventextraction,SimultaneousEquationmethod,AbsorbanceRatiomethod,DifferenceSpectroscopymethod,DerivativeSpectroscopy),Calculationofwavelengthmaximausing WoodwardFieserrulesfordienesandα,β-unsaturatedketones withalkylsubstituents,anddeterminationofpKa.	**2**

1.4	**Fluorimetry:**IntroductiontoMolecularEmissionSpectroscopy,Theoryoffluorescence, Concepts of singlet, doublet and tripletelectronic states, internalandexternalconversions,factorsaffectingfluorescenceandquenchingoffluorescence Instrumentation - Filter fluorimeter and Spectrofluorimeter, Sources of radiation,Monochromators(Filters,gratings),Samplecells,Detectors Applications-Chemicalderivatizationtofluorescentcompound,e.g.useof	3
	Dansylchloride,Fluoresamine,o-phthalaldehyde&ChoiceoffluorimetryoverUV-Visspectroscopy(SensitivityandSpecificity), Pharmaceuticalapplications	
2	**UNIT–II**	**10**
2.1	**IRSpectroscopy**: Introduction,requirementsforI.R.absorption,vibrationalandrotationaltransitions, dipole changes, potential energy diagrams (harmonic oscillator andanharmonic oscillator), force constants, fundamental modes of vibrations in polyatomicmolecules,factorsaffectingvibrations Sample preparation forI.R spectroscopy -Solids (mulling, pelleting and thin filmdeposition,andinsolutionform),Liquids(Neatandinsolutionform),samplehandling techniques (Attenuated Total Reflectance and Diffuse Reflectance)Instrumentation (FTIR) - Sources of radiation, wavelength selectors, detectors -Golay cell,Bolometer, Thermocouple,Thermister,Pyroelectric detectorApplications– Pharmaceutical applicationsincluding Identification,Polymorphanalysis,structureelucidation foralkanes,alkenes,alkynes,alcohols,amines,aldehydes,ketones,carboxylicacidsandesters,Nitroandcyanocompounds, Benzenederivatives	**4**
2.2	**Flame Photometry:** Principle, interferences, instrumentation and pharmaceuticalapplications.	**2**
2.3	**Atomic absorption spectroscopy**: Principle, interferences, backgroundcorrectionmethods,instrumentationandpharmaceuticalapplications.	**2**
2.4	**Nepheloturbidometry**: Principle, instrumentation and pharmaceuticalapplications.	**2**
3	**UNIT–III**	**10**

3.1	Classification of chromatographicmethods on the basis of- interaction of soluteto the stationary phase, chromatographic bed shape and the physical state of themobile phase, by mechanism- Adsorption, partition, ion-exchange, size exclusionandaffinitychromatography,Methodology,advantages,disadvantagesand applicationsofvariouschromatographicmethods. *Terminologies/concepts:*stationaryphase,mobilephase,retentiontime,gradientandisocraticelution,normalandreversephasechromatography,retention factor,internalstandard,referencestandard,workingstandard,tailing factor(symmetryfactor), asymmetry factor, resolution, signal to noise ratio, columnchromatography, preparative chromatography, Plate number, HETP, resolution,*Quantitativeanalysis*(Peakheight,peakareas,calibrationcurve,internalstandard, andareanormalization) *Optimization of column performance* (Column efficiency and band broadening,shape of peak-Gaussian, Plate height, Number of theoretical plates, van Deemterequation,Capacityfactor,Selectivityfactor,Tailingfactor,peakwidth,andResolution) Numericalandjustification-basedproblemsrelatedtochromatographicmethods Adsorptionandpartitionchromatography-Advantages,disadvantagesandpharmaceuticalapplications	**4**
3.2	**Thin-layerchromatography-:**Introduction,Principle,Methodology-typesofadsorbents, Developmental techniques**,** Visualisation techniques, Rf values andfactorsaffectingresolution,advantages,disadvantages,pharmaceuticalapplicationsof TLCandPreparativeTLC. **HPTLC:**Instrumentation-Applicator,photodensitometry,photodocumentation,	**2**
	AdvantagesofHPTLCoverTLCandHPLC.	
3.3	**Paperchromatography:**Introduction,Principle,Methodology-Developmental techniques(Ascending,Descending,RadialandTwo-dimensional)andSprayreagents,advantages,disadvantages andpharmaceuticalapplications.	**2**
3.4	**Electrophoresis**: Introduction, factors affecting electrophoretic mobility,Techniquesofpaper,gel,capillaryelectrophoresis,applications.	**2**
4	**UNIT–IV**	**8**
4.1	**Gaschromatography:Introduction,theory,Instrumentation-**Carriergassupply,SampleinjectionsystemincludingHeadspaceanalysis,Columns(Packed, Open tubular columns, Capillary columns) and column ovens, Detectors(Thermalconductivity,Electroncapture,Flameionization),derivatization, temperature programming, advantages, limitations and pharmaceuticalapplications.	**4**

4.2	**Highperformanceliquidchromatography(HPLC):**Introduction,theory,Instrumentation-Mobilephasereservoir,DualpistonreciprocatingPumps,Sample injection systems (Rheodyne injector and autosampler), Column types(analytical,guardandpreparativecolumns)andcolumnpacking(porous,pellicularandmonolithic),Detectors(ConceptofsoluteandbulkpropertydetectorRefractiveindex,UV-Vis,Photodiodearray,fluorescence,,Electrochemical, Evaporative Light Scattering), Differences between UPLC andHPLC,Applications,AdvantagesandLimitationsofHPLC. **Ionpairchromatography-** Introduction,theory,instrumentationandpharmaceuticalapplications	**4**
5	**UNIT–V**	**7**
5.1	**Ionexchangechromatography:**Introduction,classification,ionexchange resins,properties,mechanismofionexchangeprocess,factorsaffectingionexchange,methodologyandapplications.	**2**
5.2	**Gel chromatography:** Introduction, theory,instrumentation and Pharmaceuticalapplications.	**2**
5.3	**Affinity chromatography:** Introduction, theory, instrumentation andapplications.	**2**
5.4	**AnalyticalmethodValidation-ICHguidelines.**	**1**
	TOTAL	**45**

ReferenceBooks(LatestEditionstobeadopted):

1. Skoog,D.A.,F.J.HollerandS.R.Crouch.PrinciplesofInstrumentalAnalysis,6th edition,Brooks Cole,2006
2. Connors,K.A.,A Textbook of PharmaceuticalAnalysis,3rd edition, John Wiley and Sons,Canada,2007.
3. A. H. Beckett and J. B. Stenlake, Practical Pharmaceutical Chemistry, Part I and II, 4th edition, CBSPublishersandDistributors,India,1997.
4. D.A.Skoog,D.M.West,F.J.HollerandS.R.Crouch,FundamentalsofAnalyticalChemistry,9thedition,SaundersCollegePublishing,USA,2013.
5. G.D.Christian,AnalyticalChemistry,6thedition,JohnWiley&Sons,Singapore,reprintbyWileyIndiaPvt.Ltd, 2003.
6. H.H.Willard,L.L.MerritandJ.A.Dean,InstrumentalMethodofAnalysis,7thedition,CBSPublishers &Distributors, NewDelhi,1988.
7. IndianPharmacopoeia,TheIndianPharmacopoeiaCommission,MinistryofHealthandFamilyWelfare ,Governmentof India.
8. UnitedStates Pharmacopeia
9. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas, B. Sivasankar, Vogel's Textbook ofQuantitativeChemicalAnalysis,6thedition,PearsonEducation,NewDelhi,2009.
10. D.G.Watson,PharmaceuticalAnalysis–Atextbook forpharmacystudentsandpharmaceuticalchemists.5th edition,Elsevier,2020.
11. J.W.Robinson,E.M.S.Frameand G.M.FrameII,UndergraduateInstrumentalAnalysis,7thedition,MarcelDekker,CRCPress,Taylor&Francis group,New York,USA,2014.
12. R.Kellnar,J.M.Mermet,M.Otto,M.Valcarceland,H.M.Widmer,AnalyticalChemistry:Amodern approachtoanalytical science,2ndedition,Wiley-VCH,USA,2004.
13. J.W.Munson,PharmaceuticalAnalysis:Modernmethods(intwoparts),1stedition,MarcelDekkerInc.,USA,1981.
14. W.Kemp,OrganicSpectroscopy,PalgravePublishersLtd.,3rdedition,NewYork,USA,1991

15. R. M. Silverstein,F.X.WebsterandD.J.Kiemle,Spectrometricidentificationoforganiccompounds,8th edition,John Wiley&Sons,Inc.(Indianedition),NewDelhi(Referencebook),2014.
16. J. R. Dyer, Applications of Absorption Spectroscopy Of Organic Compounds,Eastern EconomyEdition,Prentice- Hallof IndiaPvtLtd,NewDelhi,India,2011.
17. D. L. Pavia, G. M. Lampman, G. S. Kriz and J. R. Vyvyan, Introduction to Spectroscopy, 3rd edition,Brooks/ColeCengageLearning,Australia,2011
18. L.R.Snyder,J.J.Kirkland,J.L.Glajch,PracticalHPLCMethodDevelopment,2nd edition,Wiley-Intersciencepublication,JohnWiley&Sons,Inc.,Canada(Referencebook),1997
19. S. Ahuja and M.W. Dong,Handbook of Pharmaceutical Analysisby HPLC, Volume 6of SeparationScienceandTechnology,1st edition,ElsevierAcademicPress,Indianedition(Referencebook),2005 .

BP702T

INDUSTRIALPHARMACYII(Theory) 45Hours

Course Objectives:

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

Course Outcomes:

The learner should be able to:

1. Understand and apply the process of pilot plant and scale up considerations for solid orals, liquid orals and semisolids.
2. Comprehend the WHO guidelines for Technology Transfer, Transfer from R&D to production, Documentation, Commercialization, TOT agencies in India, Technology of Transfer (TOT) related documentation - confidentiality agreements, licensing, MoUs, legal issues.
3. Explain different Laws and Acts that regulate pharmaceutical industry as well as regulatory requirements for drug approval process.
4. Demonstrate quality management practices in pharmaceutical industries.
5. Know the compositions roles and responsibilities of various regulatory Indian bodies and describe the regulatory requirements for drug approval processes.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP702T CO1	3	3	1	1	1	3	3	2	3	2	3
BP702T CO2	3	2	1	2	1	2	1	2	2	2	3
BP702T CO3	3	3	1	2	2	2	3	2	3	2	3
BP702T CO4	3	3	1	2	1	1	2	2	2	1	3
BP702T CO5	3	3	1	2	2	2	2	3	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

Unit	Details	Hours

1.	**UNIT–I**	**10**
	Pilotplantscaleuptechniques: Generalconsiderations-includingsignificance of personnel requirements, space requirements, raw materials,Pilot plant scale up considerations for solids, liquid orals, semi solids andrelevantdocumentation,SUPACguidelines,IntroductiontoPlatformtechnology	
2	**UNIT–II**	**10**
	Technology development and transfer: WHO guidelines for TechnologyTransfer:Terminologies,Technologytransferprotocol,Qualityrisk management, Transfer from R & D to production (Process, packaging andcleaning),GranularityofTTProcess(API,excipients,finished products,packing materials) Documentation, Premises and equipment,qualificationandvalidation,qualitycontrol,analyticalmethodtransfer ,Approvedregulatory bodies and agencies, Commercialization - practical aspects andproblems (case studies), TOT agencies in India - APCTD, NRDC, TIFAC,BCIL,TBSE/SIDBI;TechnologyofTransfer(TOT)relateddocumentation -confidentialityagreements,licensing,MoUs,legalissues.	
3	**UNIT–III**	**10**
3.1	**Regulatoryaffairs:**Introduction,HistoricaloverviewofRegulatoryAffairs, Regulatoryauthorities,RoleofRegulatoryaffairsdepartment,ResponsibilityofRegulatoryAffairsProfessionals.	**2**
3.2	**Regulatory requirements for drug approval:** Drug Development Teams,Non-ClinicalDrugDevelopment,Pharmacology,DrugMetabolismandToxicology,GeneralconsiderationsofInvestigationalNewDrug(IND)Application, Investigator's Brochure (IB) and New Drug Application (NDA),Clinicalresearch/BEstudies,ClinicalResearchProtocols,Biostatisticsin Pharmaceutical Product Development, Data Presentation for FDASubmissions,ManagementofClinicalStudies.	**8**
4	**UNIT–IV**	**8**
	Qualitymanagementsystems: Qualitymanagement&Certifications:Conceptof Quality,TotalQualityManagement,Qualitybydesign,Six Sigmaconcept,Outof Specifications(OOS),Changecontrol,IntroductiontoISO9000seriesofqualitysystemsstandards,ISO14000,NABL,GLP.	
5	**UNIT–V**	**7**
	IndianRegulatoryRequirements: CentralDrugStandardControlOrganization(CDSCO)andStateLicensingAuthority:Organization,Responsibilities,Common TechnicalDocument(CTD),Certificateof Pharmaceutical Product (COPP), Regulatory requirements and approvalproceduresforNewDrugs.ANDA	
	TOTAL	**45**

RecommendedBooks:(LatestEditionstobeadopted):

1. https://en.wikipedia.org/wiki/Regulatory_affairs.(RegulatoryAffairsfromWikipedia,thefreeencyclopedia,lasteditedJuly2021)
2. http://www.iraup.com/about.php.(InternationalRegulatoryAffairsUpdates,2005)
3. DouglasJ.Pisano,DavidMantus,FDARegulatoryAffairs:AGuideforPrescription drugs, MedicalDevices, andBiologics,2nd edition,Informa Healthcare.,Inc,2008.

4. http.//www.cgmp.com/ra.htm.(RegulatoryAffairsbroughtbylearningplus,inc.)

BP703T

PHARMACYPRACTICE(Theory) 45Hours

CourseObjectives:

The course introduces several aspects of Hospital Pharmacy like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. The course also introduces different aspects of community pharmacy like dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

CourseOutcomes:

Uponcompletionof thecourse,thestudentshallbeableto

1. Recall the organizational structure of hospitals, hospital pharmacy, and community pharmacy and their functioning.
2. Recognize various drug distribution system in the hospital, develop the contents of hospital formulary and understand the monitoring of drug therapy of patient through medication chart review and clinical review.
3. Describe the functioning of pharmacy and therapeutic committee as well as identify and assess adverse drug reactions.
4. Understand pharmaceutical care services and carry out patient counselling in community pharmacy.
5. Describe the functions and responsibilities of hospital pharmacists and clinical pharmacist and appreciate the concept of Rational Drug Therapy.
6. Explain drug store management and inventory control as well as interpret selected laboratory results of specific disease states.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP703 CO1	3	1	1	1	1	3	3	3	3	1	3
BP703 CO2	3	1	1	3	1	3	3	3	3	1	3
BP703 CO3	3	1	1	3	1	3	3	3	3	1	3
BP703 CO4	3	1	1	2	1	3	3	3	3	1	3
BP703 CO5	3	1	1	2	3	3	3	3	3	1	3
BP703 CO6	3	1	1	3	1	3	3	3	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1.	**UNIT–I**	**10**
1.1	**Hospitalanditsorganization** Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals,Classificationbasedonclinicalandnon-clinicalbasis,OrganizationStructureofaHospital,andMedicalstaffinvolvedinthehospitalandtheirfunctions.	**2**
1.2	**Hospitalpharmacyanditsorganization** Definition,functionsofhospitalpharmacy,Organizationstructure,Location,Layoutandstaffrequirements,andResponsibilitiesandfunctionsofhospitalpharmacists.	**2**

1.3	**Adversedrugreaction** Classifications - Excessive pharmacological effects, secondary pharmacologicaleffects,idiosyncrasy,allergicdrugreactions,geneticallydeterminedtoxicity,toxicityfollowingsuddenwithdrawalofdrugs,Druginteraction-beneficialinteractions,adverseinteractions,andpharmacokineticdruginteractions,pharmacodynamicdruginteractions.Methodsfordetectingdruginteractions,spontaneous case reports and record linkage studies, and Adverse drug reactionreportingandmanagement.	3
1.4	**CommunityPharmacy** Organizationandstructureofretailandwholesaledrugstore,typesanddesign,	3
	Legalrequirementsforestablishmentandmaintenanceofadrugstore,Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.Roleofpharmacist.	
2	**UNIT–II**	10
2.1	**Drug distributionsystemina hospital** Dispensing of drugs to inpatients, types of drug distribution systems, chargingpolicy and labelling. Dispensing of drugs to ambulatory patients and dispensing ofcontrolleddrugs.	2
2.2	**Hospitalformulary** Definition,contentsofhospitalformulary,DifferentiationofhospitalformularyandDrug list,preparationandrevision,andadditionanddeletionofdrugfrom hospitalformulary.	2
2.3	**Therapeuticdrugmonitoring** Need forTherapeuticDrugMonitoring,Factorstobeconsideredduringthe Therapeutic DrugMonitoring, andIndianscenariofor Therapeutic DrugMonitoring.Roleofpharmacist.	2
2.4	**Medicationadherence** Causesofmedicationnon-adherence,pharmacistroleinthemedicationadherence,andmonitoringof patientmedicationadherence.	1
2.5	**Patientmedicationhistoryinterview** Needforthepatientmedication historyinterview,medicationinterviewforms.	1
2.6	**Communitypharmacy management** Financial,materials,staff,andinfrastructurerequirements.	2
3	**UNIT–III**	10
3.1	**Pharmacyandtherapeuticcommittee** Organization,functions,Policiesofthepharmacyandtherapeuticcommitteein including drugsinto formulary,inpatientand outpatientprescription,automaticstoporder,andemergencydruglistpreparation.	2
3.2	**Druginformationservices** DrugandPoisoninformationcentre,Sourcesofdruginformation,Computerisedservices,andstorageandretrievalofinformation.	1
3.3	**Patientcounselling** Definitionofpatientcounselling,factorsaffectingcounselling,stepsinvolvedinpatientcounselling,andspecialcases.Roleofpharmacist.	2
3.4	**Educationandtrainingprograminthehospital** Roleofpharmacistintheeducationandtrainingprogram,Internalandexternaltraining program,Servicestothenursinghomes/clinics,Codeof ethicsforcommunitypharmacy,andRoleofpharmacistintheinterdepartmentalcommunicationandcommunityhealtheducation.	3

3.5	**Prescribedmedicationorder andcommunicationskills** Prescribed medication order- interpretation and legal requirements, and Communicationskills- communicationwithprescribersandpatients.	2
4	**UNIT–IV**	8
4.1	**Budgetpreparationandimplementation** Budgetpreparationandimplementation.	2
4.2	**ClinicalPharmacy** IntroductiontoClinicalPharmacy,Conceptofclinicalpharmacy,functionsand	5
	responsibilitiesofclinicalpharmacist, Drugtherapymonitoring-medicationchart review,clinicalreview,pharmacistintervention,Wardroundparticipation,Medicationhistoryandpharmaceuticalcare.	
4.3	**Overthecounter(OTC)sales** Introductionandsaleofoverthecounter,andRationaluseofcommonoverthecountermedications.	1
5	**UNIT–V**	7
5.1	**Drugstore managementandinventorycontrol** Organisationofdrugstore,typesofmaterialsstockedandstorageconditions,Purchaseandinventorycontrol:principles,purchaseprocedure,purchaseorder, procurementandstocking,Economicorderquantity,Reorderquantitylevel,andMethodsusedfortheanalysisofthedrugexpenditure.	3
5.2	**Investigationaluseofdrugs** Description,principlesinvolved,classification,control,identification,roleofhospitalpharmacist,advisorycommittee.	2
5.3	**InterpretationofClinicalLaboratoryTests** Bloodchemistry,haematology,andurinalysis.	2
	TOTAL	45

RecommendedBooks(LatestEditionstobeadopted):

1. MerchantS.H.and Dr.J.S.Quadry.Atextbookofhospitalpharmacy,4th edition,B.S.Shah Prakashan,2001.
2. ParthasarathiG,KarinNyfort-Hansen,MilapCNahata.AtextbookofClinicalPharmacyPractice-essentialconceptsandskills,1st edition,Chennai:OrientLongmanPrivateLimited,2004.
3. WilliamE.Hassan.Hospitalpharmacy,5th ed.Philadelphia:Lea&Febiger,1986.
4. TipnisandBajaj.HospitalPharmacy,1st ed.,CareerPublications,2008.
5. ScottLT.Basicskillsininterpretinglaboratorydata,4th edition,AmericanSocietyofHealthSystemPharmacistsInc,2009.
6. Parmar N.S. Health Education and Community Pharmacy, 18th edition, CBS Publishers & Distributors;2008.

Journals:

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

BP704T

NOVELDRUG DELIVERYSYSTEMS(Theory) 45 Hours

CourseObjectives:

Thiscourseisdesignedtoimpart basic knowledgeontheprinciplesandmethodsfordevelopmentofnoveldrugdeliverysystems.

CourseOutcomes:

Uponcompletionof thecoursestudentshallbeableto:

1. Know the basic concepts of novel drug delivery systems.
2. Classify polymers and their applications in novel drug delivery systems.
3. Explain the design of novel drug delivery systems for oral,transdermal, ocular,transmucosal, nasal, pulmonary, and parenteral route.
4. Describe the multiparticulate systems and implantable delivery systems.
5. Illuminate the classification, components & design,methods of preparation, characterization and applications of liposomes, niosomes, nanoparticles (polymeric and lipid), monoclonal antibodies and their applications.
6. Summarize the targetingsystemsfor brain, colon, lymphatics andtumors.

CO-PO mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP704 CO1	3	1	2	1	1	1	2	1	3	2	3
BP704 CO2	3	1	3	1	1	1	2	1	3	3	3
BP704 CO3	3	1	3	3	1	1	2	1	3	2	3
BP704 CO4	3	1	2	3	1	1	2	1	3	2	3
BP704 CO5	3	1	2	2	1	1	2	1	3	2	3
BP704 CO6	3	1	2	2	1	1	2	1	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**10**
1.1	**Controlleddrugdeliverysystems**:Introduction,terminology/definitionsandrationale , advantages, disadvantages, selection of drug candidates. Oral systems-Matrix&reservoirsystems.Approachestodesignofcontrolledreleaseformulationsbase dondiffusion,dissolutionandionexchangeprinciples. Physicochemical and biological properties of drugs relevant to controlled releaseformulations.Evaluationofthesystems.	**7**
1.2	**Polymers:**Introduction,classification,properties,advantagesandapplicationofpolymer sinformulationofcontrolledreleasedrugdeliverysystems.	**3**
2	**UNIT–II**	**10**
2.1	**Microencapsulation:**Definition,advantagesanddisadvantages,microspheres/microc apsules,microparticles,methodsofmicroencapsulation(phaseseparation coacervation (varioustechniques),Wursterprocess,spray drying and related processes, interfacial polymerization, multiorifice centrifugal process,pancoating,solventevaporation;extrusion&spheronization),applications	**4**
2.2	**MucosalDrugDeliverysystem:**Introduction,Principlesofbioadhesion, mucoadhesion,advantagesand disadvantages,transmucosal permeability andformulationconsiderationsofbuccaldeliverysystems.	**3**

2.3	**Implantable Drug Delivery Systems:** Introduction, advantages anddisadvantages,conceptofimplantsandosmoticpump(Basic principlesofosmotic drugdelivery,classification-Implantableosmoticpumps,oralosmoticpumps,applications&evaluation)	3
3	**UNIT–III**	10
3.1	**Transdermal Drug Delivery Systems:** Introduction, Permeation through skin,factors affecting permeation, permeation enhancers, basic components of TDDS,formulationapproaches.	3
3.2	**Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages,approachesfor GRDDS –Floating, highdensitysystems,swellingandexpandable,mucoadhesive,inflatableandgastroadhesivesystemsandtheirapplications.	2
3.3	**Nasopulmonarydrugdeliverysystem:**IntroductiontoNasal andPulmonaryroutesofdrugdelivery,Advantagesandlimitations;Nasaldrugdelivery-absorption pathwaysofintranasally administereddrugs,permeationenhancers,intranasal formulations, nose-to-brain delivery Pulmonary delivery- Weibel modelof Lungs (Pulmonary tree), aerosol deposition mechanisms and pattern in lungs,conceptsofmassmedianaerodynamicdiameter(MMAD)andFineparticle fraction (FPF) Formulation of Inhalers (dry powder and metered dose), nasalsprays,nebulizers.	5
4	**UNIT–IV**	8
	Nanotechnology and its Concepts: Concepts and approaches for targeted drugdeliverysystems,advantagesanddisadvantages,introductiontoliposomes,niosomes, nanoparticles (polymeric and lipid), monoclonal antibodies and theirapplications. ConceptofTargetingtoBrain:Bloodbrainbarrier(BBB),transportthrough	
	BBB, factorsaffectingdrugpermeationthroughBBB,strategiesforbraindrugdelivery ConceptofLymphatictargeting-needandapproaches- Concept of Targeting to tumor – EPR effect,ligand-based active targetingwithtwoexamples	
5	**UNIT–V**	7
5.1	**Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods toovercome–Preliminarystudy,ocularformulations,insitugellingsystemsand ocuserts(Non-erodibleandErodibleinserts).	5
5.2	**Intrauterine Drug Delivery Systems:** Introduction, advantages anddisadvantages,developmentofintra uterinedevices(IUDs).	2
	TOTAL	45

RecommendedBooks:(LatestEditionstobeadopted):

1. YW.Chien,NovelDrugDeliverySystems,2nd edition,revisedandexpanded,MarcelDekker,Inc.,New York,1992.
2. Robinson,J. R.,Lee V.H.L, Controlled Drug DeliverySystems,2nd edition,revised and expanded,MarcelDekker,Inc.,NewYork,1992.
3. Edith Mathiowitz, Encyclopedia of Controlled Delivery. Wiley Interscience Publication, 1st edition, JohnWileyandSons,Inc,NewYork,1999.
4. N.K.Jain,Controlled andNovel DrugDelivery,1stedition,CBSPublishers&Distributors,NewDelhi,1997(reprintin2001).
5. S.P.VyasandR.K.Khar,ControlledDrugDelivery-

conceptsandadvances,1st edition,VallabhPrakashan,NewDelhi,2002.

Journals

1. IndianJournalofPharmaceuticalSciences(IPA).
2. IndianDrugs(IDMA).
3. JournalofControlledRelease(ElsevierSciences).
4. DrugDevelopmentandIndustrialPharmacy(Marcel& Dekker).
5. InternationalJournalofPharmaceutics(Elsevier Sciences)

BP705P
INSTRUMENTALMETHODSOFANALYSIS(Practical)

CourseObjectives:

To impart to the learner through experiential learning the knowledge to operate the instruments, understandtheir functioning, prepare solutions accurately, conduct analysis using appropriate instrument, calculate,reportandinterprettheresultsofanalysis.

CourseOutcomes:

Uponcompletionofthecoursethelearnershouldbeableto:

1.Record,calculate and interpret data obtained from UV spectrophotometry,fluorimetry,colorimetry,flamephotometryandnepheloturbidometryanalysis.

2.Develop and optimize mobile phase composition for qualitative analysis by TLC and interpret dataobtainedbyTLCandpaperchromatography.

3. Outlineworkingandapplicationofcolumnchromatography,HPLCandGC.

4.ApplyICHguidelinestovalidateananalyticalmethodbyUVspectroscopyandinterpretresultsobtained.

MappingCO-PO:

BP705P ***CourseOutcomes***	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	2	3	3	3	2	2	3
CO2	3	3	3	3	2	3	3	3	2	2	3
CO3	3	3	3	3	2	3	3	3	2	1	3
CO4	3	3	3	3	2	3	3	3	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

LISTOFEXPERIMENTS

1. Determinationofabsorptionmaximaandeffectofsolventsonabsorptionmaximaoforganiccompounds.
2. Estimationofdextrosebycolorimetry.
3. Estimationofsulfanilamide/streptomycinsulphateinjectionbycolorimetry.
4. Simultaneousestimationofibuprofenandparacetamol/caffeineandsodiumbenzoateinjectionbyUVspectroscopy-simultaneousequationmethodandabsorbanceratiomethod
5. UVspectrophotometricestimationofformulationbyDifferencespectroscopy:e.g.,PhenylephrineHClophthalmic solution.
6. AssayofTrimethoprimincotrimoxazoletablets
7. Assayofparacetamol/paracetamoltablets/RifampicincapsulesbyUV-Spectrophotometry.
8. Estimationofquininesulfatebyfluorimetry.

9. Studyofquenchingoffluorescence.
10. Determinationofsodiumbyflamephotometry.
11. Determinationofpotassiumbyflamephotometry.
12. Determinationofchloridesandsulphatesbynepheloturbidometry.
13. Separationofaminoacidsbypaperchromatography.
14. Separationofsugarsbythinlayerchromatography.
15. Separationofplant pigmentsbycolumnchromatography.
16. DemonstrationexperimentonHPLC.
17. DemonstrationexperimentonGasChromatography.
18. Determinationof validationparameters (linearity, precision, accuracy) byUVspectroscopy: e.g., Ibuprofen,Paracetamol.

RecommendedBooks(LatestEditions):

1. BeckettA.H.,StenlakeJ.B.,PracticalPharmaceuticalChemistry,Vol.I&II,2nd edition,AthlonePress,Universityof London,London,1970.
2. G.D.Christian,AnalyticalChemistry,6th edition,JohnWiley&Sons,Singapore,reprintbyWileyIndiaPvt. Ltd,2003.
3. Connors, K. A., A Textbook of Pharmaceutical Analysis,3rd edition, John Wiley and Sons, Canada,2007.
4. Skoog, D. A., F. J. Holler and S. R. Crouch. Principles of Instrumental Analysis, 6th edition, BrooksCole,2006
5. Skoog,D.A.,andD.M.West.FundamentalsofAnalyticalChemistry,7thedition,BrooksCole,USA,1995.
6. Watson,D.G,PharmaceuticalAnalysis:ATextbookforPharmacyStudentsandPharmaceuticalChemists ,4th edition,Elsevier,2015.
7. J.Mendham,R.C.Denney,J.D.Barnes,M.J.K.Thomas,B.Sivasankar,Vogel'sTextbookofQuantitativeChemicalAnalysis,6thedition,PearsonEducation,NewDelhi,2009.
8. Indian Pharmacopoeia, Indian Pharmacopoeia Commission, Ministry of Health andFamilyWelfare,India.
9. Vogel A.I.,Textbook ofQuantitativeInorganicAnalysis,2nd edition,LongmanGreenandCo.,London,1951.
10. D.C.Garrett., QuantitativeAnalysisofDrugs,3rdedition,SpringerUS,1964.
11. P. D. Sethi, Quantitative Analysis of Drugs in Pharmaceutical Formulations, 3rd edition, CBSPublishersandDistributorsPvt. Ltd2019

BP706PS
PRACTICESCHOOL(180Hours)

Every candidate shall undergopractice schoolfora periodof 150 hours evenly distributedthroughoutthe semester. The student shall opt any one of the domains for practice school declared by the programcommittee from time to time. At the end of the practice school, every student shall submit a printed report(in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams ofsemester VII, the report submitted by the student, knowledge and skills acquired by the student throughpractice school shall be evaluated by the subject experts at college level and grade pointshallbeawarded.

SEMESTER VII

BP706PS
Practice School-Pharmaceutical Analysis (150 hours)

Course objectives:

This course aims to establish a solid understanding of pharmaceutical analysis and its significance, enable effective utilization of spectroscopic techniques for analysis and interpretation, and empower students with practical skills in chromatographic techniques. Additionally, the course focuses to foster adherence to Good Laboratory Practices and maintaining high standards of Quality Control.

Course outcomes:

Course Code & CO number	*At the successful completion of the course, the learners will be able to:*	*Syllabus Unit no.*
BP706PS CO1	Understand the crucial role of pharmaceutical analysis in meeting regulatory standards, and develop skills to design SOPs.	1
BP706PS CO2	Perform calibration techniques to evaluate instrument usage.	2
BP706PS CO3	Design experiments, validate methods, evaluate, and synthesize data generated through spectroscopic, chromatographic techniques or other analytical techniques used for characterization or analysis of pharmaceuticals.	3
BP706PS CO4	Conduct thorough and efficient searches in scientific literature to critically evaluate sources, summarize findings and synthesize complex information into comprehensive reports.	4

CO-PO Mapping

BP706PS CO5	Apply statistical methods and advanced mathematical calculations to optimize the method, quantify results, and analyse data within the realm of pharmaceutical analytical processes.	

CO-PO Mapping for BP706PS PRACTICE SCHOOL-PHARMACEUTICAL ANALYSIS										
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**
CO1	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

DETAILS		HOURS
Module 1	Foundations in Pharmaceutical Analysis • Introduction-Overview of pharmaceutical analysis, significance of pharmaceutical analysis in drug development and quality control • Vital role of pharmacopoeias • Standard operating procedures (SOPs) in pharmaceutical analysis • GLP in pharmaceutical analysis • Data integrity and documentation • Sample preparation	**20**
Module 2	Calibration of analytical instruments • Calibration of analytical instruments.	**30**
Module 3	Spectroscopic and chromatographic analysis Spectroscopic analysis: Basics of spectra interpretation and Qualitative/ Quantitative analysis Chromatographic analysis: • Sample injection/ sample application, separation, and data interpretation Validation and Quality control: • Validation of analytical methods • Quality control in pharmaceutical analysis • Overview of regulatory requirements in pharmaceutical analysis	**50**
Module 4	Literature Search Skills & Real-world Applications • Literature search strategies • Scientific database navigation • Critical evaluation of literature • Literature organisation • Reviewing and summarising findings • Hands-on case studies and/or projects: Pharmaceutical products or internally developed formulations analysis or Impurity profiling or Stability testing or Bioanalytical techniques or other characterisation and analytical techniques	**50**

BP706PS
Practice School-Pharmaceutics (150 hours)

Course Description:
This course is designed to provide comprehensive understanding of pharmaceutical product development and keep them updated with current pharmaceutical industrial procedures for formulation development.

Course Outcomes	Questions ***After completion of the course, the learner will be able to:***	Units covered
CO1	Execute in-depth literature search pertaining to pharmaceutical product development.	Unit 1 to 6
CO2	Apply the knowledge of preformulation in development of dosage form.	Unit 3
CO3	Design the process for development of the pharmaceutical product.	Unit 3,4, 5
CO4	Apply the knowledge of statistics to assess the suitability of the pharmaceutical product.	Unit 4,5
CO5	Acquire the necessary practical and ethical skills for data compilation, interpretation and report writing.	Unit 6

CO-PO Matrix:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	3	3	3	2	2	3	3	3	2	3
CO2	3	3	3	3	2	2	3	2	3	2	3
CO3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	1	2	3	3	3	2	3
CO5	3	3	1	3	1	3	3	3	1	1	3

Course Outline

Unit	Details	Hours
1	Review of Basics of Pharmaceutical Dosage form (anyone from Suspensions/Tablets/Parenterals/Modified Dosage forms)	20

2	Literature search- • Introduction to steps and techniques for effective literature search. • Utilisation of various data bases and various resources for search of research articles/review articles/patents of last 5 years. • Market search for various dosage forms and strengths • Common excipients search -MSDS, IIG, GRAS database • Drug Profile -Pharmacopeial monograph/Drug Bank • Marketed generic brands/innovative product composition.	30
3	Preformulation work • Preformulation of selected model drug • Functionality testing of evaluation. • Evaluation of innovative product • Packaging aspects	30
4	Formulation development, optimization, and stability studies • Identification of suitable formulation process and its process parameters. • Optimization of formulation based on process/formulation components. • Investigation of stability of developed formulations.	30
5	Introduction to data analysis (standard deviation/release kinetics/ similarity/dissimilarity/ permeation data) and data representation of formulation	20
6	Data compilation, ethics (plagiarism check) and report writing	20
	Total	150

BP706PS
Practice School-Pharmaceutic Chemistry (150 hours)

Course Objectives:
Practice school is an educational innovation seeking to link industry academia relationship. The student will be able to meet the rapidly changing needs and challenges of professional workplace. They acquire knowledge and skills and also an economic relevance to the society.

Course Outcomes: After the successful completion of course, the students will be able to-

Course Code & CO number	*At the successful completion of the course, the learners will be able to:*
BP706PS CO1	Apply theoretical knowledge learned in classroom in practical setting.

BP706PS CO2	Understanding the importance and applications of various subjects and their correlation with practice of Pharmacy.
BP706PS CO3	Development of skills in the handling of modern tools Acquire skills of documentation and record keeping Plan academic, career and personal interests via research experience.
BP706PS CO4	Establish a link with potential future employers.
BP706PS CO5	Understand and Analyze their personal strengths and limitations as professionals.
BP706PS CO6	Build their interpersonal skills, communication skills, leadership qualities etc to excel in their future career prospects.

CO-PO Mapping:

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP706PS CO1	2	0	1	1	0	1	1	1	0	0	1
BP706PS CO2	1	0	1	0	0	1	1	1	1	0	1
BP706PS CO3	1	1	0	2	1	0	1	1	0	0	1
BP706PS CO4	1	0	0	0	1	1	1	1	0	0	0
BP706PS CO5	1	1	1	0	2	2	1	1	1	0	0
BP706PS CO6	1	0	0	0	1	2	1	1	0	0	0

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak).

COURSE MODULES	TOPICS	DURATION (In Hours)
	1.Bioisosterism in drug design and development. a) Introduction to bioisosterism. b) Classical and Non classical bioisosteres. c) Bio-isosteric replacement of functional groups with examples. d) Case study of procaine and procainamide. 3) Applications of bioisosterism in drug design and	

Module I **(Synthetic Chemistry)**	development. **2.Green Chemistry** a) Introduction and significance of green chemistry b) 12 basic principles of green chemistry. c) Merits & demerits of green chemistry over conventional or traditional methods. d) Real world examples of drugs synthesised by green chemistry technique. e) Calculation of Atom economy and reaction efficiency of compounds synthesised by both the methods. **3.Physico chemical properties of drug molecules in relation to biological activity** a) Experimental determination of log p by shake flask method b) Optimum range of log p value and importance. c) Functional groups in improving the lipophilicity of drugs. d) Novel Chromatographic techniques to calculate log p value. **4.Click Chemistry: A fascinating method of connecting organic groups** a) Definition and significance. b) Types of reactions in Click chemistry. c) Recent advancements of click chemistry in i) Bioconjugation ii)Polymer chemistry andMacromolecular Engineering iii)Role of click chemistry in drug delivery. **5. Synthesis and purification of any one Organic Medicinal compound** by green chemistry and characterization by TLC, Melting point and IR spectroscopy.	**25 Hrs**
MODULE –II Development and Analysis of Polymer Drug Conjugates for Targeted Drug Delivery and applications.	1. Good Lab Practices 2. Systematic Literature search using authentic sources 3. Purification of Compounds using column chromatography 4. Techniques used for Synthesis of Polymer drug conjugate 5. Introduction to GPC and lyophilization and its application in Polymer science 6. Characterization of PDC using spectroscopical methods such as GPC, FTIR,	25hrs

	Viscosity and NMR 7. Study the standard plot of drug using UV spectrophotometry. 8. Study the percentage polymer drug conjugation using UV spectrophotometry. 9. Drug release at specific pH conditions	
MODULE III **Early Phase Hit/ lead discovery using computational methods.**	1. Various steps in a hit and lead discovery 2. Multiple techniques in computation chemistry 3. Good practices in structure-based drug design 4. Generate SAR using Molecular docking.	10 hrs
MODULE-IV **Estimation of metabolic stability/ liability of a compound.**	1. Isolation of microsomes, ultra/Ca^{+2} aggregation 2. Cyp content and Protein contents 3. Introduction to incubation 4. Phenotyping, correlation analysis, Human liver bank 5. HRMS-1 ketoconazole metabolite and prediction assignment 6. Genotyping 7. Inhibition study protocol, HPLC methods, Cyp substrates and inhibitors, drug sweetener interactions 8. Development of microsomal incubation conditions 9. Development of an HPLC assay for compound and/or metabolite 10. Conduct of microsomal incubation 11. Conduct of HPLC assay of the incubation mixture 12. Analysis of data	10 hrs
MODULE-V **Molecular Biology and Drug Discovery**	An update and application of Molecular Biology in drug discovery	10 hrs
MODULE-VI **Live demonstrations in labs**	Hands on Experience/ Demonstration of latest technologies available in respective laboratories. 1. pH calibration and Micropipette calibration 2. Determination of Cyp Contents 3. Determination of Km and Vmax 4. Conventional and MW synthesis of pNIPAM and pDEA 5. Lyophilization, GPC and viscometer 6. Column chromatography for synthesized products	25 hrs.
MODULE-VII **INTRODUCTION TO**	Basic principles of HPLC, ^{1}H-NMR, HR-MS.	45

ANALYTICAL TECHNIQUES		
		150Hrs

BP706PS

Practice School-Natural Product Development (150 hours)

Course Objectives:

The objective of the course is to provide hands- on training and experience in conceptualizing, designing and executing project involving herbs as starting material; across the entire value chain right from herb identification, authentication and standardization to analytical method development and formulation as conventional / NDDS dosage form

B. Pharm Final Year, Semester VII **BP706PS Natural Product Development (150 hours)**			
Course Code & CO number	***At the successful completion of the course, the learners will be able to:***	***Syllabus Unit no.***	
BP706PS CO1	Understand the project outline and identify the steps involved	1, 2, 3 & 4	

Course Outcomes (CO):

Course code & CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BP706PS CO2			Perform literature survey and assess the current							1, 2, 3 & 4		
BP706PS CO1	3	3	3	3	3	3	3	3	3	3		3
BP706PS CO3			Collate scientific literature and present and defend							1, 2, 3 & 4		
BP706PS CO2	3	3	3	3	3	3	3	3	3	3		3
BP706PS CO4			Design experimentation protocols for the project							1, 2, 3 & 4		
BP706PS CO3	3	3	3	3	3	3	3	3	3	3		3
BP706PS CO5			Plan and schedule the project steps with respect to							1, 2, 3 & 4		
BP706PS CO4	3	3	3	3	3	3	3	3	3	3		3
BP706PS CO6			Interpret experimental findings and data and apply							1, 2, 3 & 4		
BP706PS CO5	3	3	3	3	3	3	3	3	3	3		3
BP706PS CO7			Draft project report as per standard scientific norms							1, 2, 3 & 4		
BP706PS CO6	3	3	3	3	3	3	3	3	3	3		3

Module	Details	Hours
1	Ensuring quality of herb as the starting material for industry Introduction - Tools and techniques of literature survey, documentation protocols and report writing Techniques of herb authentication and standardization, Pharmacopoeial and regulatory specifications, compliance concerns Development of extraction schemes and optimization Modern techniques of extraction, designing extraction schemes based on nature of phytoconstituents, phytoequivalence of extracts and regulatory perspectives, optimization of extraction processes Chromatographic techniques in evaluation of natural products Introduction of chromatographic techniques, analytical method development, biomarkers and analytical markers, qualitative and quantitative analyses, application in authentication and standardization of extracts and finished natural products	45
2	Plan and schedule the project steps with respect to timelines and resources management	45
3	Interpret experimental findings and data and apply suitable data analytical tools Draft project report as per standard scientific norms and perform plagiarism check on the draft report	45
4	Conventional and Novel Drug Delivery Systems (NDDS) platforms for developing natural product – based finished formulations Concept of BCS classification of phytoconstituents, selecting suitable formulation type, challenges associated with formulation of natural products, development and evaluation of natural product - based	15

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

BP706PS

Practice School-Pharmacology (150 hours)

Course Objectives:

This course aims to offer students hands-on learning opportunities in the field of Pharmacology, with a focus on Pharmacology, Toxicology, and Molecular Biology-related processes. It also facilitates learning experiences related to conducting literature reviews and analyzing them to draw comparisons and contrasts with existing scientific knowledge. Additionally, students will gain an understanding of how to create scientific reports, utilizing ICT tools, illustrations, graphical data representation, and plagiarism detection software, all of which will enhance their insights into the field of Pharmacology.

B. Pharm Final Year, Semester VII BP706PS PRACTICE SCHOOL (PRACTICAL- 180 hours)		
BP706PS Course Outcomes	**At the successful completion of the course, the learners will be able to:**	**Syllabus Unit no.**
BP706PS CO 1	Understand the rationale behind the preclinical models for Pharmacological and Toxicological Evaluations.	Unit 1
BP706PS CO 2	Discuss the concept and the principle behind the Pharmacology, Toxicology and Molecular Biology based techniques.	Unit 2
BP706PS CO 3	Understand the research problem identified from areas of Pharmacology and Toxicology and perform a literature review for the identified research problem.	Unit 3
BP706PS CO 4	Generate a collective research project report by leveraging the insights obtained through Microsoft Excel and Microsoft Office applications (Information and Communication Technology tools) to create a research report that addresses the identified research problem.	Unit 4
BP706PS CO 5	Apply statistical analysis methods to the obtained data and illustrate the results using tables, graphs, and schematic diagrams.	Unit 5
BP706PS CO 6	Assess the group-created project report using plagiarism detection software.	Unit 6

Mapping CO-PO

BP706PS Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

SEMESTER
VIIIBP801T

BIOSTATISITCSANDRESEARCHMETHODOLOGY(Theory) 45Hours

CourseObjectives:

To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics,Graphs, Correlation, Regression, logistic regression, Probability theory, Sampling technique, Parametrictests, Non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials andObservationalandExperimentalstudies,SPSS,R, MINITABstatisticalsoftware's,andanalysingthestatisticaldatausingExcel**.**

CourseOutcomes:

Uponcompletionof thecoursethestudentshallbeable to:

1. KnowtheoperationofMSExcel,SPSS,RandMINITAB®,DoE(DesignofExperiment).
2. Knowthevarious statisticaltechniquesthatapplytoanalysisofagivendataset.
3. Appreciatetheuseofstatisticaltechniquesindataanalysis.

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP801T CO1	3	3	3	3	-	-	-	1	-	-	3
BP801T CO2	3	3	3	3	-	-	-	1	-	-	3
BP801T CO3	3	3	3	3	-	-	2	1	-	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	10
1.1	**Introduction:**Statistics,Biostatistics,Frequencydistribution.	2
1.2	**Measuresofcentraltendency**:Mean,Median,Mode- Pharmaceutical examples.	3
1.3	**Measuresof dispersion**: Dispersion,Range,standard deviation - Pharmaceuticalproblems.	2
1.4	**Correlation**:Definition,KarlPearson'scoefficientofcorrelation,Multiplecorrelation-Pharmaceuticalsexamples.	3
2	**UNIT–II**	10
2.1	**Regression:**Curvefittingbythemethodofleastsquares,fittingthelines y= a+bx andx=a+by,Multipleregression,standarderrorofregression–Pharmaceuticalexamples.	3

2.2	**Probability:**Definitionofprobability,Binomialdistribution,Normaldistribution,Poisson'sdistribution,properties–problems. Sample,Population,largesample,smallsample,Nullhypothesis,alternative hypothesis,sampling,essenceofsampling,typesofsampling,Error-Itype,Error-IItype,Standarderrorof mean(SEM)-Pharmaceuticalexamples.	4
2.3	**Parametrictest**:t-test(Sample,PooledorUnpairedandPaired),ANOVA,(OnewayandTwoway),LeastSignificancedifference.	3
3	**UNIT–III**	10
3.1	**NonParametrictests:**WilcoxonRankSumTest,Mann-WhitneyUtest,Kruskal-Wallistest,FriedmanTest.	2
3.2	**IntroductiontoResearch:**Needforresearch,NeedfordesignofExperiments,ExperientialDesignTechnique,plagiarism.	3
3.3	**Graphs:**Histogram,PieChart,CubicGraph,responsesurfaceplot,CounterPlotgraph.	2
3.4	**Designing the methodology:** Sample size determination and Power of a study,Reportwriting and presentation of data, Protocol, Cohorts studies, Observationalstudies,Experimentalstudies,Designingclinicaltrial,variousphases.	3
4	**UNIT–IV**	8
4.1	BlockingandconfoundingsystemforTwo-levelfactorials	2
4.2	**Regressionmodeling:**HypothesistestinginSimpleandMultipleregressionmodels.	2
4.3	**IntroductiontoPracticalcomponentsofIndustrialandClinicalTrialsproblems**:StatisticalAnalysisUsingExcel,SPSS,MINITAB®,DESIGNOF EXPERIMENTS,R-OnlineStatisticalSoftware'stoIndustrialandClinicaltrialapproach.	4
5	**UNIT–V**	7
5.1	**DesignandAnalysisofexperiment-FactorialDesign:**Definition,2^2,2^3design.Advantageoffactorialdesign.	3
5.2	**Response Surface methodology**:Centralcomposite design, Historicaldesign,OptimizationTechniques.	4
	TOTAL	45

RecommendedBooks(Latesteditionstobeadopted):

1. Sanford Bolton, Charles Bon, Pharmaceutical statistics - Practical and clinical applications, Drugs andthe Pharmaceutical Sciences, Vol. 135, 4th edition revised and expanded, Marcel Dekker, New York,
2. S.C.Gupta,FundamentalofStatistics,7thedition,HimalayaPublishingHouse,2018.
3. R. Pannerselvam, Design and Analysis of Experiments , 1st edition, PHI Learning India Pvt Limited,2012.
4. Douglas, and C. Montgomery, Design and Analysis of Experiments , 10th edition, John Wiley and Sons,2019

BP802T

SOCIALANDPREVENTIVE PHARMACY(Theory) 45Hours

CourseObjectives:

The purpose of this course is to introduce to students a number of health issues and their challenges. Thiscourse also introduces anumberof national health programmes. The roles of the pharmacist in thesecontextsarealsodiscussed.

CourseOutcomes:

Afterthesuccessfulcompletionofthiscoursethestudentshallbeableto:

1. Acquirehighconsciousness/realizationofcurrentissuesrelatedtohealthandpharmaceuticalproblemswithinth

ecountryandworldwide.
2. Acquireacriticalwayofthinkingbasedoncurrenthealthcaredevelopment.
3. Evaluatealternativewaysofsolvingproblemsrelatedtohealthandpharmaceuticalissues.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP802T CO1	3	3	3	3	2	3	3	2	3	3	3
BP802T CO2	3	3	1	1	2	3	3	3	3	2	3
BP802T CO3	3	3	3	1	2	3	3	3	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	10
1.1	**Conceptofhealthanddisease:**Definition,conceptsandevaluationofpublichealth.Understandingtheconceptofpreventionandcontrolofdisease,social causes ofdiseasesandsocialproblemsofthesick.	
1.2	**Socialandhealtheducation:**Foodinrelationtonutritionandhealth,Balanceddiet, Nutritionaldeficiencies,Vitamindeficiencies,Malnutritionanditsprevention.	
1.3	**Sociologyandhealth:**Socioculturalfactorsrelatedtohealthanddisease,Impact	
	ofurbanizationonhealthanddisease,Povertyandhealth.	
1.4	**Hygieneandhealth:**personalhygieneandhealthcare;avoidablehabits.	
2	**UNIT–II**	10
2.1	**Preventivemedicine:**Generalprinciplesofpreventionandcontrolofdiseasessuchascholera,SARS,Ebolavirus,influenza,acuterespiratoryinfections, malaria,chickenguinea,dengue,lymphaticfilariasis,pneumonia,hypertension,diabetes mellitus,cancer,drugaddiction-drugsubstanceabuse.	
3	**UNIT–III**	10
	Nationalhealthprograms,itsobjectives,functioningandoutcomeofthefollowing: HIV and AIDS control programme, TB, Integrated disease surveillanceprogram(IDSP),Nationalleprosycontrolprogramme,Nationalmentalhealthprogram,Nationalprogrammeforpreventionandcontrolofdeafness,Universal immunization programme,National programme for control of blindness,Pulsepolioprogramme.	
4	**UNIT–IV**	8
	Nationalhealthinterventionprogrammeformotherandchild,Nationalfamilywelfareprogramme,Nationaltobaccocontrolprogramme,NationalMalaria Prevention Program, National programme for the health care for the elderly, Socialhealthprogramme;roleofWHO inIndiannationalprogram.	
5	**UNIT–V**	7
	Communityservicesinrural,urbanandschoolhealth:FunctionsofPHC, Improvementin rural sanitation,national urban health mission,Health promotionandeducationinschool.	
	TOTAL	45

RecommendedBooks(Latesteditionstobeadopted):

1. PrabhakaraGN,ShortTextbookofPreventiveandSocialMedicine,,2nd Edition,ISBN:9789380704104,JaypeePublications,2010.
2. Roy RabindraNath,SahaIndranil,TextbookofPreventiveand SocialMedicine(Mahajanand Gupta),4th Edition,ISBN:9789350901878,JaypeePublications,2013.
3. JainVivek,ReviewofPreventive and SocialMedicine (Including Biostatistics),6th Edition,ISBN:

9789351522331,JaypeePublications,2014.
4. Hiremath Lalita D, Hiremath Dhananjaya A, Essentials of Community Medicine—A PracticalApproach,2nd Edition,ISBN:9789350250440, JaypeePublications,2012.
5. Park,TextbookofPreventiveandSocialMedicine,21st Edition,ISBN-14:9788190128285,BanaridasBhanotPublishers,2011.
6. RameshAdepu, CommunityPharmacyPractice,1st edition,PharmaMedPress, 2017

RecommendedJournals:
1.ResearchinSocialandAdministrativePharmacy,Elsevier,Ireland.

BP803ET
PHARMACEUTICALMARKETING MANAGEMENT(Theory)–ELECTIVE 45Hours

CourseObjectives:
ThecoursewillprovidetheKnowledgeandKnow-howofmarketingmanagementandgroomstudentsfortakingupchallengingrolesinSalesandProductmanagement.

CourseOutcomes:
Uponcompletionofthecoursethestudentwillbeableto:
1. Understandmarketingconceptsandtechniquesandtheirapplicationsinthepharmaceuticalindustry.
2. Summarize the importance of market research, promotional techniques and consumer analysis.
3. Outline the product life cycle and pharmaceutical marketing channels
4. Describe the importance of management in pricing management and government regulation.

Course code &CO number	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP803ET CO1	3	1	1	1	1	2	1	1	1	1	3
BP803ET CO2	3	3	3	3	2	3	3	2	3	2	3
BP803ET CO3	3	3	3	3	2	3	3	3	3	2	3
BP803ET CO4	3	1	2	1	1	2	3	1	3	2	3

Unit	Details	Hours
1	**UNIT–I**	**10**
1.1	**Marketing:** Definition,generalconcepts,andscopeofmarketing;Distinctionbetweenmarketing&selling;Marketingenvironment;Industryandcompetitiveanalysis; Analyzingconsumerbuyingbehaviour;industrialbuyingbehaviour.	

1.2	**Pharmaceuticalmarket:** Quantitativeandqualitativeaspects;sizeandcompositionofthemarket;demographicdescriptionsandsocio-psychologicalcharacteristicsoftheconsumer;market segmentation& targeting. Consumer profile; Motivation and prescribinghabitsofthephysician;patients'choiceofphysicianandretailpharmacist. AnalyzingtheMarket;Roleofmarketresearch.	
2	**UNIT–II**	**10**
	Productdecision: Meaning,Classification,productlineandproductmixdecisions,productlifecycle,productportfolioanalysis;productpositioning;Newproductdecisions; Productbranding,packagingandlabellingdecisions,Productmanagementinpharmaceuticalindustry.	
3	**UNIT–III**	**10**
	Promotion: Meaningandmethods,determinantsofpromotionalmix,promotionalbudget;Anoverviewofpersonalselling,advertising, directmail,journals,sampling,retailing, medicalexhibition,publicrelations,onlinepromotionaltechniquesforOTCProducts.	
4	**UNIT–IV**	**8**
4.1	**Pharmaceuticalmarketingchannels:** Designingchannel,channelmembers,selectingtheappropriatechannel,conflictinchannels,physicaldistributionmanagement:Strategicimportance,tasksinphysicaldistributionmanagement.	
4.2	**Professionalsalesrepresentative(PSR):** Duties of PSR, purpose of detailing, selection and training, supervising, norms forcustomer calls, motivating, evaluating, compensation and future prospects of thePSR.	
5	**UNIT–V**	**7**
5.1	**Pricing:** Meaning,importance,objectives,determinantsofprice;pricingmethodsandstrategies,issuesinpricemanagementinpharmaceutical industry.Anoverviewof DPCO(DrugPriceControlOrder)andNPPA(NationalPharmaceuticalPricingAuthority).	
5.2	**Emergingconceptsinmarketing:** Vertical&HorizontalMarketing;RuralMarketing;Consumerism;IndustrialMarketing; GlobalMarketing.	
	TOTAL	**45**

RecommendedBooks:(LatestEditionstobeadopted):

1. PhilipKotlerandKevinLaneKeller:MarketingManagement,15th Globaledition,Pearson,2015.
2. Walker,Boyd andLarreche,MarketingStrategy-Planningand Implementation,International3rd revisededition,McGrawHillEducation,1999.
3. DhruvGrewalandMichaelLevy:Marketing,8th edition,McGrawHill,2022
4. ArunKumarandNMenakshi,MarketingManagement,3rd edition, VikasPublishing,India,2016.
5. RajanSaxena:MarketingManagement,3rd edition,TataMC Graw-HillEducation,India, 2005.
6. Ramaswamy, U.S & Namakamari, S: Marketing Management: Global Perspective, Indian Context, 4th edition,Ombooks,2009
7. RaviShanker,ServiceMarketing,1st edition,ExcelBooks,NewDelhi,2009.
8. SubbaRaoChanganti,PharmaceuticalMarketinginIndia,Excelbooks,NewDelhi,2005.

BP804ET

PHARMACEUTICALREGULATORYSCIENCE(Theory)–ELECTIVE 45Hours

CourseObjectives:

Thiscourse isdesigned to impart the fundamental knowledge on the regulatory requirementsforapprovalof new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan,Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentationrequirements,andregistrationproceduresformarketingthedrugproducts.

Course Outcomes:

Uponcompletionof thecoursestudentshallbeableto;

1. Appraise on different stages of drug discovery and development of pre-clinical studies, non-clinical activities, clinical studies and understand the process if generic drug development process.
2. Explain the various regulatory authorities and agencies governing the manufacturing and sale of pharmaceutical product.
3. Know the registration process of Indian drug product in overseas market (USA and European Union)

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP804ET CO1	3	3	3	3	2	3	3	2	3	3	3
BP804ET CO2	3	3	1	1	2	3	3	3	3	2	3
BP804ET CO3	3	3	3	1	2	3	3	3	3	2	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation –

Unit	Details	Hours
1	**UNIT–I**	**12**
1.1.	**NewDrugDiscoveryanddevelopment** Stages of drug discovery, Drug development process, pre-clinical studies,non-clinical activities, clinical studies, Innovator and generics, Concept ofgenerics, Generic drug product development, Medical Devices, Biologics,Biosimilars.	**6**
1.2.	OverviewofQualitysystems&AssuranceforDrugsandBiologics,Biologics,MedicalDevices.	**6**
2	**UNIT–II**	**9**
2.1	**RegulatoryApprovalProcess** Approvalprocessesandtimelinesinvolvedin InvestigationalNew Drug (IND),New Drug Application (NDA),AbbreviatedNew DrugApplication(ANDA) inUS.ChangestoanapprovedNDA/ANDA.	**6**
2.2	**Regulatoryauthoritiesandagencies** Overviewofregulatory authoritiesofUnited States,EuropeanUnion,Australia,Japan,Canada(Organizationstructureandtypes ofapplications).	**3**
3	**UNIT–III**	**10**

3.1.	RegulatoryConcepts Basicterminologies,guidance,guidelines,regulations,laws andacts,Orangebook,FederalRegister,Codeof FederalRegulatory,Purplebook.	2
3.2.	**RegistrationofIndiandrugproductinoverseasmarket(USA&EuropeanUnion)** Procedure forexportof pharmaceutical products,Technical documentation,DrugMasterFiles(DMF),CommonTechnicalDocument(CTD),electronic CommonTechnicalDocument(eCTD),ASEANCommonTechnicalDocument(ACTD)research.	**8**
4	**UNIT–IV**	**7**
	Clinicaltrials Developingclinicaltrialprotocols,InstitutionalReviewBoard/IndependentEthicscommittee-formationandworkingprocedures,Informedconsentprocessandprocedures,GCPobligationsofInvestigators,sponsors&Monitors,Managing and Monitoring clinical trials,Pharmacovigilance -safetymonitoringinclinicaltrials.	
5	**UNIT–V**	**7**
	OverviewofRegulationof: -Pharmaceutical&BiologicProducts -MedicalDevices&Diagnostics -Nutraceuticals&DietarySupplements	
	TOTAL	**45**

Recommendedbooks(Latesteditiontobeadopted):

1. Sachin Itkar, N.S. Vyawahare, Drug Regulatory Affairs, 4th edition, Nirali Prakashan, EducationalPublishers,2019.
2. IraR.BerryandRobertP.Martin(Editors),ThePharmaceuticalRegulatoryProcess,DrugsandthePharmaceuticalSciences,Vol.185,2ndEdition,InformaHealthcare,Inc,2008.
3. Richard A Guarino,New Drug Approval Process:Accelerating Global Registrations,DrugsandthePharmaceuticalSciences,5th edition,Vol.190,InformaHealthcare,Inc,2009.
4. SandyWeinberg,GuidebookforDrugRegulatorySubmissions,1st edition,JohnWiley&Sons.Inc.,2008.
5. DouglasJ.Pisano,DavidMantus,FDARegulatoryAffairs:AGuideforPrescriptiondrugs,MedicalDevices,andBiologics,2nd edition,InformaHealthcare.,Inc,2008.
6. LeonShargelandIsaderKaufer,GenericDrugProductDevelopment,SolidOralDosageforms,Vol.143,1st edition,MarcelDekker,NewYork,2005.
7. FayA.RozovskyandRodneyK.Adams,ClinicalTrialsandHumanResearch:APracticalGuidetoRegulatoryCompliance,1st edition,Jossey-Bass,SanFrancisco,2003.
8. JohnI.GallinandFrederickP.Ognibene,PrinciplesandPracticesofClinicalResearch,3rd Edition,,Academic Press,2012.
9. RickNg.,Drugs: FromDiscoverytoApproval,2nd Edition,WilleyBlackwell,2012,

BP805ET

PHARMACOVIGILANCE (Theory)–ELECTIVE 45Hours

CourseObjectives:

This course will provide an opportunity for the student to learn about the development of pharmacovigilanceas a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance. Thecourse will train studentsonestablishing pharmacovigilance programin an organization,variousmethods that can be used to generate safety data, signal detection, skills of classifying drugs, diseases andadversedrugreactions.

CourseOutcomes:

Uponcompletionof thecoursestudentshallbeableto;

1. AppreciatedrugsafetymonitoringandHistoryanddevelopmentofpharmacovigilance
2. UnderstandtheNationalandinternationalscenarioofpharmacovigilanceandDictionaries,codingandterminologiesusedinpharmacovigilance
3. Understandthemechanismsfor Detectionofnewadversedrugreactionsandtheirassessment, Adversedrugreactionreportingsystemsandcommunicationinpharmacovigilance
4. HaveknowledgeofMethodstogeneratesafety dataduringpreclinical,clinicalandpostapprovalphasesofdrugs' lifecycle,Drugsafetyevaluationinpediatrics,geriatrics,pregnancy,andlactation.
5. KnowthePharmacovigilanceProgramofIndia(PvPI),ICHguidelinesforICSR,PSUR,expeditedreporting,pharmacovigilanceplanningandCIOMS requirementsforADRreporting
6. Writecasenarrativesofadverseeventsandtheirquality.

MappingCO-PO:

BP805ET *CourseOutcomes*	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**10**
1.1	**IntroductiontoPharmacovigilance** HistoryanddevelopmentofPharmacovigilance.Importanceofsafetymonitoring ofMedicine.WHOinternationaldrugmonitoring programme. PharmacovigilanceProgramofIndia(PvPI).	**4**
1.2	**Introductiontoadversedrugreactions** Definitions and classification of ADRs. Detection and reporting. Methods inCausality assessment. Severity and seriousness assessment. Predictability andpreventabilityassessment.Managementofadversedrugreactions.	**4**
1.3	**Basicterminologies usedinpharmacovigilance** Terminologiesofadversemedicationrelatedevents. Regulatoryterminologies	**2**
2	**UNIT–II**	**10**
2.1	**Druganddiseaseclassification** Anatomical,therapeutic,andchemicalclassificationofdrugs.International classificationofdiseases.Dailydefineddoses.InternationalNon-proprietaryNamesfordrugs.	**3**
2.2	**Drugdictionaries andcodinginpharmacovigilance** WHOadversereactionterminologies.MedDRAandStandardisedMedDRAqueries. WHOdrugdictionary. Eudravigilancemedicinalproduct dictionary.	**3**
2.3	**Informationresourcesinpharmacovigilance** Basicdruginformationresources.SpecialisedresourcesforADRs	**2**

2.4	**Establishingpharmacovigilanceprogramme** Establishinginahospital.Establishment&operationofdrugsafetydepartmentinindustry.ContractResearchOrganisations(CROs).Establishinganationalprogramme.	2
3	**UNIT–III**	10
3.1	**Vaccinesafetysurveillance** VaccinePharmacovigilance. Vaccinationfailure.Adverseeventsfollowingimmunization.	3
3.2	**Pharmacovigilancemethods** Passivesurveillance– Spontaneousreportsandcaseseries.Stimulatedreporting.Activesurveillance– Sentinelsites,drugeventmonitoringand registries.Comparativeobservationalstudies –Cross sectionalstudy,casecontrolstudyandcohortstudy.Targetedclinicalinvestigations.	5
3.3	**Communicationinpharmacovigilance** EffectivecommunicationinPharmacovigilance.CommunicationinDrug SafetyCrisismanagement.CommunicatingwithRegulatoryAgencies,BusinessPartners,Healthcarefacilities&Media.	2
4	**UNIT–IV**	8
4.1	**StatisticalmethodsforevaluatingmedicationsafetydataSafetydatageneration** Preclinicalphase.Clinicalphase.Postapprovalphase.	3
4.2	**ICHGuidelinesforPharmacovigilance** OrganizationandobjectivesofICH.Expeditedreporting.Individualcasesafetyreports.Periodicsafetyupdatereports.Postapprovalexpedited reporting.Pharmacovigilanceplanning.Goodclinicalpracticeinpharmacovigilance studies.	5
5	**Unit – V**	7
5.1	**Pharmacogenomicsofadversedrugreactions** GeneticsrelatedADRwithexamplefocusingPKparameters.	3
5.2	**Drugsafetyevaluationinspecialpopulation** Paediatrics.Pregnancyandlactation.Geriatrics.	2
5.3	**CIOMS** CIOMSWorkingGroups.CIOMSForm.	1
5.4	**CDSCO(India)andPharmacovigilance** D&C Act and Schedule Y. Differences in Indian and global pharmacovigilancerequirements.	1
	TOTAL	45

RecommendedBooks(Latesteditionstobeadopted):

1. SKGupta,TextbookofPharmacovigilance,1st edition,JaypeeBrothersMedicalPublishersPvt.Ltd,2019.
2. BartonCobert,PierreBiron,PracticalDrugSafetyfromAtoZ,1edition,JonesandBartlettPublishersInc,2017
3. Elizabeth B. Andrews, Nicholas Moore (eds), Mann's Pharmacovigilance, 3rd edition, Wiley BlackwellPublishers,2014.
4. John Talbot,Patrick Walle,Stephens'Detection ofNewAdverse Drug Reactions,Wiley BlackwellPublishers.
5. Patrick Waller and Mira Harrison-Woolrych, An Introduction to Pharmacovigilance, 2nd edition, WileyBlackwellPublishers,2017
6. BartonCobert,WilliamGregory,Jean-

LoupThomas,Cobert'sManualofDrugSafetyandPharmacovigilance,3rdedition,WorldScientific,2019.
7. Brian L. Strom, Stephen E Kimmel, Sean Hennessy (Editors), Textbook of Pharmacoepidemiology, 6thedition,WileyBlackwellPublishers,2013.
8. G.Parthasarathi,KarinNyfortHansen,MilapC.Nahata,ATextbook ofClinicalPharmacy Practice-EssentialConceptsandSkills,1stedition,UniversitiesPress,2014.
9. NationalFormularyofIndia,MinistryofHealth,Government ofIndia,5thedition,2016
10. YashpalMunjal,APITextbookofMedicine,10thedition,JaypeeBrothers MedicalPublishers(P)Ltd,2015.
11. GPMohantaandPKManna.,TextbookofPharmacovigilance:ConceptandPractice,Firstedition,BSPbooks, 2015.
12.http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP806ET
QUALITYCONTROLANDSTANDARDIZATIONOFHERBALS(Theory)ELECTIVE45Hours

CourseObjectives:

Inthiscoursethestudentwilllearnaboutthevariousmethodsandguidelinesforevaluationandstandardization of herbs and herbal drugs. The course also provides an opportunity for the student to learncGMP,GAPandGLPintraditionalsystemofmedicines.

CourseOutcomes:

Uponcompletionofthesubjectthestudentshallbeableto;

1. KnowWHOguidelinesforqualitycontrolofherbaldrugs
2. KnowQualityassuranceinherbaldrugindustry
3. Knowtheregulatoryapprovalprocessandtheirregistrationin Indianandinternationalmarkets
4. AppreciateEUandICHguidelinesforqualitycontrolofherbaldrugs

Unit	Details	Hours
1	**UNIT–I**	10
	Basictestsfordrugs– Pharmaceuticalsubstances,Medicinalplantsmaterialsanddosageforms. WHO guidelines for quality control of herbal drugs.Evaluationofcommercialcrudedrugsintendedforu se.	
2	**UNIT–II**	10
2.1	**Qualityassuranceinherbaldrugindustry**ofcGMP,GAP,GMPandGLPintraditi onalsystemofmedicine.	6
2.2	WHOGuidelinesoncurrentgoodmanufacturingPractices(cGMP)forHerbalMedi cinesWHO GuidelinesonGACPforMedicinalPlants.	4
3	**UNIT–III**	10
	EUandICHguidelinesforqualitycontrolofherbaldrugs. Research Guidelines for Evaluating the Safety and Efficacy of HerbalMedicines.	
4	**UNIT–IV**	08

	Stabilitytestingofherbalmedicines.Applicationofvariouschromatographictechniquesinstandardizationofherbalproducts. Preparationofdocuments fornewdrugapplicationandexport registration.GMPrequirementsandDrugs&CosmeticsActprovisions.	
5	**UNIT–V**	**07**
	Regulatoryrequirementsforherbalmedicines. WHO guidelines on safety monitoring of herbal medicines inpharmacovigilancesystems. ComparisonofvariousHerbalPharmacopoeias. Roleofchemicalandbiologicalmarkersinstandardizationofherbalproducts.	
	TOTAL	**45**

RecommendedBooks:(LatestEditionstobeadopted):

1. EvansW.C,TreaseandEvans,Pharmacognosy,16th edition,W.B.Sounders&Co.,London,2009.
2. Tyler,V.E,Brady,L.R.andRobbers,J.E.,Pharmacognosy,9thEdn.,Lea andFebiger,Philadelphia,1988.
3. WallisT.E,TextbookofPharmacognosy,5thedition,J&AChurchillLtd,London,1967.
4. MohammadAli,Pharmacognosy andPhytochemistry,1stedition,CBSPublishers&Distributors,NewDelhi,2018reprint
5. Kokate C.K., Purohit A. P., Gokhale S.B., Textbook of Pharmacognosy, 37th Edition, Nirali Prakashan,NewDelhi,2007
6. ChoudharyR.D,HerbalDrugIndustry,1st edition,EasternPublishers,NewDelhi,1996.
7. AnsariS.H.,EssentialsofPharmacognosy,2ndedition, BirlaPublications,NewDelhi,2007.
8. KokateC.K.,PurohitA.P.,GokhaleS.B,PracticalPharmacognosy,13thedition,NiraliPrakashan,NewDelhi, 2009.
9. Iyengar M.A and Nayak S.G.K, Anatomy of Crude Drugs, 12th edition, PharmaMed Press, A unit ofBSPbooksPvt.Ltd,Hyderabad,2011.
10. KhandelwalK.R.andVrundaSethi,PracticalPharmacognosy:TechniquesandExperiments,24thedition,NiraliPrakashan,2014.
11. VasudevanT.N.LaddhaK.S,PracticalPharmacognosy,1stedition,NewVrindaPublishingHouse,Jalgaon,1987.
12. ShahB.A.,SethA,TextbookofPharmacognosyandPhytochemistry,1stedition,ElsevierPublications ,AdivisionofReedElsevierIndiaPvt.Ltd,NewDelhi,2010.
13. Remington,TheScienceandPracticeofPharmacy,21stedition,LippincottWilliamsandWilkins,2005.
14. BobbersJE,SpeedieMK,andTylerVE,Pharmacognosy&Pharmacobiotechnology,WilliamsandWilkins,Baltimore,1996.
15. VyasSPandDixitVK,TextbookofBiotechnology,1stedition,CBS Publishers,2012.
16. DubeyRC,ATextbookofBiotechnology,5thedition,SChandPublishing,2014.
17. AppelL,Theformulationandpreparationofcosmetic,fragrancesandflavours,2ndedition,MicellePress,1994.
18. Panda H,HerbalCosmetics,3rdrevisededition, AsiaPacificBusiness Press,2015.
19. REndress,PlantcellBiotechnology,1stedition,Springer-Verlag,Berlin, 1994.
20. Pharmacopeial standards for Ayurvedic Formulation (Council of Research in Indian Medicine &Homeopathy).
21. Mukherjee,P.W.QualityControlofHerbalDrugs:AnApproachtoEvaluationofBotanicals,1stedition,BusinessHorizonsPublishers,NewDelhi,India,reprint2012.
22. Agarwal,S.S.,HerbalDrugTechnology,2ndedition,UniversitiesPress,2002.
23. EMEA.GuidelinesonQualityofHerbalMedicinalProducts/TraditionalMedicinalProducts.
24. ShindeM.V.,DhalwalK.,PotdarK.,MahadikK,Applicationofqualitycontrolprinciplestoherbaldrugs.International Journalof Phytomedicine1(2009);p.4-8.
25. WHO,QualityControlMethodsforMedicinalPlantMaterials,WorldHealthOrganization,Geneva,1998.
26. WHO, Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications,WesternPacificSeriesNo3,WHORegionalofficefortheWesternPacific,Manila,199

8.
27. WHO, The International Pharmacopeia, Vol. 2: Quality Specifications,3rd edition,World HealthOrganization,Geneva,1981.
28. WHO,QualityControlMethodsforMedicinalPlantMaterials.WorldHealthOrganization,Geneva,1999.
29. WHO,WHOGlobalAtlasofTraditional,ComplementaryandAlternativeMedicine.2vol.set.Vol. 1 containstextand Vol.2,maps.WorldHealthOrganization,Geneva,2005.
30. WHO,GuidelinesonGoodAgriculturaland CollectionPractices(GACP)forMedicinalPlants.WorldHealthOrganization,Geneva,2004.

BP807ET

COMPUTERAIDEDDRUGDESIGN(Theory)-ELECTIVE 45Hours

CourseObjectives:

Thiscourseisdesignedto providedetailedknowledgeofthe applicationofcomputationalmethodsin rationaldrugdesignprocessandvarioustechniquesusedinrationaldrugdesignprocess.

CourseOutcomes:

Uponcompletionofthecourse,thestudentshallbeabletounderstand:

1. Designanddiscoveryofleadmolecules
2. Therole ofdrugdesignindrugdiscoveryprocess
3. TheconceptofQSARanddocking
4. Variousstrategiestodevelopnewdruglikemolecules.
5. Thedesignofnewdrugmoleculesusingmolecularmodellingsoftware

Unit	Details	Hours
1	**UNIT–I**	10
1.1	**IntroductiontoDrugDiscoveryandDevelopment** Stagesofdrugdiscoveryanddevelopment.	2
1.2	**LeaddiscoveryandAnalog BasedDrug Design** Rationalapproachestoleaddiscoverybasedontraditionalmedicine,Randomscreening, Non-randomscreening, serendipitousdrugdiscovery, leaddiscoverybasedondrugmetabolism,leaddiscoverybasedonclinicalobservation.	4
1.3	**AnalogBasedDrugDesign:**Bioisosterism,Classification,Bioisosteric replacement.Anythreecasestudies.	4
2	**UNIT–II**	10
	QuantitativeStructureActivityRelationship(QSAR) SARversusQSAR,HistoryanddevelopmentofQSAR,Typesofphysicochemical parameters, experimental and theoretical approaches for thedetermination of physicochemical parameters such as Partition coefficient,Hammett'ssubstituentconstantandTaftsstericconstant.Hanschanalysis, FreeWilsonanalysis,3D-QSARapproacheslikeCOMFAandCOMSIA.	
3	**UNIT –III-MolecularModelingandvirtualscreeningtechniques**	10
3.1	**VirtualScreeningtechniques:**Druglikenessscreening,Conceptofpharmacophoremappingandpharmacophore- basedscreening,	6
3.2	**Moleculardocking**:Rigiddocking,flexibledocking,manualdocking,Dockingbasedscreening.*Denovo*drugdesign.	4
4	**UNIT–IV**	8
	Informatics &Methodsindrugdesign Introductionto Bioinformatics, chemoinformatics. ADMEdatabases,c	

	hemical,biochemicalandpharmaceuticaldatabases.	
5	**UNIT–V**	7
	Molecular Modeling: Introduction tomolecularmechanicsandquantummechanics. EnergyMinimization methods andConformationalAnalysis,globalconformationalminimadetermination.	
	TOTAL	**45**

Recommended Books(LatestEditionstobeadopted)

1. BealeJ.M.,BlockJ.H.,WilsonandGisvold'sTextbookofOrganicmedicinalandPharmaceuticalChemistry, 20th edition,LippincottWilliams&WilkinsPublishers,2004.
2. LemkeT.L.,WilliamsD. A.,RocheV.F.,Zito.,S.W.,Foye'sPrinciplesofMedicinalChemistry, 7th edition,LippincottWilliams,andWilkinsPublishers,2001.
3. AbrahamD.J.,Burger'sMedicinalChemistryandDrugDiscovery,VolItoIV,6thedition,JohnWileyandSons ,Inc.,2003.
4. SmithH.J.,SmithandWilliams'IntroductiontoPrinciplesofDrugDesignandAction,4thedition,TaylorandF rancisPublications,CRCPress,2005.
5. RobertGCK,DrugActionattheMolecularLevel,1stedition,PalgraveMacmillanUK,1977.
6. MartinYC,QuantitativeDrugDesign, 2ndedition,CRCpress,2010.
7. Korolkovas A, Burckhalter JH, Essentials of Medicinal Chemistry, 2nd edition, Wiley-Blackwell,1988.
8. WolfME,TheBasisofMedicinalChemistry,Burger'sMedicinalChemistry,JohnWiley&Sons, NewYork,1980
9. PatrickGraham,L.,AnIntroductiontoMedicinalChemistry,OxfordUniversityPress,2013.
10. SmithHJ,Williams H,eds,"IntroductiontotheprinciplesofDrugDesign"WrightBoston.
11. Silverman R. B. The Organic Chemistry of Drug Design and Drug Action, 3rd edition,Academic PressNewYork,2014.

BP808ET

CELLANDMOLECULARBIOLOGY (Theory)-ELECTIVE 45Hours

CourseObjectives:

The course will introduce the student to cells, their physiological properties, their structure, the organellestheycontain,interactionswiththeirenvironment,theirlifecycle,division,deathandcellfunction.

CourseOutcomes:

Uponcompletionofthesubjectthestudentshallbeableto;

1. Learn history of cell and molecular biology and understand basic chemical, physical and genetic foundations of cell
2. Explain about structure of biomolecules DNA, RNA and proteins and their importance in various cellular processes
3. Outline mechanisms of gene expression and its regulation
4. Learn and understand cellular process like cell cycle, cell death, cell signaling pathways
5. Assess how to carry out analysis of genome and proteome and application techniques like transgenics
6. Analysis and assess molecular basis of diseases like cancer and application of biotechnology in designing new line of treatment modalities.

MappingCO-PO:

BP805ET *CourseOutcomes*	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO 10	PO 11
CO1	3	-	2	1	-	-	-	-	-	-	3
CO2	3	1	2	1	-	-	-	-	-	-	3
CO3	3	1	3	1	-	-	-	-	-	-	3
CO4	3	1	2	1	-	-	-	1	-	-	3
CO5	3	2	3	3	1	1	2	1	3	1	3
CO6	3	2	3	3	1	1	3	1	3	1	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	**10**
	a) Celland MolecularBiology:Definition,theory andbasicsandApplications. b) CellandMolecularBiology:HistoryandSummation. c) TheoryoftheCell.Propertiesofcells andcell membrane. d) ProkaryoticversusEukaryotic e) Cellular Reproduction f) ChemicalFoundations–anIntroductionandReactions (Types)	
2	**UNIT–II**	**10**
	DNAandtheFlowofMolecularStructure,DNAFunctioning,DNAandRNA,Typesof RNA,TranscriptionandTranslation.	
3	**UNIT–III**	**10**
	Proteins:Defined**and**AminoAcids,ProteinStructure,Regularitiesin Protein Pathways, Cellular Processes, Positive Control and significance ofProteinSynthesis.	
4	**UNIT–IV**	**8**
	ScienceofGenetics,TransgenicsandGenomicAnalysis,CellCycleanalysis,MitosisandMeiosis,CellularActivitiesandCheckpoints.	
5	**UNIT–V**	**7**
	a) CellSignals:Introduction b) ReceptorsforCellSignals c) SignalingPathways:Overview d) MisregulationofSignalingPathways e) Protein-Kinases:Functioning	
	TOTAL	**45**

RecommendedBooks(LatestEditionstobeadopted):

1. HugoW.B.and RusselA.D,PharmaceuticalMicrobiology,8th Edition,BlackwellScientificpublications,Oxford,London,2013.
2. ReedG.,PrescottandDunn's,IndustrialMicrobiology,4thedition,CBSPublishers&Distributors,Delhi,2004.
3. Pelczar MJ, Chan ECS, Kreig NR. Microbiology, 6th Edition, Tata McGraw Hill Education Pvt. Ltd,Delhi,1993.
4. HarrisM,TindallB,and Cox,PharmaceuticalMicrobiology,1st edition,1964,The WilliamsandWilkins,Baltimore,1964.

5. RoseAH,IndustrialMicrobiology,1st edition,Butterworths(Elsevier), Oxford,1961.
6. FrobisherM,HinsDillRD,CrabtreaKT,GoodHeartCR,FundamentalsofMicrobiology,9thedition,Japan,19 74.
7. CarterS.J.,CooperandGunn's.TutorialPharmacy, 6th edition,CBS Publications,NewDelhi,2005.
8. PepplerHJ, MicrobialTechnology,2nd Edition,AcademicPress (Elsevier),Massachusetts ,1979.
9. I.P.,B.P.,U.S.P.-latesteditions.
10. Reba Kanungo, AnanthnarayanandPaniker'sTextbookofMicrobiology,10th Edition, Orient-Longman,Chennai,2017.
11. Pommerville,J.C.,Alcamo'sFundamentalsofMicrobiology,3rdEdition,JonesandBartlett,Burlington ,Massachusetts,2014.
12. JainN.K,PharmaceuticalMicrobiology,3rd Edition, VallabhPrakashan, Delhi,2001.
13. Garry G.M.,Bergey's Manual of SystematicBacteriology,2nd Edition,Springerpublishing,NewYork,2005.
14. B.R.GlickandJ.J.Pasternak:MolecularBiotechnology:PrinciplesandApplicationsofRecombinantDNA:5th edition,2017,TaylorandFrancis
15. KubyImmunology,Punt Jet aleds,8th edition,WHFreeman,2018.
16. J.W.Goding:MonoclonalAntibodies–PrinciplesandPractice,AcademicPress,1996.
17. J.M.WalkerandE.B.Gingold:MolecularBiologyandBiotechnology,4th edition,RoyalSocietyofChemistry,2 000.
18. ZaborskyO, ImmobilizedEnzymes,2nd edition, CRCPress,Cleveland, Ohio, 1973.
19. S.B.Primrose:MolecularBiotechnology,2nd edition,WileyBlackwell,1992.
20. LehningerAL,NelsonDL,CoxMM.LehningerPrinciplesof Biochemistry,7th edition,Macmillan,NewYork, 2017.
21. Murry RK, Granner DK, Mayes PA, Rodwell VW, Harper's Biochemistry, 23rd edition,Appleton&Lange,Connecticut,1993.
22. BergJM,TymoczkoJL,StryerL.Biochemistry, 9th edition, WH Freeman,NewYork,2019.

BP809ET

COSMETICSCIENCE(Theory)–ELECTIVE 45Hours

Course Objectives: Thiscourse isdesignedimpartthe learnerwithknowledge of Cosmeticologywithrespecttothetypesofformulations,evaluation,andregulatoryaspects.

CourseOutcomes: Uponcompletionofthecourse,thelearnershallbeableto:

1. Identify types of skin, skin disorders and summarize the various raw materials used in cosmetics.
2. Identify, compare, and correlate the different standards & testing products for evaluation of various cosmetic products based on their application.
3. Identify and comprehend the process involved in the large-scale production of cosmetic products based on their application.
4. Discuss the regulatory guidelines and sensorial assessment for cosmetics.

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP809ET CO1	3	2	3	-	-	1	1	2	3	3	3
BP809ET CO2	3	2	3	3	-	3	3	2	3	3	3
BP809ET CO3	3	2	3	3	-	2	2	2	3	3	3
BP809ET CO4	3	2	3	3	-	3	3	2	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT–I**	10
1.1	Classificationofcosmeticandcosmeceuticalproducts. DefinitionofcosmeticsasperIndianandEUregulations,Evolutionofcosmeceuticals fromcosmetics,cosmeticsasquasiandOTCdrugs.	2
1.2	**Cosmetic excipients:** Surfactants, rheology modifiers, humectants, emollients,preservatives,perfumes,colours,oils,fats, waxes, antioxidantsand water.Classificationandapplications. **Skin:**Basicstructureandfunctionofskin. **Hair:**Basicstructureofhair.Hairgrowthcycle. **OralCavity:** Common problemassociatedwithteethandgums**.**	8
2	**UNIT–II**	10
2.1	**Principlesofformulationandbuildingblocksofskincareproducts:** Facewash,Moisturizingcream,ColdCream,Vanishingcream,Barriercreamsandcoloredcosmetics(eyemakeup,lipsticks,andnaillacquer)their relativeskinsensory,advantagesanddisadvantages.Applicationoftheseproductsinformulationofcosmeceuticals.	5
	PrinciplesofformulationandbuildingblocksofHaircareproducts: CleansingandConditioningshampoo,Hairconditioners,antidandruffshampoo. Hair grooming preparations - Hair setting lotions & sprays; Brilliantines,Hairoils. ChemistryandformulationofPara-phylenediamine-basedhairdye.Principlesofformulationandbuildingblocksoforalcareproducts:toothpowder, toothpaste, Toothpaste for bleeding gums, sensitive teeth. Teethwhitening,denturecleansers,mouthwash. Shavingproducts(Wet,Dry&After shave), Depilatorypreparations	5
3	**UNIT–III**	10
3.1	SunprotectionClassificationofSunscreensandSPF.	2
3.2	**Roleofherbs incosmetics:** SkinCare:Aloeandturmeric.H aircare:Hennaandamla. Oralcare:Neemandclove. CasestudyofHerbalproducts(SelfStudy)	6
3.3	**Analyticalcosmetics:**BISspecificationandanalyticalmethodsforshampoo,skin-creamandtoothpaste.	2
4	**UNIT–IV**	8
	PrinciplesofCosmeticEvaluation:Principlesofsebumeter,corneometer.MeasurementofTEWL,SkinColor,Hairtensilestrength,Haircombingproperties,Soapsandsyndetbars.Evolutionandskinbenefits.Irritationandsensitizationreactionstocosmetics,sensitivitytestingandsafetyaspects.Sensorialevaluationofcosmetics-conceptandneed,sensoryperception,requirements for sensory testing, methods used, interpretation and documentation/representation.	
5	**UNIT–V**	7
	Oilyanddryskincausesleadingtodryskin,skinmoisturisation.Basicunderstandingofthetermscomedogenic,dermatitis.	

	CosmeticproblemsassociatedwithHairandscalp:Dandruff,Hairfallcauses. Cosmeticproblemsassociatedwithskin:blemishes,wrinkles,acne,prickl yheat,andbodyodor. AntiperspirantsandDeodorants-Activesandmechanismofaction.	
	TOTAL	**45**

RecommendedBooks(LatestEditionstobeadopted):

1. R.G.Harry,JBWilkinson,Harry'sCosmeticology,editedbyJ.B.WilkinsonandR.J.Moore,7th edition,Harlow Essex:LongmanScientific &TechnicalPublishers,1994.
2. P.P.Sharma,Cosmetics– Formulations,ManufacturingandQualityControl,5thEdition,VandanaPublicationsPvt.Ltd., Delhi,2008.
3. NandaS,NandaAandKharRK,CosmeticTechnology,BirlaPublications,2011.
4. J.S.Jellinek,FormulationandfunctionofcosmeticS,3rd edition,WileyInterscience,NewYork,1970
5. Poucher's Perfumes, Cosmetics & Soaps, 10th Ed, Editor- Hilda Butler, Kluwer Academic Publishers,Netherlands,2000.
6. Kemp S.E., Hollowood T, Hort J., "Sensory evaluation-A practical handbook," John Wiley & Sons,2009.
7. M.S.Balsam,E.Sagarin,S.D.Gerhon,S.J.StrianseandM.M.RiegerCosmeticsScienceandTechnology,Edited by M.S.Balsam,E. Sagarin,S.D.Gerhon,S. J. Strianse andM. M. Rieger,Volumes1,2and3,Wiley-Interscience,WileyIndiaPvt.Ltd.,2008
8. Morten C. Meilgaard, B. Thomas Carr, Gail Vance Civille, Sensory Evaluation Techniques, 4th Edition,CRCPress
9. ISO 13299:2016 Sensory analysis — Methodology — General guidance for establishing a sensoryprofile(https://www.iso.org/standard/58042.html)
10. BISstandardsforcosmeticspreparations(https://www.bis.gov.in/index.php/standards/technical-department/petroleum-coal-and-related-products/indian-standards-referred-in-government-regulations/)

BP810ET
EXPERIMENTALPHARMACOLOGY-ELECTIVE 45Hours

CourseObjectives:

Thiscourseisdesignedtoimpartthebasicknowledgeofpreclinicalstudiesinexperimentalanimalsincludingdesign,conduct andinterpretationsofresults.

Objectives:

Uponcompletionofthecoursethestudentshallbeableto,

1. Appreciatetheapplicationsofvariouscommonlyusedlaboratoryanimals.
2. Appreciateand demonstratethevariousscreeningmethodsusedinpreclinicalresearch
3. Appreciateanddemonstratetheimportanceofbiostatistics andresearchmethodology
4. Designandexecutearesearchhypothesisindependently

Unit	Details	Hours
1	**UNIT–I**	**8**
	LaboratoryAnimals: StudyofCPCSEAandOECDguidelinesformaintenance,breedingand	

	conductofexperimentsonlaboratoryanimals,Commonlabanimals:Descriptiona ndapplicationsofdifferentspeciesandstrainsofanimals.Popular transgenic andmutantanimals. Techniques for collection of blood and common routes of drug administrationinlaboratoryanimals,Techniquesofbloodcollectionandeuthanasia.	
2	**UNIT–II**	**13**
2.1	**Preclinicalscreeningmodels** Introduction: Dose selection,calculation and conversions,preparationofdrugsolution/suspensions,groupingofanimalsandim portanceofshamnegativeandpositivecontrolgroups.Rationaleforselectionofani malspeciesandsexforthestudy. **Studyofscreeninganimalmodelsfor**Diuretics,nootropics,anti-Parkinson's,anti-asthmatics.	**6**
2.2	**Preclinicalscreeningmodels:**forCNS activity-analgesic,antipyretic,anti-inflammatory,generalanaesthetics,sedativeandhypnotics,antipsychotic,antidepr essant,antiepileptic,anti-Parkinsonism,Alzheimer'sdisease	**7**
3	**UNIT–III**	**12**
	Preclinicalscreeningmodels:forANSactivity,sympathomimetics, sympatholytics,parasympathomimetics,parasympatholytics,skeletal musclerelaxants,drugsactingoneye,localanaesthetics.	
4	**UNIT–IV**	**12**
4.1	**Preclinical screening models:** for CVS activity-antihypertensives,diuretics,antiarrhythmic, anti-dyslipidemic, anti-aggregatory,coagulants,andanticoagulants. Preclinical screening models for other important drugs like antiulcer,antidiabetic,andanticancer.	**6**
4.2	**ResearchmethodologyandBiostatistics** Selection of research topic, review of literature, research hypothesisandstudydesign. Pre-clinicaldataanalysisandinterpretationusing Student's't'testandOne-wayANOVA.Graphicalrepresentationof data.	**6**
	TOTAL	**45**

RecommendedBooks(LatestEditionstobeadopted):

1. Ghosh MN. Fundamentals of Experimental Pharmacology, 6th edition, Hilton & Company, Kolkata,2015.
2. KulkarniSK.Handbookof experimentalpharmacology,4thedition, VallabhPrakashan, 2012.
3. CPCSEAguidelines forlaboratoryanimalfacility, 2020.
4. VogelH.G,DrugdiscoveryandEvaluation,3rdedition, Springer,2007.
5. Suresh Kumar Gupta and S. K. Gupta, Drug Screening Methods, 3rd edition, Jaypee Brothers MedicalPublishers,2016.
6. PSSSundarRaoandJRichard,IntroductiontoBiostatisticsandResearchMethods,5thedition,PHILearningPvtLtd,2012.

BP811ET

ADVANCEDINSTRUMENTATIONTECHNIQUES(Theory)–ELECTIVE 45Hours

CourseObjectives:

This course deals with the application of instrumental methods in qualitative and quantitative analysis ofdrugs. This course is designed to impart advanced knowledge on the principles and instrumentation ofspectroscopicandchromatographichyphenatedtechniques.Thisalsoemphasizesontheoreticalandpracticalknowledge onmodernanalyticalinstrumentsthatareusedfordrugtesting.

CourseOutcomes:

Uponcompletionofthecoursethestudentswillbeable to:

1. Describetheprincipleandworkingof^{1}HNMRand^{13}C-NMRspectroscopy,massspectrometrytechniquesandhyphenatedtechniques.
2. Analyse and Interpretspectral data to predict structure of agiven compound and propose massfragmentationpathway.
3. Explainfundamentals,workingprincipleandapplicationsofX-raydiffractiontechniqueandthermalmethodsof analysislikeTG,DSC andDTA and extraction techniques.
4. Understand the concepts and quality control aspects related to radiopharmaceuticals andradioimmunoassay.
5. Describecalibrationproceduresforanalyticalinstrumentsandcomparevalidationparametersforanalyticalandbioanalyticalprocedures.

CO-PO Mapping for BP 811 ET ADVANCED INSTRUMENTATION TECHNIQUES (THEORY)											
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO1	3	1	1	2	1	3	3	1	3	-	3
CO2	3	3	3	2	1	3	3	3	3	-	3
CO3	3	2	3	2	1	3	3	1	3	2	3
CO4	3	2	2	2	1	3	3	1	3	2	3
CO5	3	3	3	2	1	3	3	2	3	-	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	UNIT-I	19

1.1	**NuclearMagneticResonancespectroscopy** Principlesof ^{1}H-NMRand ^{13}C-NMR,spinningnucleus,precessionalmotion,precessionalfrequency,gyromagneticratio,energytransitionsandrelaxationprocesses,NMRSpectra,chemicalshift,factorsaffectingchemicalshift(Electronegativity-ShieldingandDeshielding,VanderWaal'sdeshielding,anisotropiceffect),shieldinganddeshielding,VanderWaal'sdeshielding,Deuterium exchange, Chemical and magnetic equivalence, anisotropic effect (e.g.Alkanes,alkenes,alkynes,carbonyl,aromaticandcyclohexane),Solvents,Referencecompoundsandinternalstandards,couplingconstant,Spin-spincoupling – Spin-spin splitting (N+1 rule (Pascal's triangle), theory of spin-spinsplitting, formation of doublet, triplet and quartet due to possible spin orientations,inverted tree diagram, Coupling constants & values for alkyl, alkenyl, aromatic),relaxation,instrumentationandpharmaceuticalapplications Structuralelucidationofsimpleorganicmoleculeswithmolecularformulausing ^{1}H-NMR and/or ^{13}C-NMR with or without IR spectroscopic and UV spectroscopicdata	
1.2	**MassSpectrometry-** Principles, Mass spectrum, relative abundance,mass to charge ratio, molecularion, fragment ion (daughter ion), metastable ion, base peak, isotope peak, mass tocharge ratio, Fragmentation, Ionization techniques – Electron impact, chemicalionization,MALDI,FAB,Analyzers-TimeofflightandQuadrupole,instrumentation,pharmaceutical applications ExamplesofdifferentFragmentationpathways-Fissions(homolyticandheterolytic,αandβfission),Rearrangement(McLafferty,RetroDiel-Alders,4	
	memberedcyclic rearrangement),NitrogenruleandEven electronrule	
2	**UNIT–II**	**10**
2.1	**Thermal MethodsofAnalysis**:Principles,instrumentation,factorsaffectinganalysis and pharmaceutical applications of Thermogravimetric Analysis (TGA),DifferentialThermal Analysis(DTA),DifferentialScanningCalorimetry(DSC).	
2.2	**X-RayDiffractionMethods:**OriginofX-rays,basicaspectsofcrystals,X-rayCrystallography,Bragg'sLaw. Rotating crystal technique, single crystal diffraction, powder diffraction,instrumentation,structuralelucidationandpharmaceuticalapplications.	
3	**UNIT–III**	**6**
3.1	**Calibrationandvalidation-**asperICHandUSFDAguidelines.	
3.2	**CalibrationoffollowingInstruments-**Electronicbalance,UV-VISspectrophotometer,FTIRspectrophotometer,Fluorimeter,FlamePhotometer,HPLCandGC. Comparison of validation of analytical and bioanalytical methods by ICH andUSFDAguidelines	
4	**UNIT–IV**	**6**

4.1	**RadiopharmaceuticalsandRadioimmunoassay** Propertiesofradionuclide,Radioisotope,Radioactivedecay,half-lifeofradioactivity,specificactivity,Becquerel,curie,SievertandGray,Relativebiologicaleffectiveness,Radionuclidicpurity,Radiochemicalpurity,Safetyaspects of radiopharmaceutical laboratory, Measurements of radioactivity- Geiger-MullerCounting,liquidScintillationCounting Requirementsofradiopharmaceuticals-Propertiesofradionuclides,Pharmaceuticalandchemicalproperties,Radionuclidegenerator-99mTcgenerator,Qualitycontrolofradiopharmaceuticals:Physical,Chemical(Radionuclidic purity,Radiochemicalpurity) Radioimmunoassay-Importance,variouscomponents,Principle,different methods,LimitationandApplicationsofRadioimmunoassay	
4.2	**Extractiontechniques**: NernstDistributionlaw andpartitioncoefficient,Distributioncoefficient,DistributionRatio,Percentextractionorextractionefficiency,Separabilityfactor. Generalprincipleandprocedureinvolvedin thesolidphase extractionandliquid-liquidextraction	
5	**UNIT-V**	**4**
	Hyphenatedtechniques-Significance,interfacesandapplicationsof-LC-MS/MS, GC-MS/MS,HPTLC-MS.	
	TOTAL	**45**

RecommendedBooks(LatestEditionstobeadopted):

1. Sharma,B.K.,InstrumentalMethodsofChemicalAnalysis,24th revisedandenlargededition,GoelPublishing House,Meerut,2005.
2. Y.R.Sharma,ElementaryOrganicspectroscopy,PrinciplesandChemicalApplications,5thEdition,S.ChandPublishing,2013.
3. BeckettA.H., Stenlake J.B., Practical Pharmaceutical Chemistry,Vol.I &II,2nd edition,AthlonePress,Universityof London,London,1970
4. Connors,K.A.,ATextbookofPharmaceuticalAnalysis,3rdedition,JohnWileyandSons,Canada.,2007.
5. Skoog,D.A.,F.J.HollerandS.R.Crouch.PrinciplesofInstrumentalAnalysis,6thedition,BrooksCole,2006.
6. J.Mendham,R.C.Denney,J.D.Barnes,M.J.K.Thomas,B.Sivasankar,Vogel'sTextbookofQuantitativeChemicalAnalysis,6thedition,PearsonEducation,NewDelhi,2009.
7. Silverstein RMand WebsterFX,Spectrophotometricidentification ofOrganicCompounds,6thedition,JohnWileyandSons,1998.
8. FinarI.L., OrganicChemistry,Vol.1,4thedition, Longman,1963.
9. Organicspectroscopy,WilliamKemp,3rdedition,Macmillan,2019.
10. P.D.Sethi,QuantitativeAnalysisofDrugsinPharmaceuticalFormulations,3rdedition,CBSPublishers ,2019.
11. D. C.Garrett,ThequantitativeAnalysisofDrugs,,3rdedition,Springer,1976.

BP812ET
DIETARYSUPPLEMENTSANDNUTRACEUTICALS(Theory)–ELECTIVE 45Hours

CourseObjectives:

Thiscoursecoversfoundationaltopicthatareimportantforunderstandingtheneedandrequirementsofdietarysupplementsamongdifferentgroupsinthepopulation.

CourseOutcomes:

Aftercompletionof thecoursethestudentshouldbeableto:

1. Understandtheneedofsupplements bythedifferentgroup ofpeopletomaintainhealthylife.
2. Understandtheoutcomeofdeficienciesindietarysupplements.
3. Appreciatethecomponentsindietarysupplementsandtheapplication.
4. Appreciatetheregulatoryandcommercialaspectsofdietarysupplementsincludinghealthclaims.

Unit	Details	Hours
1	**UNIT-I**	10
	DefinitionsofFunctionalfoods,NutraceuticalsandDietarysupplements.Classification ofNutraceuticals,Healthproblemsanddiseasesthatcanbeprevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heartdisease,stress,osteoarthritis, hypertensionetc. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutritioneducationincommunity. Source, Name of marker compounds and their chemical nature,Medicinal usesand health benefits of following used as nutraceuticals/functional foods: Spirulina,Soyabean,Ginseng,Garlic,Broccoli,Gingko,Flaxseeds.	
2	**UNIT–II**	10
	Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemicalnaturemedicinal benefits)offollowing: a) Carotenoids-αandβ-Carotene, Lycopene,Xanthophylls, leutin b) Sulfides:Diallylsulfides,Allyltrisulfide. c) Polyphenolics:Reservetrol. d) Flavonoids-Rutin,Naringin,Quercitin,Anthocyanidins,catechins,Flavones. e) Prebiotics/Probiotics.:Fructooligosaccharides,Lactobacillum. f) Phytoestrogens:Isoflavones,daidzein, Geebustin, lignans. g) Tocopherols. h) Proteins,vitamins,minerals,cereal, vegetables,andbeveragesas functionalfoods:oats,wheatbran,ricebran,seafoods,coffee,teaandthelike.	
3	**UNIT–III**	10
	a) Introduction to free radicals: Free radicals, reactive oxygen species, productionof free radicals in cells, damaging reactions of free radicals on lipids, proteins,Carbohydrates,nucleic acids. b) Dietaryfibresandcomplexcarbohydratesasfunctionalfoodingredients.	
4	**UNIT–IV**	8
	a) Free radicals in Diabetesmellitus,Inflammation,Ischemic reperfusion injury,Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidneydamage,muscle damage.Free radicals involvement in otherdisorders. Freeradicalstheoryof ageing. b) Antioxidants:Endogenousantioxidants–enzymaticandnonenzymaticantioxidantdefence,Superoxidedismutase,catalase,Glutathioneperoxidase,GlutathioneVitaminC,VitaminE,α-Lipoicacid,melatoninSyntheticantioxidants:ButylatedhydroxyToluene,ButylatedhydroxyAnisole. c) Functionalfoodsforchronicdiseaseprevention.	
5	**UNIT-V**	7

	a) Effectofprocessing,storageandinteractionsofvariousenvironmentalfactorsonthepotential ofnutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPsonFoodSafety.Adulterationoffoods. c) PharmacopoeialSpecificationsfordietarysupplementsandnutraceuticals.	
	TOTAL	**45**

RecommendedBooks(LatestEditionstobeadopted):

1. SriLakshmiB,Dietetics,8th edition,NewAgePublishersPvt Ltd,2014.
2. K.TAgusti, P.FaizalandPaulAugustine, Roleofdietaryfibresandnutraceuticalsinpreventingdiseases,BSPBooksPvtLtd.,2018.
3. Cooper. K.A., AdvancedNutritionalTherapies, 1st edition,ThomasNelsonInc, UnitedKingdom, 1998.
4. JeanCarper,TheFoodPharmacy,NewEdition,Simon&Schuster,London,2000.
5. James F. Balch and Phyllis A Balch, Prescription for Nutritional Healing, 2nd Edn, Avery PublishingGroup,NewYork,1997.
6. G.GibsonandC.WilliamsEditors,FunctionalfoodsWoodheadPublishingCompany,1st edition,London,2000 .
7. Goldberg, I., Functional Foods – Designer foods, Pharma foods, Nutraceuticals, Chapman and Hall, 1st edition,NewYork.1994.
8. Labuza,T.P.,FunctionalFoodsandDietarySupplements:Safety,GoodManufacturingPractice(GMPs) and Shelf- Life Testing in Essentialsof Functional Foods, M.K. Sachmidl and T.P. Labuzaeds.1st edition,SpringerPublications,2000.
9. WidmanRECandBrunoRS,HandbookofNutraceuticalsandFunctionalFoods,ThirdEdition(ModernNutrition),CRCPress,2019.
10. Shils, ME, Olson, JA, Shike, M., Modern Nutrition in Health and Disease. eighth edition. Lea andFebiger.1994.

BP813ET
PHARMACEUTICALPRODUCTDEVELOPMENT(Theory)ELECTIVE 45Hours

CourseObjectives:

This course covers topics that will provide the learner with understanding of essential active and excipient studies required for pharmaceutical product development. The course will enable the learner to understand the step-by-step procedure to be followed towards developing a stable commercially viable product.

CourseOutcomes:

Aftercompletingthecoursethestudentshouldbeableto:

1. Apply different characterization techniques forevaluating API and excipients before the initiation ofproductdevelopment
2. Understand anddevisestrategiesindesigningstablecommerciallyviableproducts
3. Understand the characterization of differentdosageformsforessentialqualityparameters
4. Understand and deviseprotocolsfordevelopmentofproductsexhibitingregulatorycompliance

CO-PO Mapping

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP813ET CO1	3	3	3	3	3	3	3	2	3	3	3
BP813ET CO2	3	3	3	3	3	3	3	2	3	3	3
BP813ET CO3	3	3	3	3	3	3	3	2	3	3	3
BP813ET CO4	3	3	2	3	3	3	3	3	3	3	3

While mapping Course Outcomes (CO) with POs the degree of associationsareindicated as 3 (Strong), 2(Moderate) and1 (Weak). No relation -

Unit	Details	Hours
1	**UNIT-I**	10
1.1	Introductiontopharmaceuticalproductdevelopment: Objectives, concept of product life cycle, regulations related topreformulation,formulationdevelopment,PurposeandroleofIIG ,stability assessment,manufacturing and quality control testingofdifferenttypesofdosageforms.	
2	**UNIT–II**	10
2.1	AnadvancedstudyofPharmaceuticalExcipientsinpharmaceuticalproductdevelopmentwithaspecialreferencetothefollowingcategories i. Solventsandsolubilizers. ii. Lipids,Cyclodextrinsandtheirapplications. iii. Non-ionicsurfactantsandtheirapplications. iv. Polyethyleneglycolsandsorbitols. v. Suspendingandemulsifyingagents. vi. Semisolidexcipients.	
3	**UNIT–III**	10
3.1	IPEC role and responsibility, Introduction to EXCIPACT- for excipientregulations. An advanced study of Pharmaceutical Excipients inpharmaceutical product development with a special reference to thefollowingcategories i. Tabletandcapsuleexcipients. ii. Directlycompressiblevehicles.	
	iii. Coatmaterials. iv. Excipients inparenteralandaerosolsproducts. v. ExcipientsforformulationofNDDS. Selectionandapplicationofexcipientsinpharmaceuticalformulationswithspecific industrialapplications.	
4	**UNIT–IV**	8
	Optimization techniquesin pharmaceutical product development.A study ofvariousoptimizationtechniquesforpharmaceuticalproductdevelopmentwithspecificexamples.Optimizationbyfactorialdesignsandtheirapplications.AstudyofQbDanditsapplicationinpharmaceuticalproductdevelopment.Self-studyoncase studiesbasedonQbDapproachindevelopmentofsolid,semisolidandparenteraldosageforms	
5	**UNIT-V**	7
	Selection and quality control testing of packaging materials forpharmaceuticalproductdevelopment- regulatoryconsiderations. Regulatoryconsiderationsforproductdevelopmentpertainingto FDAguidelines-BCSclassificationanditsimportancewithrelevanceto Biowaivers,Q1/Q2approachindevelopmentoforal,dermalandinjectabledosageforms.	
	TOTAL	45

RecommendedBooks(Latesteditionstobeadopted):

1. Stanford Bolton and CharlesBon,PharmaceuticalStatisticsPractical and ClinicalApplications,5th edition,CRCpress,2009.
2. EncyclopediaofPharmaceuticalTechnology,6volumeset,editedbyJamesSwarbrick,3rd Edition,InformaHe

althcarePublishers,2006
3. RoopKKhar,SPVyas,FarhanJAhmad,GauravKJain,TheTheoryandPracticeofIndustrialPharmacy,4thEdition,CBSPublishersandDistributorsPvt.Ltd.2013.
4. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical andBiopharmaceutical Principles in the Pharmaceutical Sciences, 6th edition, Walter Kluer, Philadelphia,2011.
5. S. P. Vyas and R. K. Khar, Targeted and Controlled Drug Delivery, Novel Carrier Systems, CBS PublishersandDistributorsPvt.Ltd,2019.
6. Ansel H.C.,Allen L.V., Pharmaceutical Dosage Forms and Drug Delivery Systems,10thedition,LippincottWilliamsandWalkins,USA,2014.
7. Michael E. Aulton, Aulton's Pharmaceutics – The Design and Manufacture of Medicines, 4th Ed. ,2013.
8. Gennaro A.R., Remington's: The Science and Practice of Pharmacy, 21st edition, Lippincott WilliamsandWilkins,Philadelphia,2005.
9. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3 edited byHerbertA.Lieberman,Leon Lachman,Joseph B.Schwartz,2nd edition,Marcel DekkerInc.,NewYork,1990.
10. Liberman H.A, Lachman L, Pharmaceutical dosage forms.Parenteral Medications, volume 1, 2,3edited by Avis K, Herbert A. Lieberman H. A.and Lachman L,Martin, M., 3rd edition,MarcelDekkerInc.NewYork.1993.
11. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3 edited byHerbertA.Lieberman,Martin,M., and GilbertS. Banker,2nd edition,Marcel DekkerInc.NewYork,1998.
12. https://ipec-federation.org/
13. https://www.accessdata.fda.gov/scripts/cder/iig/index.cfm
14. AdvancedReviewArticles relatedtothetopics.

BP814PW
PROJECTWORK 180Hours

Project is a requirement for the B. Pharm. degree, wherein under the guidance of a faculty member, agroup of not more than five learners in the eighth semester, is required to do some innovative work withthe application of knowledge gained while learning various courses in the earlier years. The area of theproject shall be directly related to any one of the elective courses opted by the student in semester VIII.The learner/s is/are expected to do a survey of literature in the subject, work out a Project plan and carryit out through survey, experimentation and/or modelling / computation. Through the Project work thelearner should exhibit skills for both analysis and critical thinking. The complete details of the projecthave to submitted as a report of not less than 25 pages (A4, 1 inch margin, single line space, font TimesRoman, font size 12, excluding count of reference pages) to the College before the prescribed date. ThecreditsassignedforProjectis6credits

BP814PW PROJECT WORK
Pharmaceutical Analysis

Course objective: To provide the learners with hands-on experience in applying the knowledge and skills to address real-world challenges or research questions, thereby enhancing their practical problem-solving abilities,fostering deeper understanding of the subject matter, and instilling teamwork and leadership qualities.

Course outcomes:

Course Code & CO number	*At the successful completion of the course, the learners will be able to:*
BP814PWCO1	Develop, plan and design project after identifying existing research gaps, by conducting an in-depth literature review, and collecting relevant data.
BP814PWCO 2	Formulate research objectives, hypotheses, and methodologies
BP814PWCO 3	Collect experimental data, analyze, tabulate data for effective presentation, and apply statistical analysis to interpret results.
BP814PWCO 4	Develop critical thinking skills to analyseexperimental data, and provide practical and implementable suggestions.
BP814PWCO 5	Manage timelines, promote teamwork, and cultivate leadership skills, by overcoming project-related challenges.

CO-PO Mapping for BP706PS PRACTICE SCHOOL-PHARMACEUTICAL ANALYSIS

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

BP814PW PROJECT WORK
Pharmaceutics

Course Description:
This course is designed to provide comprehensive understanding of pharmaceutical product development and keep them updated with current pharmaceutical industrial procedures for formulation development.

Course Outcomes (CO):

B. Pharm Final Year, Semester VIII BP814PW PROJECT WORK (180 hours)	
Course Code & CO number	***At the successful completion of the course, the learners will be able to:***
BP814PW CO1	Develop, plan and design project after identifying existing research gaps, by conducting an in-depth literature review, and collecting relevant data.
BP814PW CO2	Formulate research objectives, hypotheses, and methodologies.
BP814PW CO3	Collect experimental data, analyze, tabulate data for effective presentation, and apply statistical analysis to interpret results.
BP814PW CO4	Develop critical thinking skills to analyse experimental data and provide practical and implementable suggestions.
BP814PW CO5	Manage timelines, promote teamwork, and cultivate leadership skills, by overcoming project-related challenges.

Course code & CO number	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
BP814PW CO1	3	3	3	3	3	3	3	3	3	3	3
BP814PW CO2	3	3	3	3	3	3	3	3	3	3	3
BP814PW CO3	3	3	3	3	3	3	3	3	3	3	3
BP814PW CO4	3	3	3	3	3	3	3	3	3	3	3
BP814PW CO5	3	3	3	3	3	3	3	3	3	3	3

BP813PW PROJECT WORK
Pharmaceutical Chemistry

Course Objectives:
The students should be able to study on multi-disciplinary areas related to pharmacy profession and gain more advanced knowledge of the research and manuscript writing. Develop required skills for technical presentation.

Course Outcomes: After the successful completion of course, the students will be able to-

Course Code & CO number	***At the successful completion of the course, the learners will be able to:***	***Up to Bloom's***

		level
BP813PW CO1	Develop, plan and design project.	Level 4
BP813PW CO2	Identify existing research gaps.	Level 4
BP813PW CO3	Conduct an in-depth literature review, and collect relevant data for research project studies.	Level 4
BP813PW CO4	Formulate research objectives, hypotheses, and methodologies	Level 4
BP813PW CO5	Collect experimental data, analyse, and tabulate data for effective presentation.	Level 4
BP813PW CO6	Conduct statistical analysis and interpret results.	Level 4
BP813PW CO7	Develop critical thinking skills to analyse complex data.	Level 5
BP813PW CO8	Provide practical and implementable suggestions.	Level 5
BP813PW CO9	Optimise resource utilisation for project outcomes.	Level 5
BP813PW CO10	Manage timelines and overcome project-related challenges.	Level 5
BP813PW CO11	Collaborate with peers, mentors, and experts to foster a multidisciplinary/transdisciplinary approach to research.	Level 6

Course code & CO number	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BP813PW CO1	2	0	1	1	0	1	1	1	0	0	1
BP813PW CO2	1	0	1	0	0	1	1	1	1	0	1
BP813PW CO3	1	1	0	2	1	0	1	1	0	0	1
BP813PW CO4	1	0	0	0	1	1	1	1	0	0	0
BP7813PWCO5	1	1	1	0	2	2	1	1	1	0	0
BP813PW CO6	1	0	0	0	1	2	1	1	0	0	0
BP813PW CO7	1	1	1	2	2	1	0	1	0	0	1
BP813PW CO8	2	1	0	1	0	0	0	0	0	0	0
BP813PW CO9	1	1	1	0	0	0	1	1	0	0	1
BP813PW CO10	0	1	0	2	1	1	1	1	1	0	1
BP813PW CO11	1	2	0	0	1	0	1	1	0	0	1

BP814PW PROJECT WORK
Pharmacology

Course Objectives:

This course aims to offer students hands-on learning opportunities in the field of Pharmacology, with a focus on Pharmacology, Toxicology, and Molecular Biology-related processes. It also facilitates learning experiences related to conducting literature reviews and analyzing them to draw comparisons and contrasts with existing scientific knowledge. Additionally, students will gain an understanding of how to identify a scientific problem and to create scientific reports, utilizing ICT tools, illustrations, graphical data representation, and plagiarism detection software, all of which will enhance their insights into the field of Pharmacology.

Course outcomes

B. Pharm Final Year, Semester VIII BP813PW PROJECT WORK (PRACTICAL- 180 hours)	
BP814PW Course Outcomes	**At the successful completion of the course, the learners will be able to:**
BP814PW CO 1	Understand the research problem identified.
BP814PW CO 2	Perform a literature review for the identified research issue by exploring sources like Pubmed, Google Scholar, and Scopus, and structure the primary and secondary literature review that was carried out.
BP814PW CO 3	Analyze the data gathered and draw conclusions regarding the research problem based on the analysis conducted.
BP814PW CO 4	Apply statistical analysis methods to the obtained data and illustrate the results using tables, graphs, and schematic diagrams.
BP814PW CO 5	Generate a collective research project report by leveraging the insights obtained through Microsoft Excel and Microsoft Office applications (Information and Communication Technology tools) to create a research report that addresses the identified research problem.
BP814PW CO 6	Assess the group-created project report using plagiarism detection software.

Mapping CO-PO

BP814PW Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3