

B. PHARM SEMESTER - III

**SEMESTER-III
SCHEME OF TEACHING**

SUB CODE	NAME OF SUBJECT	CONTACT HOURS PER WEEK		CREDITS	
		T	P	T	P
B301T	Pharmaceutical Microbiology-I Theory	4	--	3	--
B301P	Pharmaceutical Microbiology-I Practical	--	3	--	3
B302T	Physical Pharmaceutics Theory	4	--	3	--
B302P	Physical Pharmaceutics Practical	--	3	--	3
B303T	Organic Chemistry-I Theory	4	--	3	--
B303P	Organic Chemistry-I Practical	--	3	--	3
B304T	Pharmacology-I Theory	4	--	3	--
B304P	Pharmacology-I Practical	--	3	--	3
B305T	Pharmacognosy-I Theory	4	--	3	--
B305P	Pharmacognosy-I Practical	--	3	--	3
	Tutorial	1	--	--	--
	Total	36		30	

SCHEME OF EXAMINATION

SUB CODE	NAME OF SUBJECT	DURATION OF EXAM (HRS)		MARKS			
				THEORY		PRACTICAL	
		T	P	University level evaluation	Institute level evaluation	University level evaluation	Institute level evaluation
B301T	Pharmaceutical Microbiology-I Theory	3	--	80	20	--	--
B301P	Pharmaceutical Microbiology-I Practical	--	3	--	--	80	20
B302T	Physical Pharmaceutics Theory	3	--	80	20	--	--
B302P	Physical Pharmaceutics Practical	--	3	--	--	80	20
B303T	Organic Chemistry-I Theory	3	--	80	20	--	--
B303P	Organic Chemistry-I Practical	--	3	--	--	80	20
B304T	Pharmacology-I Theory	3	--	80	20	--	--
B304P	Pharmacology-I Practical	--	3	--	--	80	20
B305T	Pharmacognosy-I Theory	3	--	80	20	--	--
B305P	Pharmacognosy-I Practical	--	3	--	--	80	20
	Total	30		400	100	400	100

SUBJECT : **Pharmaceutical Microbiology-I**
SUBJECT CODE : **B301T & B301P**

RATIONALE :

Microbiology is an exciting discipline with far-reaching impacts in human health and disease. This course will focus on the study of bacteria, viruses, and fungi and their interrelationship with human disease development. There will be emphasis on microbial structure, growth, metabolism, genetics and microbial diversity. Laboratory focuses on microbial identification, handling, staining and growth. During the first half of the course the basic principles of microbiology including microbial growth and metabolism, reproduction, and microbial diversity will be covered. The second half of the course we will draw on the basic principles learned in the first half of the semester to understand microbiology as it relates to human health, and human disease

COURSE OBJECTIVES : This course will cover topics in the history of microbial morphology and physiology, bacterial metabolism, genetics, and the classification of microorganisms.

- This course will increase awareness and appreciation for microscopic organisms in environment and their relationships to humans in health and disease
- This course will also provide with tools for a better understanding of microbial pathogenesis, means of control and treatment
- This course will give information about the most important microbial diseases caused by bacteria, fungi, protozoans and worms
- Additionally, this course will also cover special topics: emerging infectious diseases and global public health, nosocomial infections and antibiotic resistance
- The practical laboratory portion of the course will provide a review of procedures used to isolate and identify microorganisms, as well as understanding in bacterial transmission and how to avoid it, antimicrobial agents, antibiotics and correct handling of laboratory samples.

LEARNING OUTCOMES:

Understand how microorganisms survive where they do, how they are related, and how they interact with us.

- Have a solid grasp of the scope of the microbial world and its role in human disease
- How to control bacterial growth- use of chemical and physical agents to control microbe propagation
How to provide a microbe-free environment for the health professional
- Understand the rationale behind the use of chemicals to control bacterial propagation (anti-microbial agents)
- How microorganisms relates with us causing disease
- Summarize mechanisms of animal defenses to infection, including primary defenses, innate immunity, and acquired immunity.
- How microbes harm us by causing Pathogenesis
- Learn the most important disease-causing organisms: Bacteria, viruses, protozoans and worms.
- Classification and characteristics in the laboratory will help acquire basic bacteriological skills so as to successfully use them.

PREREQUISITES: Basic principles of Biology and Chemistry

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TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B301T & B301P	Pharmaceutical Microbiology-I	4	3	7	3	3	20	20	80	80	200

CONTENTS:

1	Scope of microbiology in pharmaceutical sciences.	10
2	Classification of microorganisms with subtypes.	20
	Bacteria-Characteristic features of bacterial cell, Classification of bacteria, shape, sizes and aggregation of bacteria.	
	Viruses and Fungi-Characteristic features and classification.	
	Protozoa, Algae and others.	
	Anaerobes and Aerobes.	
3	Identification methods of microorganisms:	25
	Staining techniques-	
	Microscopy-Light microscopy, Dark field microscopy, Fluorescence microscopy, Electron microscopy.	
4	Nutritional requirement of microorganisms:	20
	Types of culture media-compositions and applications.	
5	Growth characteristics and growth kinetics with emphasis on Bacteria and fungi.	10
6	Bioburden: General microbiology of air, water and soil-possible contamination in pharmaceuticals.	15

B301P Pharmaceutical Microbiology-I Practicals

1	Introduction to microscope
2	Introduction to procedures in microbiology laboratory.
3	Data collection: Ideal slides of microorganisms. (Bacteria, virus, Spirochetes, Rickettsia, Fungi etc.)
4	Preparation of various growth media
5	Identification of microbes by staining techniques

BOOKS RECOMMENDED:

1	Principles Of Microbiology By Ronald M. Atlas, W.C. Brown Publishers
2	Pharmaceutical Microbiology By W.B. Hugo And A.D. Rusell, Blackwell Science
3	“Introduction To Medical Microbiology”, Ananthanarayan R., Orient Longman Publication
4	“Introduction To Microbiology”, Rao A.S., Prentice-Hall Of India
5	“Fundamentals Of Microbiology”, Frobisher, W B Saunders Publication
6	“General Microbiology”, Stanier, Macmillan Publication
7	“Mechanism Of Microbial Disease”, Schechter Moselio, Williams And Wilkins Publication
8	“Medical Microbiology : A Guide To Microbial Infection - Pathogenesis Immunity Laboratory Diagnosis And Control”, Greenwood David Ed., Churchill Livingstone Publication
9	“Medical Microbiology”, Baron Ellen Jo (Et Al...), Willey - Liss Publication
10	“Microbiology”, Pelczar Michael J., Tata McGraw-Hill Publication
11	“Microbiology An Introduction”, Tortora Gerard, Benjamin Cumming Publication
12	Bergey’s Manual Of Systematic Bacteriology By Williams & Wilkins- A Waverly Co.

B. PHARM SEMESTER - III

SUBJECT : Physical Pharmaceutics

SUBJECT CODE : B302T & B302P

RATIONALE : This course makes the student learn the application of physical chemical principles to problems in the pharmaceutical sciences. Physical and theoretical foundations are discussed and applied and problem solving is emphasized.

COURSE OBJECTIVES :

To learn some of the important physical properties of drugs and excipients that can immensely affect the drug manufacturing process. The knowledge should include the importance of these properties and its correct utilization in drug manufacturing.

LEARNING OUTCOMES:

1. Explain the properties
2. Measure this properties
3. Alter the properties using different techniques to achieve desired result

PREREQUISITES: An introduction to metrology and pharmaceutical calculations; the prescription and those legal considerations concerning this document; and an introduction to pharmaceutical dosage forms

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B302T & B302P	Physical Pharmaceutics	4	3	7	3	3	20	20	80	80	200

CONTENTS:

1	Micromeritics and powder Rheology: Fundamental and derived properties of powders. Methods of determination and importance in formulation development of various properties like--- Particle size and distribution, (average particle size, number and weight distribution) Particle area, Densities, Angle of repose, , porosity, packing arrangement, density, bulkiness and flow properties. Brief discussion of concept of particle engineering.	20
2	Rheology: Objectives of measuring rheology of pharmaceuticals. Concept of Viscosity, Consistency, Fluidity, Flow. Concept of Relative viscosity, Kinematic viscosity, and its importance. Types of rheological systems: Newtonian systems and Non-Newtonian systems—Sub types and their characteristic Features, Rheograms, Numerical. Plug flow and Viscoelasticity, Antithixotropy, Psychorheology Rheometry: Different types of viscometers with their function and uses. Application of rheology in pharmacy.	20

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3	Surface and interfacial phenomenon: Types of interfaces, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid liquid interfaces, complex films, electrical properties of interface.	20
4	Disperse systems: Colloidal dispersions: Definition, types, properties of colloids, protective colloids. Suspension and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions: Types, theories of emulsification, concept and applications of HLB system, physical stability of emulsions.	20
5	Buffers and isotonic solutions: The buffer equation-Buffer eq. for weak acid and base. Factors affecting the pH of buffer solutions Buffer capacity-Calculation of buffer capacity Influence of concentration on buffer capacity Buffer capacity of physiological fluids and its importance. Influence of buffer capacity and pH on tissue irritation and absorption In vivo biological buffer systems-Preparation of pharmaceutical buffers. Buffered isotonic solutions—Importance of Tonicity, Hyper and Hypotonic solutions. Methods for adjustment of tonicity-White Vincent method, Cryoscopic method, Sodium chloride equivalent method.	20

B302P Physical Pharmaceutics Practical

1	To determine particle size distribution by Microscopy, by Sieving, by Andreason pipette.
2	To determine derived properties of given powders.
3	To study the effect of particle size on derived properties of given powders.
4	To study the effect of particle shape on derived properties of given powders.
5	To find out optimum concentration of glidant.
6	To determine true density of powders.
7	To determine viscosity of given liquid by different viscometers.
8	To study effect of temperature on viscosity of liquids.
9	To determine surface tension by capillary rise method.
10	To determine CMC of surfactants.
11	To determine spreading co-efficient of given liquid.
12	To find work done in emulsification. And to find out rate of creaming.
13	To find optimum blend of emulsifiers.
14	To prepare stable emulsion using required HLB value.
15	To optimize suspending agent concentration.

BOOKS RECOMMENDED:

1	Essentials Of Physical Pharmacy”, Derle D V, Pharma Book Syndicate Publication
2	Martins Physical Pharmacy And Pharmaceutical Sciences”, Sinlko Patrick J., B I Publication
3	Textbook Of Physical Pharmaceutics”, Subramanian C.V.S., Vallabh Prakashan
4	Pharmaceutical Engineering”, Sambhamurthy K.
5	Physicochemical Principles Of Pharmacy”, Forence A.T., Macmillan Publication
6	Physical Characterization Of Pharmaceutical Solids Vol-70”, Brittain Harry G. Ed., Marcel Dekker Publication
7	The Theory And Practice Of Industrial Pharmacy”, Lachman Leon, Varghese Publication
8	Elementary Chemical Engineering”, Peters Max
9	Perry’s Chemical Engineers Handbook”, Perry Robert H

SUBJECT : Organic Chemistry-I

SUBJECT CODE : B303T & B303P

RATIONALE :Majority of the drugs used are organic in nature and therefore understanding the basics of organic chemistry, naming these complex chemical structures, understanding the chemical and physical properties of the common groups of compounds and also doing synthesis of these compounds becomes very important in understanding drug properties

COURSE OBJECTIVES :

1. To learn fundamentals of chemical bonds, stereochemistry
2. To learn basic chemical functional groups of compounds with respect to their physical and chemical properties.
3. To learn the simple organic chemical reactions.
4. To identify organic compounds by testing their physical and chemical properties.

LEARNING OUTCOMES: The student should be able to:

1. Define and explain different types of chemical bonds.
2. Name the organic compounds according to IUPAC nomenclature system.
3. Narrate physical and chemical properties of different compounds representing different functional group
4. To understand reactivity of various functional groups.
5. Synthesis some organic compounds.
6. Identify unknown organic compounds by conducting different physical and chemical tests.

PREREQUISITES: Basic organic chemistry learnt at HSC level.

TEACHING AND EVALUATION SCHEME:

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		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B303T & B303P	Organic Chemistry-I	4	3	7	3	3	20	20	80	80	200

CONTENTS:

1	The subject of organic chemistry will be treated in its modern perspective keeping for the sake of convenience, the usual classification of organic compounds. Basics Structure and Properties: Atomic structure, Atomic orbitals, Molecular orbital theory, wave equation, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases, general nomenclature.	20
2	Stereochemistry Stereochemistry: Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations, stereochemistry of specific reactions and intermediates, Stereo selective and stereospecific reactions	30
3	Structure, Nomenclature, Preparation and Reactions Structure, Nomenclature, Preparation and Reactions of: Alkanes, Alkenes, Alkynes; Cycloalkanes,	50

Dienes, Benzene, Polynuclear aromatic compounds, Arenes, Alkyl halides, Alcohols, Ethers, Epoxides, Amines, Phenols, Aldehydes and ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates – carbocations, carbanions, carbenes, nitrene and nitrenium ions.
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B303P Organic Chemistry-I Practical

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| 1 | Introduction to laboratory and safety hazards. |
| 2 | Introduction to organic compound identification test. |
| 3 | Introduction to reagent test. |
| 4-9 | Introduction to functional group (I) to (V) and to identifies the given unknown. |
| 10 | To synthesize acetanilide from aniline. |
| 11 | To synthesize p – bromo acetanilide from acetanilide. |
| 12 | To synthesize p – bromo aniline from p – bromo acetanilide. |
| 13 | To synthesize Benzoic acid from benzamide or phenyl benzoate |
| 14 | To synthesize m- dinitro benzene from nitrobenzene. |
| 15 | To synthesize Benzamide from benzoyl chloride. |
| 16 | To Synthesize Phenyl benzoate |

BOOKS RECOMMENDED:

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|-----|--|
| 1. | Morrison & Boyd, Organic Chemistry, Prentice-Hall, 6 th , 2001. |
| 2. | Solomon & Fryhle, Organic Chemistry, Wily, 8 th , 2004. |
| 3. | Shriner & Morill, The systemic Identification of Organic Compounds, Wily, 8 th , 2004. |
| 4. | Furniss, Vogel's Textbook of Practical Organic Chemistry, Pearson education, 5 th , 2004. |
| 5. | Elie E, Stereochemistry of Carbon Compounds, McGraw-Hill, 7 th , 1962. |
| 6. | Elie E, Elements of Stereochemistry, wily, 3 rd , 1969. |
| 7. | Cahn & Dermer, Introduction to Chemical Nomenclature, Butterworths, 3 rd , 1979. |
| 8. | Warren S, Organic synthesis-The disconnection approach, Wily, 4 th , 1982. |
| 9. | Wheland G Advanced Organic Chemistry, Wily, 3 rd , 1960. |
| 10. | March J, Advanced Organic Chemistry, McGraw-Hill, 3 rd , 1985. |
| 11. | Kagan H, Organic Stereochemistry, Wily, 4 th , 1965. |
| 12. | House H, Modern Synthetic Reactions, Wily, 2 nd , 1972. |

B. PHARM SEMESTER - III

SUBJECT : Pharmacology-I
SUBJECT CODE : B304T & B304P
RATIONALE : This is one of the core subjects of Pharmacy field where student learns the biological effects of drugs. The subject has direct application to the profession as it teaches the student about how the drug produce effect, what effects are produced, what side effects are produced, where and when it should be used etc.

COURSE OBJECTIVES :

- To learn general concepts how the drug produces effect and what factors can contribute in producing the drug effects.
- To learn the mechanism of action, pharmacological effects, pharmacokinetics, adverse effects, therapeutic application of various classes of drugs.

LEARNING OUTCOMES: The student should be able to:

1. Define and explain the various terminologies pertaining to the subject.
2. Explain the basic principles of Pharmacokinetics and pharmacodynamics
3. Narrate the principles involved in measurement of drug effects
4. Classify the drugs according to pharmacological classes
5. Explain the mechanism of action, pharmacodynamics and pharmacokinetic effects of drugs, adverse effects, contraindications and therapeutic application of various classes of drugs.
6. Conduct some simple in vitro and in vivo experiments to demonstrate the pharmacological actions of the drugs.

PREREQUISITES: Knowledge of Human Anatomy Physiology, Health Education, Biochemistry and basic physics and chemistry.

TEACHING AND EVALUATION SCHEME:

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		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B304T & B304P	Pharmacology-I	4	3	7	3	3	20	20	80	80	200

CONTENTS:

1	General pharmacology:	
	Introduction to pharmacology, sources of drugs, dosage forms and routes of administration.	05
	Pharmacodynamics : General principles of drug action, molecular basis of drug targets ,	15
	Pharmacokinetics: Absorption, Distribution, Metabolism and Excretion (ADME) of drugs. Principles of Pharmacokinetics, Bioavailability and Bioequivalence	10
	Pharmacogenetics, Adverse Drug Reaction (ADR), Drug interactions (DI)	10
	Bioassays & Preclinical studies	05
	Clinical Trials	05
2	Pharmacology of Peripheral Nervous system:	
	Neurohumoral transmission (autonomic and somatic)	05
	Parasympathomimetics, Parasympatholytics, Sympathomimetics, adrenergic receptor and neuron blocking agents, ganglionic stimulants and blocking agents	20
	Neuromuscular blocking agents (NMJ Blockers)	05
	Basics of ANS disorders	10
3	Pharmacology of Respiratory System	
	Drugs used in treatment of Bronchial asthma, Dry cough, COPD (also Mucolytic, Expectorants, Anti-tussives)	10

B304P Pharmacology-I Practical

1. To study the modulation of hypnotic effect of phenobarbitone in presence of microsomal enzyme modulators.
2. To study biotransformation and excretion of aspirin in healthy human volunteers.
3. Introduction to Experimental Pharmacology
4. To study basic instruments used for isolated tissue experiments.
A. To study different laboratory animals.
B. Introduction to CPCSEA its construction and its function (CPCSEA guidelines).
A. To study various methods of euthanasia
B. To study various methods of anesthesia & method of disposal of animals.
5. Demonstration of mounting of isolated rat ileum.
6. To determine PD_2 value of Ach/Histamine using rat/G. Pig ileum.
7. To determine dose ratio of Carbachol/ Ach & Physostigmine/ Ach using rat ileum.
8. To determine PA_2 value of Atropine/Mepyramine using rat/G.pig ileum.
9. To find out nature of unknown drug using rat ileum.
10. To study the effect of various drugs acting on neuromuscular junction using simulation software. (Computer Assisted Experiment)
11. To study the effect of various drugs on cat nictating membrane.(Computer Aided Experiment)

BOOKS RECOMMENDED: (LATEST EDITION)

1. Pharmacological Basis Of Therapeutics By Goodman & Gillman
2. Pharmacology And Pharmacotherapeutics By Satoskar & Bhandarkar
3. Essentials Of Pharmacotherapeutics By F.S.K. Barar
4. Essentials Of Medical Pharmacology By K.D. Tripathi
5. Pharmacology By Rang & Dale
6. Fundamentals Of Experimental Pharmacology By M.N. Ghosh
7. Handbook Of Experimental Pharmacology By S.K. Kulkarni
8. Pharmacology by V. J. Sharma
9. Lippincott's Pharmacology by Heavy & Champ
10. General P'ology : Basic Concept by H.L. Sharma
11. Practicals in Pharmacology by Dr. Goyal
12. Medical Pharmacology By Goth
13. Pharmacology By Gaddum
14. Principles Of Drug Action By Goldstein Aronow & Kalaman
Supplementary :
15. Lewis Pharmacology By Crossland
16. Elements Of Pharmacology By Dr. Derasari & Dr. Gandhi
17. Drug Interactions By Hansten
18. Pharmacological Experiments On Isolated Preparations By Perry
19. Drug Receptor- Rang HP

B. PHARM SEMESTER - III

SUBJECT : Pharmacognosy-I

SUBJECT CODE : B305T & B305P

RATIONALE : It provides knowledge of drugs of natural origin. Since ages humans have been using drugs from natural origin. Many of the allopathic drugs also have herbal origin. Learning these drugs is of great value for pharmacy professionals as these drugs have important place in treatment of diseases.

COURSE OBJECTIVES :

1. To learn general morphological and microscopical characters of crude drugs
2. To understand general methods of checking purity of herbal drugs.

LEARNING OUTCOMES: The student should be able to:

1. Explain structure and function of plant tissues.
2. Describe and demonstrate the morphological characters of different parts of plants.
3. Describe taxonomical characters of plants belonging to some important plant families.
4. Classify plant derived drugs
5. Demonstrate different tests used for quality control of herbal drugs.

PREREQUISITES: Biology

TEACHING AND EVALUATION SCHEME:

SUB CODE	TITLE OF SUBJECT	TEACHING SCHEME			CREDITS		EVALUATION SCHEME				TOTAL MARKS
		T	P	TOTAL HRS	T	P	INTERNAL		EXTERNAL		
							T	P	T	P	
B305T & B305P	Pharmacognosy-I	4	3	7	3	3	20	20	80	80	200

CONTENTS:

1	Plant tissue: simple and complex and tissue system	10
2	Morphology of root, stem, bark, wood, leaf, flower, fruit and seed Modification of root, stem and leaf	15
3	Histology of root, stem and leaf	10
4	Plant taxonomy: Study of the following families with special reference to medicinally important plants – Malvaceae, Apocynaceae, Solanaceae, Leguminosae, Rubiaceae	10
5	Definition, scope, history and development of Pharmacognosy	5
6	Sources of crude drugs & Classification of crude drugs	5
7	Cultivation, collection, processing and storage of crude drugs: Importance and Factors influencing cultivation of medicinal plant	10
8	Quality control of crude drugs: Adulteration and evaluation	10
9	Introduction to secondary metabolites – Definition & classification	10
10	Carbohydrates and derived products: Definition, classification & chemical tests of carbohydrates; Agar, Guar gum, Acacia, Honey, Isabgol, pectin, Starch and Tragacanth.	15

BOOKS RECOMMENDED:

1. Atal C. K. And Kapur B.M., Cultivation And Utilization Of Medicinal Plants, Rrl Jammu.
2. Rangari & Rangari, Text Book Of Pharmacognosy
3. Datta A. C., A Class Book Of Botany, Oxford Uni.
4. Bendre A. M, Ashokkumar. A Textbook Of Practical Botany Ii Rastogi Publications, Meerut, India.
5. Quadry J. S., Shah And Qadry Pharmacognosy, B. S. Shah Publication
6. Wallis T.E., Text Book Of Pharmacognosy, 5th Edition, CBS Publishers And Distributors
7. Kokate C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
8. Kokate C.K, Purohit A.P. And Gokhale S.B. Pharmacognosy (Degree) Nirali Prakashan, Pune.
9. Khandelwal K R, Practical Pharmacognosy, Nirali Prakashan
10. Trease E And Evans W.C. Pharmacognosy, Balliere Tindall. Eastbourne, U.K.
11. Tyler V.C., Brady L.R. And Robers W.E. Pharmacognosy, Lea And Febiger, Ph.
12. Iyengar, Text Book Of Pharmacognosy, Manipal Power Press.
13. MG Chauhan, Microscopy Of Leaf Drug, Jamnagar Ayurved University
14. MG Chauhan, Microscopy Of Bark Drug, Jamnagar Ayurved University
15. Jackson Betty P., Atlas Of Microscopy Of Medicinal Plants, Culinary Herbs And Spices, CBS Publication.

B305P Pharmacognosy-I Practical

1.	Care, use and types of microscopes and Preparation of different types of slides and Study of different cell and tissue system.
2.	Microscopical examination of cell contents: starch grains, calcium oxalate & carbonate crystals and phloem fibres & stomatas
3.	Morphology of plant parts indicated in theory.
4.	Microscopic examination of stem monocot and dicot plants.
5.	Microscopic examination of root monocot and dicot plants.
6.	Microscopic examination of leaf monocot and dicot plants.
7.	Morphological characteristic of plant family Solanaceae
8.	Apocynaceae
9.	Malvaceae
10.	Rutaceae
11.	Leguminosae
12.	Rubiaceae
13.	Quantitative microscopy Leaf constants
14.	Quantitative microscopy Dimention measurement
15.	To study morpholgy and chemical tests of carbohydrate containing drug.
16.	Preparation of herbarium sheets