



SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.11))
Syllabus with effect from the Academic Year 2023-2024

PROGRAMME STRUCTURE
Bachelor of Pharmacy (B. Pharm) Semester: V

To Pass	At least 40% Marks in the aggregate of University and Internal examination in each course.							
Course Type	Course code	Name of the course	Credit	Contact Hours per Week	Exam Duration in Hrs	Component of Marks		
						Internal	End Semester	Total
Core Course	UP05CBPH01	Medicinal Chemistry II – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH02	Pharmaceutical Microbiology – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH03	Pharmacology II - Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH04	Pharmacognosy and Phytochemistry II – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH05	Biopharmaceutics and Pharmacokinetics – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH06	Pharmaceutical Microbiology – Practical	2	4	4	15/6	35/14	50/20
	UP05CBPH07	Pharmacology II - Practical	2	4	4	15/6	35/14	50/20
	UP05CBPH08	Pharmacognosy and Phytochemistry II – Practical	2	4	4	15/6	35/14	50/20
Total:			26	-	-	170	480	650/260





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Course Type	Course code	Name of the course	Credit	Contact Hours per Week	Exam Duration in Hrs	Component of Marks		
						Internal	End Semester	Total
Core Course	UP05CBPH01	Medicinal Chemistry II – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH02	Pharmaceutical Microbiology – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH03	Pharmacology II - Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH04	Pharmacognosy and Phytochemistry II – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH05	Biopharmaceutics and Pharmacokinetics – Theory	4	4	3	25/10	75/30	100/40
	UP05CBPH06	Pharmaceutical Microbiology – Practical	2	4	4	15/6	35/14	50/20
	UP05CBPH07	Pharmacology II - Practical	2	4	4	15/6	35/14	50/20
	UP05CBPH08	Pharmacognosy and Phytochemistry II – Practical	2	4	4	15/6	35/14	50/20
Total:			26	-	-	170	480	650/260



Semester V

Schemes for internal assessments and end semester examinations

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
UP05CBPH01	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
UP05CBPH02	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
UP05CBPH03	Pharmacology II - Theory	10	15	1 Hr	25	75	3 Hrs	100
UP05CBPH04	Pharmacognosy and Phytochemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
UP05CBPH05	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
UP05CBPH06	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
UP05CBPH07	Pharmacology II - Practical	5	10	4 Hrs	15	35	4 Hrs	50
UP05CBPH08	Pharmacognosy and Phytochemistry II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		65	105	17 Hrs	170	480	27 Hrs	650



Bachelor of Pharmacy
B. Pharm Semester V

Course Code	UP05CBPH01	Title of the Course	MEDICINAL CHEMISTRY II - Theory
Total Credits of the Course	4	Hours per Week	3 + 1 (Tutorial)

Scope	This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.
Objectives:	Upon completion of this course the student should be able to 1. Understand the chemistry of drugs with respect to their pharmacological activity 2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs 3. Know the Structural Activity Relationship of different class of drugs 4. Study the chemical synthesis of selected drugs

Course Content: Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)		
Unit	Description	Hours
I	Antihistaminic agents: Histamine, receptors and their distribution in the humanbody H₁-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium H₂-antagonists: Cimetidine*, Famotidine, Ranitidin Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole	10



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	<p>Anti-neoplastic agents:</p> <p>Alkylating agents: Meclorothamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa</p> <p>Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine</p> <p>Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin</p> <p>Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate</p> <p>Miscellaneous: Cisplatin, Mitotane.</p>	
II	<p>Anti-anginal:</p> <p>Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.</p> <p>Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.</p> <p>Diuretics:</p> <p>Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.</p> <p>Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,</p> <p>Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.</p> <p>Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol</p> <p>Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.</p>	10
III	<p>Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol.</p> <p>Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol</p> <p>Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel</p> <p>Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.</p>	10
IV	<p>Drugs acting on Endocrine system</p> <p>Nomenclature, Stereochemistry and metabolism of steroids</p> <p>Sex hormones: Testosterone, Nandralone, Progesterones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.</p> <p>Drugs for erectile dysfunction: Sildenafil, Tadalafil.</p>	08



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	<p>Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrol</p> <p>Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone</p> <p>Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole</p>	
v	<p>Antidiabetic agents: Insulin and its preparations Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose.</p> <p>Local Anesthetics: SAR of Local anesthetics</p> <p>Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.</p> <p>Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.</p> <p>Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.</p> <p>Miscellaneous: Phenacaine, Dipiperodon, Dibucaine.*</p>	07

Suggested References:

Sr. No	References
1	Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2	Foye's Principles of Medicinal Chemistry
3	Burger's Medicinal Chemistry, Vol I to IV.
4	Introduction to principles of drug design- Smith and Williams
5	Remington's Pharmaceutical Sciences
6	Martindale's extra pharmacopoeia
7	Organic Chemistry by I.L. Finar, Vol. II
8	The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1 to 5
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel



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B. Pharm Semester V

Course Code	UP05CBPH02	Title of the Course	PHARAMACEUTICAL MICROBIOLOGY - Theory
Total Credits of the Course	4	Hours per Week	3 + 1 (Tutorial)

Scope	Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc..
Objectives:	Upon completion of the subject student shall be able to; 1. Understand methods of identification, cultivation and preservation of various microorganisms. 2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry 3. Learn sterility testing of pharmaceutical products. 4. Carried out microbiological standardization of Pharmaceuticals. 5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course Content		
Unit	Description	Hours
I	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.	10
II	Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods.	10
III	Study of morphology, classification, reproduction/ replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants	10



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	Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	
IV	Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic	08
V	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.	07

Suggested References:

Sr. No	References
1	W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London
2	Prescott and Dunn., Industrial Microbiology, 4 th edition, CBS Publishers & Distributors, Delhi
3	Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn
4	Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology
5	Rose: Industrial Microbiology
6	Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7	Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution
8	Peppler: Microbial Technology.
9	I.P., B.P., U.S.P.- latest editions.
10	Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11	Edward: Fundamentals of Microbiology.
12	N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13	Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company



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Bachelor of Pharmacy
B. Pharm Semester V

Course Code	UP05CBPH03	Title of the Course	PHARMACOLOGY II - Theory
Total Credits of the Course	4	Hours per Week	3 + 1 (Tutorial)

Scope	This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.
Objectives:	Upon completion of the subject student shall be able to; <ol style="list-style-type: none">1. Understand the mechanism of drug action and its relevance in the treatment of different diseases2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments3. Demonstrate the various receptor actions using isolated tissue preparation4. Appreciate correlation of pharmacology with related medical sciences

Course Content		
Unit	Description	Hours
I	1. Pharmacology of drugs acting on cardio vascular system a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.	10
II	1. Pharmacology of drugs acting on cardio vascular system a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders 2. Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.	10
III	3. Autocoids and related drugs a. Introduction to autocoids and classification b. Histamine, 5-HT and their antagonists.	10



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Syllabus with effect from the Academic Year 2023-2024

	<p>c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Antirheumatic drugs</p>	
IV	<p>5. Pharmacology of drugs acting on endocrine system a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones- analogues and their inhibitors. c. Thyroid hormones- analogues and their inhibitors. d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. e. Insulin, Oral Hypoglycemic agents and glucagon. f. ACTH and corticosteroids.</p>	08
V	<p>5. Pharmacology of drugs acting on endocrine system a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. 6. Bioassay a. Principles and applications of bioassay. b. Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT</p>	07

Suggested References:

Sr. No	References
1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5	Mycek M.J, Gelnei S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6	K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R.Craig & Robert
9	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata
10	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan



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Course Code	UP05CBPH04	Title of the Course	PHARMACOGNOSY AND PHYTOCHEMISTRY II - Theory
Total Credits of the Course	4	Hours per Week	3 + 1 (Tutorial)

Scope	The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine
Objectives:	Upon completion of the subject student shall be able to; 1. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents 2. to understand the preparation and development of herbal formulation. 3. to understand the herbal drug interactions 4. to carryout isolation and identification of phytoconstituents

Course Content		
Unit	Description	Hours
I	Metabolic pathways in higher plants and their determination a. Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	07
II	General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites: Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander, Tannins: Catechu, Pterocarpus Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids	14



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III	Isolation, Identification and Analysis of Phytoconstituents a. Terpenoids: Menthol, Citral, Artemisin b. Glycosides: Glycyrrhetic acid & Rutin c. Alkaloids: Atropine, Quinine, Reserpine, Caffeine d. Resins: Podophyllotoxin, Curcumin	06
IV	Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine	10
V	Basics of Phytochemistry Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs	08

Suggested References:

Sr. No	References
1	W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009
2	Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi
3	Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi
4	Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi
5	Essentials of Pharmacognosy, Dr.SH.Ansari, 11nd edition, Birla publications, New Delhi, 2007
6	Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi
7	A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005
8	R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994
9	Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor
10	The formulation and preparation of cosmetic, fragrances and flavours
11	Remington's Pharmaceutical sciences
12	Text Book of Biotechnology by Vyas and Dixit
13	Text Book of Biotechnology by R.C. Dubey



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Bachelor of Pharmacy
B. Pharm Semester V

Course Code	UP05CBPH05	Title of the Course	BIOPHARMACEUTICS AND PHARMACOKINETICS - Theory
Total Credits of the Course	4	Hours per Week	3 + 1 (Tutorial)

Scope	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 arising therein
Objectives:	Upon completion of this course the student should be able to <ol style="list-style-type: none">1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.

Course Content:

Unit	Description	Hours
I	Introduction to Biopharmaceutics Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non per oral extra-vascular routes, Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10
II	Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, <i>in-vitro</i> drug dissolution models/mechanisms, <i>in-vitro-in-vivo</i> correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	10



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III	Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E , $t_{1/2}$, V_d , AUC , K_a , Cl_t and Cl_{LR} - definitions methods of eliminations, understanding of their significance and application	10
IV	Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.	8
V	Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.	07

Suggested References:

Sr. No	References
1	Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2	Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3	Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition, Prentice-Hall International edition. USA
4	Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmkar and Sunil B. Jaiswal, Vallabh Prakashan Pitampura, Delhi
5	Textbook of Biopharmaceutics and Pharmacokinetics – Concept and Applications by CVS Subrahmanyam, Vallabh Prakashan, Delhi
6	Pharmacokinetics: By Milo Gibaldi Donald, R. Mercel Dekker Inc.
7	Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
8	Biopharmaceutics; By Swarbrick
9	Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
10	Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
11	Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
12	Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Robert F Notari Marcel Dekker Inc, New York and Basel, 1987.
13	Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania



Bachelor of Pharmacy
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Course Code	UP05CBPH06	Title of the Course	PHARMACEUTICAL MICROBIOLOGY (Practical)
Total Credits of the Course	2	Hours per Week	4

Objectives:	Upon completion of this course the student should be able to: 1. To learn various techniques of handling different microbiological instrumentation with its parameters. 2. To learn various culture techniques for developing different micro organisms 3. To learn various methods of sterilization.
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Course Content	
Sr. No.	Description
1	Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2	Sterilization of glassware, preparation and sterilization of media.
3	Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations
4	Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical)
5	Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques
6	Microbiological assay of antibiotics by cup plate method and other methods
7	Motility determination by Hanging drop method
8	Sterility testing of pharmaceuticals
9	Bacteriological analysis of water
10	Biochemical test





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





Bachelor of Pharmacy
B.Pharm Semester V

Course Code	UP05CBPH0 7	Title of the Course	PHARMACOLOGY II (Practical)
Total Credits of the Course	2	Hours per Week	4

Objectives:	<ol style="list-style-type: none">1. To demonstrate isolation of different organs/tissues from laboratory animals by simulated experiments.2. To study effect of drugs on isolated tissues.3. To perform bioassay of drug substances using different techniques.
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Course Content	
Sr. No.	Description
1	Introduction to <i>in-vitro</i> pharmacology and physiological salt solutions
2	Effect of drugs on isolated frog heart
3	Effect of drugs on blood pressure and heart rate of dog
4	Study of diuretic activity of drugs using rats/mice
5	DRC of acetylcholine using frog rectus abdominis muscle
6	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively
7	Bioassay of histamine using guinea pig ileum by matching method
8	Bioassay of oxytocin using rat uterine horn by interpolation method
9	Bioassay of serotonin using rat fundus strip by three point bioassay
10	Bioassay of acetylcholine using rat ileum/colon by four point bioassay
11	Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schild's plot method).
12	Determination of PD_2 value using guinea pig ileum
13	Effect of spasmogens and spasmolytics using rabbit jejunum
14	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model
15	Analgesic activity of drug using central and peripheral methods





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

Suggested References:

Sr. No	References
1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3	Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4	Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5	Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6	K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi
7	Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8	Modern Pharmacology with clinical Applications, by Charles R.Craig & Robert
9	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata
10	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan





SARDAR PATEL UNIVERSITY
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Bachelor of Pharmacy
B.Pharm Semester V

Course Code	UP05CBPH08	Title of the Course	PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)
Total Credits of the Course	2	Hours per Week	4

Objectives:	<ol style="list-style-type: none">1. To find out morphological and physicochemical parameters of crude drugs.2. To isolate and detect active principles of plant material.3. To separate the plant constituents.
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Course Content	
Sr. No.	Description
1	Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2	Exercise involving isolation & detection of active principles <ol style="list-style-type: none">a. Caffeine - from tea dust.b. Diosgenin from Dioscoreac. Atropine from Belladonnad. Sennosides from Senna
3	Separation of sugars by Paper chromatography
4	TLC of herbal extract
5	Distillation of volatile oils and detection of phytoconstituents by TLC
6	Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Suggested References:	
Sr. No	References
1	W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009
2	Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi





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Syllabus with effect from the Academic Year 2023-2024

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

