FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010501**

Course Title: **Medicinal Chemistry-II**

Course Objectives: Upon completion of the course the student shall 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 (SAR) of different class of drugs
4. Study the chemical synthesis of some drugs

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Antihistaminic agents:** Histamine, receptors and their distribution in the human body **H1–antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamine scuccinate, Clemastine fumarate, Diphenyl phyraline 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, Ranitidine. **Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole	10

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	Anti-neoplastic agents: **Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepa **Antimetabolites:** Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine **Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate **Miscellaneous:** Cisplatin, Mitotane	
2	**Anti-anginal:** **Vasodilators:** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. **Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine. **Diuretics:** Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol **Anti-hypertensive Agents:** Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.	**10**
3	**Anti-arrhythmic Drugs:** Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol. **Anti-hyperlipidemic agents:** Clofibrate, Lovastatin, Cholesteramine and Cholestipol **Coagulant & Anticoagulants:** Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel **Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.	**10**
4	**Drugs acting on Endocrine system** Nomenclature, Stereochemistry and metabolism of steroids **Sex hormones:** Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol. **Drugs for erectile dysfunction:** Sildenafil, Tadalafil. **Oral contraceptives:** Mifepristone, Norgestril, Levonorgestrol **Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone **Thyroid and antithyroid drugs:** L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.	**8**

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5	**Antidiabetic agents:** Insulin and its preparations Sulfonylureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose. **Local Anesthetics:** SAR of Local anesthetics **Benzoic Acid derivatives:** Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. **Amino Benzoic acid derivatives:** Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. **Lidocaine/Anilide derivatives:** Lignocaine, Mepivacaine, Prilocaine, Etidocaine. **Miscellaneous:** Phenacaine, Diperodon, Dibucaine.*	**7**

Reference Books:

1	Wilson and Griswold'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. 1-5.
9	Indian Pharmacopoeia.
10	Text book of practical organic chemistry- A.I.Vogel.

Pedagogy:

1. ICT tools (LCD projector, Laptop)
2. Traditional method (Black board)

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
40	45	5	5	5	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Describe properties, reactions and uses of antihistaminic and antineoplastic agents	**20**
CO-2	Understand properties, reactions of drugs acting on cardio vascular system	**40**

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CO-3	Learn drugs acting on endocrine system	**20**
CO-4	Explain reactions, SAR and mechanism action of antidiabetic drugs and anesthetic drugs	**20**

Curriculum Revision:	
Version:	1
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Next Review on (Month-Year):	June 2027

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010502**

Course Title: **Pharmacology-II**

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Pharmacology of drugs acting on cardio vascular system** • Introduction to hemodynamic and electrophysiology of heart. • Drugs used in congestive heart failure • Anti-hypertensive drugs. • Anti-anginal drugs. • Anti-arrhythmic drugs. • Anti-hyperlipidemic drugs	10
2	**Pharmacology of drugs acting on cardio vascular system** • Drug used in the therapy of shock. • Hematinics, coagulants and anticoagulants. • Fibrinolytics and anti-platelet drugs • Plasma volume expanders **2. Pharmacology of drugs acting on urinary system** • Diuretics • b. Anti-diuretics	10

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3	**Autocoids and related drugs** • Introduction to autacoids and classification • Histamine, 5-HT and their antagonists. • Prostaglandins, Thromboxanes and Leukotrienes. • Angiotensin, Bradykinin and Substance P. • Non-steroidal anti-inflammatory agents • Anti-gout drugs • Antirheumatic drugs	**10**
4	**Pharmacology of drugs acting on endocrine system** • Basic concepts in endocrine pharmacology. • Anterior Pituitary hormones- analogues and their inhibitors. • Thyroid hormones- analogues and their inhibitors. • Hormones regulating plasma calcium level- Parathormone, Calcitonin And Vitamin-D • Insulin, Oral Hypoglycemic agents and glucagon. • ACTH and corticosteroids	**8**
5	**Pharmacology of drugs acting on endocrine system** • Androgens and Anabolic steroids. • Estrogens, progesterone and oral contraceptives. • Drugs acting on the uterus **Bioassay** • Principles and applications of bioassay. • Types of bioassay • Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT	**7**

Reference Books:

1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw- 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	N.S.Parmar , Shiv Prakash. Screening Methods in Pharmacology
10	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company Kolkata.
11	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan

Pedagogy:

1. LCD Projector
2. Traditional Method(Black Board)

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
40	45	15	0	0	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Describe classes of drug mechanism and treatment of diseases of cardiovascular and urinary systems.	45
CO-2	Describe classes of drug mechanism and treatment of diseases of endocrine system.	25
CO-3	Learn classes of drug mechanism and treatment of diseases of autacoids related etc.	23
CO-4	Explain the Principles and applications of bioassay of drug**s.**	7

Curriculum Revision:	
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010503**

Course Title: **Pharmacognosy & Phytochemistry-II**

Course Objectives: Upon completion of the course the 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

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**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 Aminoacid pathway. Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	7

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2	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**
3	Isolation, Identification and Analysis of Phytoconstituents a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrhetinic acid, Rutin c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine d) Resins: Podophyllotoxin, Curcumin	**6**
4	Industrial production, estimation and utilization of the following phytoconstituents : Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine	**10**
5	**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.	**8**

Reference Books:

1	Evans WC. Trease and evans' pharmacognosy E-book. Elsevier Health Sciences; 2009 May 27.
2	Ali M. Pharmacognosy and phytochemistry. Vol. I, II, CBS Publication & Distributors, New Delhi. 2009.
3	Kokate CK, Purohit AP, Gokhale SB. Text book of Pharmacognosy. 56th edition, Pune: Nirali Prakashan. 2019
4	Choudhary RD. Herbal drug industry. Ist Edn, Eastern Publisher, NewDelhi, 1996.
5	Ansari SH. Essentials of pharmacognosy. IInd edition, Birla publications, New Delhi, 2007.
6	Panda H. Herbal Cosmetics. 3rd revised edition, Asia Pacific Business press Inc., NewDelhi, 2015.
7	Kalia AN. Textbook of industrial pharmacognosy. CBS Publishers & Distributors Pvt.; 2011.
8	Endress R, Endress R. Plant cell biotechnology. Berlin: Springer-Verlag; 1994 Jan.
9	Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996.
10	Louis Appell. The formulation and preparation of cosmetics, fragrances and flavours. Micelle press, 1994.

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11	Remington JP, Osol A. Remingtons Pharmaceutical sciences. Mack Publishing Company. 16th edition, 1980.
12	Vyas SP, Dixit VK. Text Book of Biotechnology. CBS publishers & distributors, New Delhi 2018.
13	Dubey RC. A textbook of Biotechnology. S. Chand Publishing; 1993.

Pedagogy:

1. ICT based teaching learning,
2. Chalk- board method

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
30	40	20	10	0	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Describe basic metabolic pathways for secondary metabolites and use of radioactive isotopes in biogenesis investigation.	**15**
CO-2	Explain biological sources, chemical composition, therapeutic uses of secondary metabolites found in selected crude drugs.	**35**
CO-3	Apply basic knowledge of modern methods of extraction, chromatography, spectroscopy and electrophoresis for isolation, identification and purification of crude drugs.	**15**
CO-4	Elaborate upon isolation, identification, analysis and industrial production of some important phytoconstituents.	**35**

Curriculum Revision:	
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010504**

Course Title: **Pharmaceutical Microbiology**

Course 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

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	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

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2	Identification of bacteria using staining techniques (simple, Gram's & Acid-fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits, and applications of physical, chemical, gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipments employed in large scale sterilization. Sterility indicators.	**10**
3	Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants, Factors influencing disinfection, antiseptics, and their evaluation for bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile Products) according to IP, BP and USP.	**10**
4	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.	**8**
5	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.	**7**

Reference Books:

1	W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2	Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3	Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4	Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5	Rose: Industrial Microbiology.
6	Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7	Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8	Peppler: Microbial Technology.
9	I.P., B.P., U.S.P.- latest editions.
10	Ananthnarayan: Textbook 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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Pedagogy:

1. ICT based (Presentations, Audio Video Tools)
2. Traditional methods (Blackboard learning)

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
37	30	10	20	3	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Know the historical development and the use of microorganisms in industry	**15**
CO-2	Learn biology of bacteria, fungi, and virus along with microscopic techniques	**45**
CO-3	Explain classification, mechanism of action and effectiveness of disinfectants, sterilization processes	**25**
CO-4	Describe the sources of contamination and monitoring in aseptic area	**7**
CO-5	Apply principles of preservation for pharmaceutical products	**8**

Curriculum Revision:	
Version:	1
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(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010505**

Course Title: **Pharmaceutical Biotechnology**

Course Objectives: Upon completion of the course the student shall be able to

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences b) Enzyme Biotechnology- Methods of enzyme immobilization and applications. c)Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d)Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f)Basic principles of genetic engineering.	10
2	a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin d) Brief introduction to PCR	10

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3	Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins, b) Structure and Function of MHC c)Hypersensitivity reactions, Immune stimulation and Immune suppressions. d)General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines, f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substitutes.	**10**
4	a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes c)Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. d)Introduction to Microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.	**8**
5	a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c)Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, d)Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.	**7**

Reference Books:

1	B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of Recombinant DNA: ASM Press Washington D.C.
2	RA Goldshyet. al.:Kuby Immunology.
3	J.W. Goding: Monoclonal Antibodies.
4	J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal Society of Chemistry.
5	Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6	S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7	Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

Pedagogy:

1. ICT Tools: Presentation, Audio-Visuals
2. Conventional Teaching method: Blackboard

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
30	30	25	10	5	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Learn various techniques of modern biotechnology	**25**
CO-2	Explain basics and applications of recombinant DNA technology in pharmacy	**25**
CO-3	Illustrate the importance of biological products including hybridoma technology	**20**
CO-4	Describe basics of immunology, immunological products and preparation of vaccines	**15**
CO-5	Learn fermentation technology and production of antibiotics, vitamins, ethyl alcohol, Glutamic acid and citric acid	**15**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010512**

Course Title: **Pharmacology-II Practical**

Course Objectives: Upon completion of the course the student shall be able to

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	Introduction to *in-vitro* pharmacology and physiological salt solutions.
2	Effect of drugs on isolated frog heart.
3	Effect of drugs on blood pressure and heart rate of dog.
4	Study of diuretic activity of drugs using rats/mice.
5	DRC of acetylcholine using frog rectus abdominis muscle.
6	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7	Bioassay of histamine using guinea pig ileum by matching method.
8	Bioassay of oxytocin using rat uterine horn by interpolation method.
9	Bioassay of serotonin using rat fundus strip by three point bioassay.
10	Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11	Determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12	Determination of PD2 value using guinea pig ileum.
13	Effect of spasmogens and spasmolytics using rabbit jejunum.
14	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15	Analgesic activity of drug using central and peripheral methods

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Reference Books:

1	Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2	Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw- 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	N.S.Parmar, Shiv Prakash. Screening Methods in Pharmacology
10	Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company Kolkata.
11	Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Determine the PA_2 and PD_2 value using chicken ileum.	35
CO-2	Perform bioassay of drugs using chicken ileum	45
CO-3	Learn analgesic, anti-inflammatory, diuretic, effect on isolated frog heart, blood pressure and heart rate of dog of drugs by simulation.	20

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010513**

Course Title: **Pharmacognosy & Phytochemistry-II Practical**

Course Objectives: Upon completion of the course the 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

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2	1. Exercise involving isolation & detection of active principles a. Caffeine from tea dust. b. Diosgenin from Dioscorea c. Atropine from Belladonna d. Sennosides from Senna
3	Separation of sugars by Paper chromatography
4	TLC of herbal extract
5	Distillation of volatile oils and detection of phytoconstitutents by TLC
6	Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv)Aloes (v)Myrrh

Reference Books:

1	Evans WC. Trease and evans' pharmacognosy E-book. Elsevier Health Sciences; 2009 May 27.

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2	Ali M. Pharmacognosy and phytochemistry. Vol. I, II, CBS Publication & Distributors, New Delhi. 2009.
3	Kokate CK, Purohit AP, Gokhale SB. Text book of Pharmacognosy. 56th edition, Pune: Nirali Prakashan. 2019
4	Choudhary RD. Herbal drug industry. Ist Edn, Eastern Publisher, NewDelhi, 1996.
5	Ansari SH. Essentials of pharmacognosy. IInd edition, Birla publications, New Delhi, 2007.
6	Panda H. Herbal Cosmetics. 3rd revised edition, Asia Pacific Business press Inc., NewDelhi, 2015.
7	Kalia AN. Textbook of industrial pharmacognosy. CBS Publishers & Distributors Pvt.; 2011.
8	Endress R, Endress R. Plant cell biotechnology. Berlin: Springer-Verlag; 1994 Jan.
9	Robbers JE, Speedie MK, Tyler VE. Pharmacognosy and pharmacobiotechnology. Williams & Wilkins; 1996.
10	Louis Appell. The formulation and preparation of cosmetics, fragrances and flavours. Micelle press, 1994.
11	Remington JP, Osol A. Remingtons Pharmaceutical sciences. Mack Publishing Company. 16th edition, 1980.
12	Vyas SP, Dixit VK. Text Book of Biotechnology. CBS publishers & distributors, New Delhi 2018.
13	Dubey RC. A textbook of Biotechnology. S. Chand Publishing; 1993.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Perform morphology, histology, powder characteristics, extraction and detection of crude drugs.	**50**
CO-2	Perform isolation and detection of active compounds from crude drugs using different analytical techniques	**50**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2020-21

Programme: **Bachelor of Pharmacy**

Semester: **V**

Course Code: **108010514**

Course Title: **Pharmaceutical Microbiology Practical**

Course 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.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/40

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

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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Reference Books:

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

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Gain knowledge of different equipments used in microbiological studies	**10**
CO-2	Illustrate growth characteristics, nutritional requirements, isolation, and identification of bacteria	**50**
CO-3	Perform microbiological assay of Pharmaceuticals	**40**

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