



Sanjivani Rural Education Society's  
Sanjivani College of Pharmaceutical Education and Research, Kopargaon

Sanjivani Rural Education Society's

# **Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**(An Autonomous Institute Affiliated to Savitribai Phule University Pune)**

**(Approved by AICTE, PCI New Delhi)**

**NBA and NAAC 'A' Accredited, CII Platinum & NIRF Rank**

## **Detailed Syllabus structure and Syllabus for the Third Year B. Pharm (w.e.f. 2024-25)**



Sanjivani Rural Education Society's  
Sanjivani College of Pharmaceutical Education and Research, Kopergaon

# **SEMESTER V**



**BP501T: Medicinal Chemistry-II (Theory) (Allotted Hrs 45)**

**Teaching Scheme**

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

**Examination Scheme:**

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

**Scope:**

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject also discusses the concept of quantitative structure activity relationship (QSAR) in drug design. The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

**Course Objectives:**

**Upon completion of the course 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 of different class of drugs
4. Study the chemical synthesis of selected drugs

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                                                                                                    | Bloom Taxonomy |                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|
|      |                                                                                                                                                                                                                                                                    | Level          | Descriptor                             |
| CO 1 | Know general aspects of the design & development of drugs including history, classification, nomenclature of Antihistaminic agents, autacoids, Drugs acting on Cardiovascular system, Drugs acting on Endocrine system, Antidiabetic agents and Local anaesthetics | 1              | Recall facts and basic concept         |
| CO 2 | Structure activity relationship (SAR) of Antihistaminic agents, autacoids, Drugs acting on Cardiovascular system, Drugs acting on Endocrine system, Antidiabetic agents and Local anaesthetics                                                                     | 4              | Analyze                                |
| CO 3 | Mechanism of Action of Antihistaminic agents, autacoids, Drugs acting on Cardiovascular system, Drugs acting on Endocrine system, Antidiabetic agents and Local anaesthetics                                                                                       | 2              | Explain ideas or concept               |
| CO 4 | Adverse effects & Therapeutic uses of Antihistaminic agents, autacoids, Drugs acting on Cardiovascular system, Drugs acting on Endocrine system, Antidiabetic agents and Local anaesthetics                                                                        | 3              | Apply                                  |
| CO 5 | Recent developments in therapeutic categories such as Antihistaminic agents, autacoids, Drugs acting on Cardiovascular system, Drugs acting on Endocrine system, Antidiabetic agents and Local anaesthetics                                                        | 5              | Evaluate                               |
| CO 6 | To know basic concepts of drug design & its parameter.                                                                                                                                                                                                             | 1, 6           | Recall facts and basic concept, Create |

**Descriptor:** 1- Recall facts and basic concept, 2- Explain ideas or concept, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create



### Mapping of Course Outcomes to Program Outcomes:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 1   | 1   | 2   | -   | 2   | 1   | -   | 2   | 2    | 3    |
| CO2 | 3   | 3   | 3   | 2   | -   | 2   | 1   | -   | 1   | -    | 3    |
| CO3 | 3   | 2   | 3   | 2   | -   | 2   | 1   | -   | 2   | 1    | 3    |
| CO4 | 3   | 2   | 2   | 2   | -   | 2   | 1   | 1   | 1   | 1    | 3    |
| CO5 | 2   | 2   | 2   | 3   | -   | 2   | 1   | 1   | 2   | 1    | 3    |
| CO6 | 3   | -   | 2   | 3   | 1   | 2   | 1   | -   | 1   | 1    | 3    |

Low-1, Medium-2, High-3

### COURSE CONTENTS

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Hours | Reference books                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <b>Antihistaminic agents and autacoids</b>                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10    | 1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.<br>2. Foye's Principles of Medicinal Chemistry.<br>3. Burger's Medicinal Chemistry, Vol I to IV.<br>4. Introduction to principles of drug design- Smith and Williams.<br>5. Remington's Pharmaceutical Sciences.<br>6. Martindale's extra pharmacopoeia.<br>7. Organic Chemistry by I.L. Finar, Vol. II.<br>8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1 to 5.<br>9. Indian Pharmacopoeia.<br>10. Text book of practical organic |
| a    | <b>Antihistaminic agents:</b> Histamine, receptors and their distribution in the human body                                                                                                                                                                                                                                                                                                                                                                                         |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| b    | <b>H1-antagonists:</b> Diphenhydramine hydrochloride, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride, Phenindamine tartrate, Promethazine hydrochloride, Trimeprazine tartrate, Fexofenadine, Astemizole, Loratadine, Cetirizine, Cromolyn sodium                                                     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| c    | <b>H2-antagonists:</b> Cimetidine, Famotidine, Ranitidine                                                                                                                                                                                                                                                                                                                                                                                                                           |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| d    | <b>Gastric Proton pump inhibitors:</b> Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| e    | <b>Autacoids:</b> Prostaglandins, Prostanoids, Leucotriene antagonists                                                                                                                                                                                                                                                                                                                                                                                                              |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|      | <b>[Diphenhydramine hydrochloride, Cetirizine, Promethazine hydrochloride, Ranitidine]</b>                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 2    | <b>Drugs acting on Cardiovascular system</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| a    | <b>Anti-anginals:</b><br><b>Vasodilators:</b> Amyl nitrite, Nitroglycerin, Pentaerythritol tetranitrate, Isosorbide dinitrate, Dipyridamole. <b>Calcium channel blockers:</b> Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.                                                                                                                                                                              |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| b    | <b>Diuretics:</b><br><b>Carbonic anhydrase inhibitors:</b> Acetazolamide, Methazolamide, Dichlorophenamide.<br><b>Thiazides:</b> Chlorthiazide, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide<br><b>Loop diuretics:</b> Furosemide, Bumetanide, Ethacrynic acid.<br><b>Potassium sparing Diuretics:</b> Spironolactone, Triamterene, Amiloride.<br><b>Osmotic Diuretics:</b> Mannitol                                                                                      |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| c    | <b>Anti-hypertensive Agents:</b><br><b><math>\alpha</math> blockers-</b> Prazosin, Terazosin<br><b><math>\beta</math> blockers-</b> Propranolol, Timolol, Atenolol<br><b>ACE inhibitors-</b> Captopril, Lisinopril, Enalapril, Quinapril hydrochloride<br><b>Angiotensin II receptor antagonists-</b> Losartan, Telmisartan, Valsartan<br><b>Misc.class-</b> Methyl dopate hydrochloride, Clonidine hydrochloride, Guanethidine monosulphate, Reserpine, Hydralazine hydrochloride. |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|      | [Isosorbide dinitrate, Nifedipine, Chlorthiazide, Furosemide, Lisinopril, Atenolol]                                                                                                                                                                                                                                                                                                                                                                                                 |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3    | <b>Drugs acting on cardiovascular system (Continued)</b>                                                                                                                                                                                                                                                                                                                                                                                                                            | 07    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |



|              |                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                                                                      |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------|
| <b>a</b>     | <b>Anti-arrhythmic Drugs:</b> Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcanide hydrochloride, Amiodarone, Sotalol.                                                                                                                                                        |           | chemistry-<br>A.I.Vogel.<br>11. An<br>Introduction to<br>Medicinal<br>Chemistry by<br>Graham Patrick |
| <b>b</b>     | <b>Anti-hyperlipidemic agents</b><br><b>HMG Co-A reductase inhibitors:</b> Lovastatin, Simvastatin, Atorvastatin<br><b>Misc. class-</b> Ezetimibe, Clofibrate                                                                                                                                                                                                                                            |           |                                                                                                      |
| <b>c</b>     | <b>Coagulant &amp; Anticoagulants:</b> Menadione, Warfarin, Clopidogrel                                                                                                                                                                                                                                                                                                                                  |           |                                                                                                      |
| <b>d</b>     | <b>Drugs used in Congestive Heart Failure:</b> Digoxin, Digitoxin, Nesiritide, Bosentan                                                                                                                                                                                                                                                                                                                  |           |                                                                                                      |
|              | <b>[Amiodarone, Atorvastatin]</b>                                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                      |
| <b>4</b>     | <b>Drugs acting on Endocrine system</b>                                                                                                                                                                                                                                                                                                                                                                  |           | 07                                                                                                   |
| <b>a</b>     | <b>Chemistry, Nomenclature, Stereochemistry and metabolism of steroids</b>                                                                                                                                                                                                                                                                                                                               |           |                                                                                                      |
| <b>b</b>     | <b>Sex hormones:</b> Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.                                                                                                                                                                                                                                                                                       |           |                                                                                                      |
| <b>c</b>     | <b>Drugs for erectile dysfunction:</b> Sildenafil, Tadalafil                                                                                                                                                                                                                                                                                                                                             |           |                                                                                                      |
| <b>d</b>     | <b>Oral contraceptives:</b> Mifepristone, Norgestril, Levonorgestrol                                                                                                                                                                                                                                                                                                                                     |           |                                                                                                      |
| <b>e</b>     | <b>Corticosteroids:</b> Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone                                                                                                                                                                                                                                                                                                            |           |                                                                                                      |
| <b>f</b>     | <b>Thyroid and antithyroid drugs:</b> L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.                                                                                                                                                                                                                                                                                                           |           | 09                                                                                                   |
| <b>5</b>     | <b>Antidiabetic agents and Local anaesthetics</b>                                                                                                                                                                                                                                                                                                                                                        |           |                                                                                                      |
| <b>a</b>     | <b>Antidiabetic agents: Insulin and its preparations</b><br><b>Sulfonyl ureas:</b> Tolbutamide, Chlorpropamide, Glipizide, Glimepiride.<br><b>Biguanides:</b> Metformin.<br><b>Meglitinides:</b> Repaglinide, Nateglinide.<br><b>Glucosidase inhibitors:</b> Acarbose, Voglibose.<br><b>DPP IV inhibitors</b> -Sitagliptin, Teneligliptin<br><b>SGLT2 inhibitors</b> – Empagliflozin, Canagliflozin      |           |                                                                                                      |
| <b>b</b>     | <b>Local Anesthetics:</b> SAR of Local anesthetics<br><b>Benzoic Acid derivatives;</b> Meprylcaine, Cyclomethycaine, Piperocaine.<br><b>Amino Benzoic acid derivatives:</b> Benzocaine, Procaine, Butacaine, Propoxycaine, Tetracaine.<br><b>Lidocaine/Anilide derivatives:</b> Lignocaine, Mepivacaine, Prilocaine, Etidocaine.<br><b>Miscellaneous:</b> Phenacaine<br><b>[Tolbutamide, Benzocaine]</b> |           | 02                                                                                                   |
| <b>6</b>     | <i>Introduction and basic concepts of Nucleic acids and proteins as drug targets. (Macromolecules as Drug Targets)</i>                                                                                                                                                                                                                                                                                   |           |                                                                                                      |
| <b>TOTAL</b> |                                                                                                                                                                                                                                                                                                                                                                                                          | <b>45</b> |                                                                                                      |

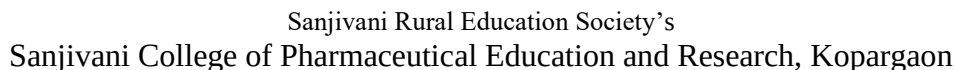
**Reference Books (Latest Editions to be adopted):**

**Reference Books:**

1. Molecular Medicine: An Introduction., Jens Kurreck.
2. Molecular Modelling: Principles and Applications, by Andrew Leach

**Text Books:**

1. Medicinal Chemistry: An Introduction, by Gareth Thomas



**(THEORY 45 HOURS)**

|                        |                                 |
|------------------------|---------------------------------|
| <b>Teaching Scheme</b> | <b>Examination Scheme:</b>      |
| Lectures: 04Hr/Week    | In SEM Exam:25 Marks            |
| Practical:             | End SEM Exam:75 Marks           |
| Tutorials: 00Hr/Week   | Continuous Assessment: 10 Marks |
| Credits: 4             | Total Marks: 100 Marks          |

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality
4. Students will know about various considerations in development of pharmaceutical dosage forms.
5. Study the basic elements of metrology.

| CO's | Course Outcomes                                                                                                                                            | Bloom Taxonomy |                                     |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------|
|      |                                                                                                                                                            | Level          | Descriptor                          |
| CO 1 | To recall the knowledge of preformulation studies for dosage form development and its applications                                                         | 2,3,4          | Evaluate, analyze, apply            |
| CO 2 | To prepare and coat tablets, capsules and pellets by various equipment and further they can evaluate in process and final product quality control.         | 1,4,6          | Create, apply, understand           |
| CO 3 | Summarize the preparation of parenteral and ophthalmic preparations and also can plan the selection of packing materials with their official requirements. | 2,3,5          | Evaluate, analyze                   |
| CO 4 | Design formulations and manufacturing of liquid orals like suspensions and emulsions                                                                       | 3,4,5          | Analyze, apply, understand          |
| CO 5 | Know the various pharmaceutical cosmetic products and their manufacturing techniques                                                                       | 4,5,6          | Analyze, apply, remember            |
| CO 6 | Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality                                                                     | 1,2,4, 5       | Create, evaluate, apply, understand |

[illegible]



## COURSE CONTENTS

RED –Least importance

Green –New Addition

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Hours                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1    | <ul style="list-style-type: none"> <li>Preformulation Studies:                     <p>Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. a. Physical properties: Physical form (crystal &amp; amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization</p> <p>BCS classification of drugs &amp; its significant Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.</p> <p>Pharmaceutical Calculations</p> <p>History of metrology, Introduction to metrology, fundamentals of metrology</p> </li> </ul> | 07<br><br><br><br><br><br><br>(+3) |
| 2    | <ul style="list-style-type: none"> <li>Tablets:                     <p>a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling.</p> <p>b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.</p> <p>c. Quality control tests: In process and finished product tests</p> <p>d. Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia</p> </li> </ul>                                                                                             | 10                                 |
| 3    | <ul style="list-style-type: none"> <li>Capsules                     <p>a. <b>Hard gelatin capsules:</b> Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.</p> <p>b. <b>Soft gelatin capsules:</b> Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.</p> <p>c. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets.</p> </li> </ul>                    | 08                                 |
| 4    | <ul style="list-style-type: none"> <li>Parenteral Products:                     <p>a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity</p> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10                                 |



**Reference Books (Latest Editions to be adopted):**

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B. Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman 3
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E. Aulton, Churchill Livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C. Ansel, Lea & Febiger, Philadelphia, 5th edition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.



(THEORY 45 HOURS)

**Teaching Scheme**

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

**Examination Scheme:**

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

**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

**Course Objectives:**

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

**Upon completion of the course a student shall be able to understand -**

•

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                                                                                                                                                | Bloom Taxonomy |            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|
|      |                                                                                                                                                                                                                                                                                                                | Level          | Descriptor |
| CO 1 | <b>Pharmacology of drugs given for congestive heart failure,</b> hypertension, angina, arrhythmia and hyperlipidemia                                                                                                                                                                                           | 1              | Apply      |
| CO 2 | <b>Pharmacology of drugs acting on cardiovascular system</b> Pharmacology of hematinics, coagulants and anticoagulants, fibrinolytics, anti-platelet drugs, plasma volume expanders, <b>Pharmacology of drugs acting on urinary system</b> diuretics, antidiuretics and drugs given for shock,                 | 2              | Apply      |
| CO 3 | <b>Autacoids and related drugs</b> Classification of autocoids and pharmacology of histamine, 5-HT and their antagonists, Prostaglandins, Thromboxanes, Leucotrienes, Angiotensin, Bradykinin, Substance P, Non-steroidal anti-inflammatory agents, Anti-gout drugs, Antirheumatic drugs                       | 3              | Apply      |
| CO 4 | <b>Pharmacology of drugs acting on endocrine system</b> Basic concepts in endocrine pharmacology and pharmacology of the analogues and inhibitors of anterior Pituitary hormones, thyroid hormones, parathormone, calcitonin, Vitamin-D, insulin, oral hypoglycemic agents, glucagon, ACTH and corticosteroids | 3              | Apply      |
| CO 5 | <b>Pharmacology of drugs acting on endocrine system</b> Pharmacology of Androgens, Anabolic steroids, estrogens, progesterone, oral contraceptives and drugs acting on the uterus.                                                                                                                             | 3              | Apply      |
| CO 6 | <b>Bioassay</b> Introduction to bioassay and bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT                                                                                                                                                                   | 3              | Apply      |



### Mapping of Course Outcomes to Program Outcomes:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO2 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO3 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO4 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO5 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO6 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |

### COURSE CONTENTS

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                       | Hours     |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1    | <b>Pharmacology of drugs acting on cardio vascular system</b> a. Introduction to hemodynamic and electrophysiology of heart. <b>Causes of cardiovascular diseases</b> b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic.                                                                          | 10        |
| 2    | <b>Pharmacology of drugs acting on cardio vascular system</b> a. Drug used in the therapy of shock. b. Hematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders <b>Haemostatic agents</b><br><b>Pharmacology of drugs acting on urinary system</b> a. Diuretics b. Anti-diuretics.                                                      | 10        |
| 3    | <b>Autocoids and related drugs</b> a. Introduction to autocoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Antirheumatic drugs                                                                                | 10        |
| 4    | <b>Pharmacology of drugs acting on endocrine system</b> 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 d. Insulin, Oral Hypoglycemic agents and glucagon. e. ACTH and corticosteroids. | 8         |
| 5    | <b>Pharmacology of drugs acting on endocrine system</b> a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus.<br><b>Bioassay</b> a. Principles and applications of bioassay. b. Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT                         | 7         |
|      | <b>TOTAL</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>45</b> |



**Reference Books (Latest Editions to be adopted):**

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 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,



## BP504T - PHARMACOGNOSY AND PHYTOCHEMISTRY II

(Theory) 45 Hours

**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 course, the student shall be able

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 carry out isolation and identification of phytoconstituents

### Course Outcomes:

| CO's | Course Outcomes                                                                                                                                                         | Bloom Taxonomy |                          |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------|
|      |                                                                                                                                                                         | Level          | Descriptor               |
| CO 1 | To understand the metabolic pathway in higher plants and their biogenetic studies.                                                                                      | 2              | Apply                    |
| CO 2 | To understand pharmacogenetic study of secondary metabolites like alkaloids, glycosides, tannins, volatile oils etc,                                                    | 3              | Explain ideas or concept |
| CO 3 | To demonstrate the different types and steps involved in isolation, identification and analysis of Phytoconstituents like terpenoids, glycosides, alkaloids and resins. | 3              | Apply                    |
| CO 4 | To understand the industrial production, estimation and utilization of Phytoconstituents.                                                                               | 2              | Apply                    |
| CO 5 | To assess the crude drug by modern methods of extraction, spectroscopy, chromatography, isolation and purification.                                                     | 1              | To understand and use    |
| CO 6 | To outline the metabolic pathway in higher plants and their biogenetic studies.                                                                                         | 2              | Apply                    |

### Mapping of Course Outcomes to Program Outcomes:

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 2   | 2   | 3   |     |     |     |     | 2   | 2    | 3    |
| CO2 | 3   |     | 1   |     |     |     |     |     | 1   |      | 3    |
| CO3 | 3   |     | 1   | 3   |     |     |     |     | 2   |      | 3    |
| CO4 | 3   |     |     | 2   |     |     |     |     | 2   |      | 3    |
| CO5 | 3   |     | 1   | 2   |     |     |     |     | 2   |      | 3    |
| CO6 | 3   |     | 1   | 2   |     |     |     |     | 2   |      | 3    |

Low-1, Medium-2, High-3



### COURSE CONTENTS

| Unit         | Chapter/Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Duration (hrs) |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1            | <b>Unit I</b><br><b>Metabolic pathways in higher plants and their determination</b><br>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.<br>b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.                                                                                                                                                                                                                                                                                                                                                                       | 07 hr.         |
| 2            | <b>UNIT-II</b><br>General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:<br><b>Alkaloids:</b> Vinca, Rauwolfia, Belladonna, Opium.<br><b>Phenylpropanoids &amp; Flavonoids:</b> Lignans, Tea, Ruta<br><b>Steroids, Cardiac Glycosides &amp; Triterpenoids:</b> Liquorice, Dioscorea, Digitalis<br><b>Volatile oils:</b> Mentha, Clove, Cinnamon, Fennel, Coriander,<br><b>Tannins:</b> Catechu, Pterocarpus<br><b>Resins:</b> Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony<br><b>Glycosides:</b> Senna, Aloes, Bitter Almond<br><b>Iridoids, Other terpenoids &amp; Naphthoquinones:</b> Gentian, Artemisia, taxus, carotenoids | 14 hr.         |
| 3            | <b>UNIT-III</b><br>Isolation, Identification and Analysis of Phytoconstituents<br>a) <b>Terpenoids:</b> Menthol, Citral, Artemisin<br>b) <b>Glycosides:</b> Glycyrrhetic acid & Rutin<br>c) <b>Alkaloids:</b> Atropine, Quinine, Reserpine, Caffeine<br><b>Resins:</b> Podophyllotoxin, Curcumin<br><b>Isolation methods of natural product with special emphasis on marine plants and microorganisms</b>                                                                                                                                                                                                                                                                                                                                       | 06 hrs         |
| 4            | <b>UNIT-IV</b><br><b>1. Industrial production, estimation and utilization of the following phytoconstituents:</b> Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine<br><b>Commercialization and Industrialization of Medicinal plants</b>                                                                                                                                                                                                                                                                                                                                                                                                                          | 10 hrs         |
| 5            | <b>UNIT-V</b><br><b>Basics of Phytochemistry</b><br><b>Modern methods of extraction</b> , application of latest techniques like Spectroscopy, chromatography & electrophoresis in the isolation, purification and identification of crude drugs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 08 hrs         |
| <b>Total</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>45</b>      |

#### Books

1. Dr. Pulok K. Mukherjee, Quality control of herbal drugs, Horizons Business publisher, New Delhi.
2. Verro E. Tyeler, Lynn R Brady and James E Robbers, Pharmacognosy, Wolters Kluwer Pvt. Ltd.



3. William C. Evans and Daphene Evans, Trease and Evans, Pharmacognosy, Elsevier science publication
4. T. E. Wallis, Text book of pharmacognosy, CBS publisher, New Delhi.
5. Dr. V.D. Rangari, Pharmacognosy and phytochemistry, Career publication Vol. I
6. Dr. V.D. Rangari, Pharmacognosy and phytochemistry, Career publication Vol. II
7. Dr. Ashutosh Kar, Pharmacognosy and pharmacobiotechnology, New age international publisher Ltd., New Delhi.
8. C.K. Kokate, A.P. Purohit and S.B. Gokhale, Pharmacognosy, Nirali Publication.
9. Shah and Quadry's Pharmacognosy, B.S. Shah Prakashan, Ahmedabad.



**SUBJECT: BP505T. Pharmaceutical Jurisprudence (Theory)**  
**(THEORY 45 HOURS)**

**Teaching Scheme**

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

**Examination Scheme:**

In SEM Exam:25 Marks

End SEM Exam:75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

**Scope:** This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

**Objectives:** Upon completion of the course, the student shall be able to understand:

1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian Pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

**Course Outcomes:**

| CO's | Course Outcomes                                                                  | Bloom Taxonomy |                          |
|------|----------------------------------------------------------------------------------|----------------|--------------------------|
|      |                                                                                  | Level          | Descriptor               |
| CO 1 | To understand basic principles, purpose and dimensions of the laws               | 2              | Apply                    |
| CO 2 | To understand the significance and relevance of Pharmaceutical laws in India     | 3              | Explain ideas or concept |
| CO 3 | To study important rules and regulations and procedures made to execute the laws | 3              | Apply                    |
| CO 4 | To explain the definitions in the Act                                            | 2              | Apply                    |
| CO 5 | To study administrative bodies                                                   | 1              | To understand and use    |
| CO 6 | To study concept of IPR and Regulatory Affairs                                   | 2              | Apply                    |

**Mapping of Course Outcomes to Program Outcomes:**

|                                                                                              | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|----------------------------------------------------------------------------------------------|-----|------|------|------|------|------|------|------|------|-------|-------|
| <b>CO1:</b> To understand basic principles, purpose and dimensions of the laws               | 3   | 1    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |
| <b>CO2:</b> To understand the significance and relevance of Pharmaceutical laws in India     | 3   | 0    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |
| <b>CO3:</b> To study important rules and regulations and procedures made to execute the laws | 3   | 0    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |
| <b>CO4:</b> To explain the definitions in the Act                                            | 3   | 0    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |
| <b>CO5:</b> To study administrative bodies                                                   | 3   | 1    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |
| <b>CO6:</b> To study concept of IPR and Regulatory Affairs                                   | 3   | 1    | 1    | 0    | 0    | 1    | 1    | 2    | 2    | 0     | 3     |



### COURSE CONTENTS

| Unit | Chapter/Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Duration (hrs) |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1    | <b>UNIT-I</b><br><b>Drugs and Cosmetics Act, 1940 and its rules 1945:</b><br>Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.                                                                                                                                                                                                                                                                                                                                                                        | 10             |
| 2    | <b>Drugs and Cosmetics Act, 1940 and its rules 1945.</b><br>Detailed study of Schedule G, H, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA)<br>Sale of Drugs – Wholesale, Retail sale and restricted license. Offences and penalties Labeling & packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.<br>Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors                                                                                                                                                                                                                                                                                                                         | 10             |
| 3    | <b>Pharmacy Act –1948:</b> Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and 122 Penalties<br><b>Medicinal and Toilet Preparation Act –1955:</b> Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.<br><b>Narcotic Drugs and Psychotropic Substances Act-1985 and Rules:</b> Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties | 10             |
|      | <b>Study of Salient Features of Drugs and Magic Remedies Act and its rules:</b> Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties<br><b>Prevention of Cruelty to animals Act-1960:</b> Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties<br><b>National Pharmaceutical Pricing Authority:</b> Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)                                                                                                                    | 8              |
| 5    | <b>Pharmaceutical Legislations – A brief review,</b> Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee<br><b>Code of Pharmaceutical ethics</b> Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath<br><b>Medical Termination of Pregnancy Act, Right to Information, Introduction to IPR</b><br>Standard Institution and Regulatory, Authorities Bureau of Indian Standards (BIS), ISO (International Organization for Standardization) (10% 3 Hrs)                                                                                                                                                                                                                                                                                                                                                             | 7              |



**BP506P SUBJECT: Industrial Pharmacy-I  
(Practical 45 HOURS)**

**Teaching Scheme**

Lectures: 00Hr/Week

Practical: 4 Hr/Week

Tutorials: 00Hr/Week

Credits: 4

**Examination Scheme:**

In SEM Exam: 15 Marks

End SEM Exam: 35 Marks

Continuous Assessment: 00 Marks

Total Marks: 50 Marks

**Scope**

Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

**Course Objectives:**

**Upon completion of the course a student shall be able to understand:**

1. Illustrate various pharmaceutical dosage forms and their manufacturing techniques.
2. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality
3. To know what are defects and errors in pharma manufacturing and how to overcome it practically
4. Learn labeling and documentation procedures followed in pharma manufacturing.

**Course Outcomes:**

| CO's | Course Outcomes                                                         | Bloom Taxonomy |               |
|------|-------------------------------------------------------------------------|----------------|---------------|
|      |                                                                         | Level          | Descriptor    |
| CO 1 | To describe various terms under IP-I practical.                         | 1              | Remembering   |
| CO 2 | To examine powders for preformulation test for different drugs.         | 4              | Analyzing     |
| CO 3 | To formulate different dosage forms as per given procedures.            | 6              | Creating      |
| CO 4 | To evaluate dosage forms and glassware's as per IP specifications.      | 5              | Evaluating    |
| CO 5 | To develop new formula from given master formula and BMR/ MFR document. | 3              | Applying      |
| CO 6 | To demonstrate the aerosol system and pan coating method.               | 2              | Understanding |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 2   | 1   | -   | 2   | -   | -   | 2   | 1   | -    | 1    |
| CO2 | 2   | 3   | 2   | 1   | 1   | -   | -   | 2   | 1   | -    | 1    |
| CO3 | 2   | 3   | 2   | 1   | 1   | -   | -   | 2   | 1   | -    | 1    |
| CO4 | 2   | 3   | 2   | 1   | 1   | -   | -   | 2   | 1   | -    | 1    |
| CO5 | 2   | 3   | 2   | 1   | 1   | -   | -   | 2   | 1   | -    | 1    |
| CO6 | 2   | 3   | 2   | 1   | 1   | -   | -   | 2   | 1   | -    | 1    |



## COURSE CONTENTS

RED –Least importance

Green –New Addition

| Unit | Details                                                     | Hours |
|------|-------------------------------------------------------------|-------|
| 1    | Preformulation of Paracetamol/Aspirin Drug                  | 4     |
| 2    | To prepare, evaluate label and submit Paracetamol granules. | 4     |
| 3    | To prepare, evaluate label and submit Paracetamol Tablet    | 4     |
| 4    | To prepare, evaluate label and submit Aspirin granules.     | 4     |
| 5    | To prepare, evaluate label and submit Aspirin Tablet.       | 4     |
| 6    | To perform film coating on tablet using pan coater.         | 4     |
| 7    | To evaluate marketed tablet.                                | 4     |
| 8    | To prepare evaluate and submit Tetracycline capsule.        | 4     |
| 9    | To prepare label evaluate and submit Vanishing cream        | 4     |
| 10   | To prepare label evaluate and submit Cold cream.            | 4     |
| 11   | To prepare evaluate and submit Calcium gluconate injection  | 4     |
| 12   | To prepare evaluate and submit Ascorbic acid injection      | 4     |
| 13   | To prepare label and submit eye drop.                       | 4     |
| 14   | To perform evaluation of glass container (as per IP)        | 4     |
| 15   | Documentation- BMR & MFR                                    | 4     |
| 16   | Demonstration of Aerosol System.                            | 4     |

### Reference Books:

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger,Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition,Marcel Dekker Series, Vol 107.
10. Indian Pharmacopoeia. 2018 edition.



**BP507P PHARMACOLOGY II (Practical)**  
**4 Hours / Week**  
**(PRACTICAL 60 HOURS)**

**Teaching Scheme**

Lectures:  
Practical: 04Hr/Week  
Tutorials:  
Credits: 2

**Examination Scheme:**

In SEM Exam:15 Marks  
End SEM Exam:35 Marks  
Continuous Assessment:  
Total Marks: 50 Marks

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                                                                                                  | Bloom Taxonomy |                                |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------------|
|      |                                                                                                                                                                                                                                                                  | Level          | Descriptor                     |
| CO 1 | Introduction to in-vitro pharmacology and physiological salt solutions, effect of drugs on isolated frog heart and effect of drugs on blood pressure and heart rate of dog                                                                                       | 1              | Recall facts and basic concept |
| CO 2 | Study of diuretic activity of drugs using rats/mice, DRC of acetylcholine using frog rectus abdominis muscle and effect of physostigmine and atropine on DRC of acetylcholine using frog rectus                                                                  | 2              | Explain ideas or concept       |
| CO 3 | Bioassay of histamine using guinea pig ileum by matching method, bioassay of oxytocin using rat uterine horn by interpolation method and bioassay of acetylcholine using rat ileum/colon by four-point bioassay, dose calculation in pharmacological experiments | 3              | Apply                          |
| CO 4 | determination of PA2 value of prazosin using rat anococcygeus muscle (by Schilds plot method) and determination of PD2 value using guinea pig ileum                                                                                                              | 3              | Apply                          |
| CO 5 | Effect of spasmogens and spasmolytics using rabbit jejunum                                                                                                                                                                                                       | 3              | Apply                          |
| CO 6 | Anti-inflammatory activity of drugs using carrageenan induced paw-edema model, analgesic activity using hot plate method, antiallegic activity by mast cell stabilization assay, clinical Case study                                                             | 3              | Apply                          |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO2 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO3 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO4 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO5 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO6 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |



### COURSE CONTENT

1. Introduction to in-vitro pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate 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. Dose calculation in pharmacological experiments.
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 using hot plate method
16. Antiallergic activity by mast cell stabilization assay
17. Clinical case study

### Reference Books (Latest Editions to be adopted):

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
2. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.
3. Goyal RK. Practicals in Pharmacology, BS Shaha Prakashan.
4. Kasture SB. A handbook of experiments in pre-clinical pharmacology, Career Publications.
5. Bikas Medhi, Ajay Prakash. Practical Manual of Experimental and Clinical Pharmacology. Jaypee Publications.

**Note:** we feel that above bioassay Practicals using isolated tissue preparations like goat tracheal chain need to be done along with using simulation software for clarifying theoretical aspects



**BP508P. Pharmacognosy and Phytochemistry-II (Practical)**  
**4 Hours / Week**

**Teaching Scheme**

Lectures:  
Practical: 04Hr/Week  
Tutorials:  
Credits: 2

**Examination Scheme:**

In SEM Exam:15 Marks  
End SEM Exam:35 Marks  
Continuous Assessment:  
Total Marks: 50 Marks

**Scope**

The subject involves the fundamentals of Pharmacognosy and phytochemistry-I like chemical test, leaf const, microscopic particle size measurement, ash value, extractive value, moisture content

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

1. To perform extraction of drug
2. To perform isolation and detection of phytoconstituent
3. To perform chemical test
4. Able to detect phytoconstituent by TLC
5. Able to analyze phytoconstituent by chemical reaction
6. To perform or analyses by HPTLC

**Course Outcomes:**

| CO's | Course Outcomes                                        | Bloom Taxonomy |                                |
|------|--------------------------------------------------------|----------------|--------------------------------|
|      |                                                        | Level I        | Descriptor                     |
| CO 1 | To perform macroscopy and microscopy of drug           | 1              | Recall facts and basic concept |
| CO 2 | To perform isolation and detection of phytoconstituent | 3              | Apply                          |
| CO 3 | To separate sugar by chromatography                    | 3              | Apply                          |
| CO 4 | To perform isolation of volatile oil by distillation   | 3              | Apply                          |
| CO 5 | To perform TLC                                         | 2              | Apply                          |
| CO 6 | To perform chemical tests                              | 2              | Explain ideas or concept       |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   |     |     |     |     |     |     |     |     |      | 3    |
| CO2 | 3   |     |     | 2   |     |     |     |     |     |      | 3    |
| CO3 | 3   |     |     | 2   |     |     |     |     |     |      | 3    |
| CO4 | 3   |     |     |     |     |     |     |     |     |      | 3    |
| CO5 | 3   |     |     |     |     |     |     |     |     |      | 3    |
| CO6 | 3   |     |     | 2   |     |     |     |     |     |      | 3    |



### COURSE CONTENT

| Sr. No. | Name of Experiment                                                                                          | Duration |
|---------|-------------------------------------------------------------------------------------------------------------|----------|
| 1.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Cinnamon</b>               | 4        |
| 2.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Cinchona</b>               | 4        |
| 3.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Senna,</b>                 | 4        |
| 4.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Clove,</b>                 | 4        |
| 5.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Ephedra</b>                | 4        |
| 6.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Fennel</b>                 | 4        |
| 7.      | Morphology, histology and powder characteristics & extraction & detection of: <b>Coriander</b>              |          |
| 8.      | Exercise involving isolation & detection of active principles<br><b>Caffeine - from tea dust.</b>           | 4        |
| 9.      | <b>Diosgenin from Dioscorea</b>                                                                             | 4        |
| 10.     | <b>Atropine from Belladonna</b>                                                                             | 4        |
| 11.     | <b>Sennosides from Senna</b>                                                                                | 4        |
| 12.     | Separation of sugars by Paper chromatography                                                                | 4        |
| 13.     | <b>HPTLC of herbal extract</b>                                                                              | 4        |
| 14.     | Distillation of volatile oils and detection of phytoconstituents by TLC                                     | 4        |
| 15.     | Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh | 4        |

#### Books

1. Dr. K.R. Khandelwal, Practical pharmacognosy (technique and experiment), Nirali Prakashan
2. Dr. V.D. Rangari, Pharmacognosy and phytochemistry, Career publication Vol. I
3. Dr. V.D. Rangari, Pharmacognosy and phytochemistry, Career publication Vol. II
4. L. W. Doner, U.S. Department of Agriculture, Agricultural Research Service, Eastern Regional Research Center, 600 E. Mermaid Lane, Wyndmoor, PA 19038, USA



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

# **SYLLABUS OF THIRD YEAR B. PHARMACY**

# **SEMESTER VI**

**W.E.F. 2024-25**



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**SUBJECT: BP601T. MEDICINAL CHEMISTRY III  
(THEORY 45 HOURS)**

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**Teaching Scheme**

Lectures: 03Hr/Week

Practical: -

Tutorials: 01Hr/Week

Credits: 4

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**Examination Scheme:**

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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**Scope:**

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

**Course Objectives:**

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

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Appreciate and understand the importance of SAR of drugs

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                      | Bloom Taxonomy |                             |
|------|----------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------|
|      |                                                                                                                      | Level          | Descriptor                  |
| CO 1 | To remember the classification and nomenclature of drugs of natural and synthetic origin                             | 1              | Understand, Remember        |
| CO 2 | To describe the concept of prodrugs and their importance                                                             | 2              | Remember, Understand, Apply |
| CO 3 | To identify the mechanism of action and therapeutic uses of drugs                                                    | 3              | Understand                  |
| CO 4 | To understand the relationship between structure of compound and its biological activity                             | 3              | Understand, Remember        |
| CO 5 | To select the synthetic route for selected category of drugs                                                         | 3              | Understand, Remember        |
| CO 6 | To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry | 3              | Understand, Remember        |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 1   | 2   | -   | 1   | -   | -   | -   | 2    | 2    |
| CO2 | 3   | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1    | 1    |
| CO3 | 3   | 1   | 1   | 2   | -   | 1   | -   | -   | 2   | 1    | 1    |
| CO4 | 3   | 1   | 1   | 2   | -   | 1   | 2   | -   | 1   | 1    | 1    |
| CO5 | 2   | -   | 1   | 1   | -   | 1   | 2   | -   | 1   | 1    | 1    |
| CO6 | 3   | -   | 1   | 3   | 1   | 1   | -   | -   | 1   | 1    | 1    |



### COURSE CONTENTS

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Hours | References                                                                                                                                                                                                                                                         |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | 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 by (*).                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |                                                                                                                                                                                                                                                                    |
| I    | <p>Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.</p> <p><b>a) <math>\beta</math>-Lactam antibiotics:</b> Penicillins, Cephalosporins, <math>\beta</math>-Lactamase inhibitors, Monobactams</p> <p><b>b) Aminoglycosides:</b> Streptomycin, Neomycin, Kanamycin</p> <p><b>c) Tetracyclines:</b> Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline</p>                                                                                                                                                                                                   | 10    | <ul style="list-style-type: none"> <li>• Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.</li> <li>• Foye's Principles of Medicinal Chemistry</li> <li>• Graham L. Patrick's An Introduction to Medicinal Chemistry Seventh Edition</li> </ul> |
| II   | <p><b>a) Antibiotics Macrolide:</b> Erythromycin, Clarithromycin, Azithromycin. Polypeptide antibiotics-Vancomycin, Bacitracin Miscellaneous: Chloramphenicol*, Clindamycin, Linzolid</p> <p><b>b) Antimalarials:</b> Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.</p> <p><b>Biguanides and dihydrotriazines:</b> Cycloguanil pamoate, Proguanil.</p> <p><b>Miscellaneous:</b> Pyrimethamine, Artesunate, Artemether, Atovaquone, Halofantrine, Lumefantrine.</p>                                                                                                                                           | 7     | <ul style="list-style-type: none"> <li>• Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.</li> <li>• Foye's Principles of Medicinal Chemistry</li> <li>• Graham L. Patrick's An Introduction to Medicinal Chemistry Seventh Edition</li> </ul> |
| III  | <p><b>Anti-tubercular Agents Synthetic anti tubercular agents:</b> Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid. *</p> <p><b>Anti-tubercular antibiotics:</b> Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate.</p> <p><b>Urinary tract anti-infective agents Quinolones:</b> SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.</p> <p><b>Antiviral agents:</b> Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine,</p> | 8     | <ul style="list-style-type: none"> <li>• Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.</li> <li>• Foye's Principles of Medicinal Chemistry</li> <li>• Graham L. Patrick's An Introduction to Medicinal Chemistry Seventh Edition</li> </ul> |



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**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                                                                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                                                                                                                                                                                                                                                                    |
| IV | <p><b>Antifungal agents:</b></p> <p><b>Antifungal antibiotics:</b> Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.</p> <p><b>Anti-protozoal Agents:</b> Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.</p> <p><b>Anthelmintics:</b> Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.</p> <p><b>Sulphonamides and Sulfones</b></p> <p>Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.</p> <p><b>Folate reductase inhibitors:</b> Trimethoprim*, Cotrimoxazole.</p> <p><b>Sulfones:</b> Dapsone*</p> | 8         | <ul style="list-style-type: none"> <li>• Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.</li> <li>• Foye's Principles of Medicinal Chemistry</li> <li>• Graham L. Patrick's An Introduction to Medicinal Chemistry Seventh Edition</li> </ul> |
| V  | <p><b>Introduction to Drug Design</b></p> <p>Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.</p> <p><b>Combinatorial Chemistry:</b> Concept and applications chemistry: solid phase and solution phase synthesis.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 7         | <ul style="list-style-type: none"> <li>• Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.</li> <li>• Burger's Medicinal Chemistry, Vol I to IV.</li> <li>• Introduction to principles of drug design- Smith and Williams.</li> </ul>           |
|    | <b>TOTAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>45</b> |                                                                                                                                                                                                                                                                    |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**SUBJECT: BP602T PHARMACOLOGY III**  
**(THEORY 45 HOURS)**

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**Teaching Scheme**

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

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**Examination Scheme:**

In SEM Exam:25 Marks

End SEM Exam:75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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**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 respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and chrono pharmacology

**Course Objectives:**

1. Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases 2. comprehend the principles of toxicology and treatment of various poisonings and 3. appreciate correlation of pharmacology with related medical sciences.

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                       | Bloom Taxonomy |            |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|
|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Level          | Descriptor |
| CO 1 | <b>Pharmacology of drugs acting on Respiratory system</b> a. Anti -asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants<br><b>Pharmacology of drugs acting on the Gastrointestinal Tract</b> a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics. | 1              | Apply      |
| CO 2 | <b>Chemotherapy</b> a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycoside                                                                                                                                                                                                               | 2              | Apply      |
| CO 3 | <b>Chemotherapy</b> a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral agents e. Anthelmintics f. Antimalarial agents g. Antiamoebic agents                                                                                                                                                                                                                                                                            | 3              | Apply      |
| CO 4 | <b>Chemotherapy</b> a. Urinary tract infections and sexually transmitted diseases b. Chemotherapy of malignancy<br><b>Immunopharmacology</b> a. Immunostimulants b. Immunosuppressants<br>Protein drugs, monoclonal antibodies, targets drugs to antigens, biosimilars                                                                                                                                                                                | 3              | Apply      |
| CO 5 | <b>Principles of toxicology</b> a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.                                                      | 3              | Apply      |
| CO 6 | <b>Chronopharmacology</b> a. Definition of rhythm and cycles b) Biological clock and their significance leading to chronotherapy                                                                                                                                                                                                                                                                                                                      | 3              | Apply      |



**Sanjivani Rural Education Society'**  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO2 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO3 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO4 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO5 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO6 | 3   | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | 1    |

**COURSE CONTENTS**

| Unit         | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Hrs       |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1            | <b>Pharmacology of drugs acting on Respiratory system</b> a. Anti -asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants f. Pulmonary Surfactants<br><b>Pharmacology of drugs acting on the Gastrointestinal Tract</b> a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics. f. Liver Pharmacology g. Pharmacology of liver cirrhosis | 10        |
| 2            | <b>Chemotherapy</b> a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides                                                                                                                                                                                                                                                                                                | 10        |
| 3            | <b>Chemotherapy</b> a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral drugs e. Anthelmintics f. Antimalarial drugs g. Antiamoebic agents                                                                                                                                                                                                                                                                                                                                                                | 10        |
| 4            | <b>Chemotherapy</b> a. Urinary tract infections and sexually transmitted diseases. b. Chemotherapy of malignancy. c. Palliative care<br><b>Immunopharmacology</b> a. Immunostimulants b. Immunosuppressant c. Recombinant proteins (Hormones, ILs, GFs) d. Enzyme pharmacology e. Vaccine pharmacology<br>Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars.                                                                                                                                                   | 8         |
| 5            | <b>Principles of toxicology</b> a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.<br><b>Chronopharmacology</b> a. Definition of rhythm and cycles. b. biological clock and their significance leading to chronotherapy   | 7         |
| <b>TOTAL</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>45</b> |

**Reference Books (Latest Editions to be adopted):**

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 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
- Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert,



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopergaon**

**SUBJECT: BP603T. Herbal Drug Technology (Theory)**  
**(THEORY 45 HOURS)**

|                        |                                 |
|------------------------|---------------------------------|
| <b>Teaching Scheme</b> | <b>Examination Scheme:</b>      |
| Lectures: 03Hr/Week    | In SEM Exam:25 Marks            |
| Practical:             | End SEM Exam:75 Marks           |
| Tutorials: 01Hr/Week   | Continuous Assessment: 10 Marks |
| Credits: 4             | Total Marks: 100 Marks          |

**Scope:** The main purpose of subject is to impart the students the knowledge of how the secondary metabolites is 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 course, the student shall be

1. Able understand raw material as source of herbal drugs from cultivation to herbal drug product.
2. Able to know the WHO and ICH guidelines for evaluation of herbal drugs.
3. Able to know the herbal cosmetics, natural sweeteners, nutraceuticals.
4. Appreciate patenting of herbal drugs, GMP

**Course Outcomes:**

| CO's | Course Outcomes                                                                       | Bloom Taxonomy |                          |
|------|---------------------------------------------------------------------------------------|----------------|--------------------------|
|      |                                                                                       | Level          | Descriptor               |
| CO 1 | Learners are able to understand the source of raw material                            | 2              | Apply                    |
| CO 2 | Learners are able to understand the factor affecting on cultivation of raw material   | 3              | Explain ideas or concept |
| CO 3 | Learners are able to understand WHO and ICH guidelines for evaluation of herbal drugs | 3              | Apply                    |
| CO 4 | Learners should able to understand herbal cosmetics, Sweeteners, nutraceuticals       | 2              | Apply                    |
| CO 5 | Learner should able to understanding patenting of product                             | 1              | To understand and use    |
| CO 6 | Learner should able to understanding GMP of product                                   | 2              | Apply                    |

**Mapping of Course Outcomes to Program Outcomes:**

|                                                                                           | PO1      | PO 2     | PO 3     | PO 4     | PO 5     | PO 6     | PO 7 | PO 8 | PO 9     | PO 10    | PO 11    |
|-------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|------|------|----------|----------|----------|
| CO1- Learners are able to understand the source of raw material                           | 3        | 3        | 3        | 3        |          |          |      |      |          |          | 3        |
| CO2 Learners are able to understand the factor affecting on cultivation of raw material   | 3        | 3        | 3        | 3        |          |          |      |      | 2        | 2        | 3        |
| CO3 Learners are able to understand WHO and ICH guidelines for evaluation of herbal drugs | 3        | 3        | 3        | 3        |          |          |      |      |          |          | 3        |
| CO4 Learners should able to understand herbal cosmetics, Sweeteners, nutraceuticals       | 3        | 3        | 3        | 3        |          |          |      |      |          |          | 3        |
| CO5 Learner should able to understanding patenting of product                             | 3        | 2        | 2        | 3        | 2        | 2        |      |      |          |          | 3        |
| CO6 Learner should able to understanding GMP of product                                   | 3        | 3        | 3        | 3        |          |          |      |      |          | 2        | 3        |
| <b>Average</b>                                                                            | <b>3</b> | <b>3</b> | <b>3</b> | <b>3</b> | <b>2</b> | <b>2</b> |      |      | <b>2</b> | <b>2</b> | <b>3</b> |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**COURSE CONTENTS**

**BP603T Herbal Drug Technology**

**6<sup>h</sup> Semester**

| Unit | Chapter/Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Duration (hrs)  |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|      | <b>Unit I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>11 Hr</b>    |
| 1    | <b>Herbs as raw materials</b><br>Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation<br>Source of<br><b>Herbs Selection</b> , identification and <b>authentication of herbal materials</b> Processing of herbal raw material<br><b>Biodynamic Agriculture</b><br>Good agricultural practices in cultivation of medicinal plants including Organic farming.<br>Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.<br><b>Indian Systems of Medicine</b><br>a) Basic principles involved in <b>Ayurveda, Siddha, Unani and Homeopathy</b><br>b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.<br><b>Pharmacognosy in various systems of medicine:</b><br>Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.<br><b>Herbarium Preparation of herbarium sheets and their importance in authentication of plants.</b><br><b>Quantification of phytoconstituent from plant extract</b> |                 |
| 2    | <b>UNIT-II</b><br><b>Nutraceuticals</b><br>General aspects, Market, growth, scope and types of products available in the market.<br>Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.<br>Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina<br><b>Study of Omega-3-polyunsaturated fatty acids, Dietary fibers, Carotenoids, proanthocyanidins, and Resveratrol</b><br><b>Herbal-Drug and Herb-Food Interactions:</b> General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra                                                                                                                                                                                                                                                                                           | <b>7 Hours</b>  |
| 3    | <b>UNIT-III</b><br><b>Herbal Cosmetics</b><br>Market overview, Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.<br><b>Herbal excipients:</b><br>Market overview, Herbal Excipients – Significance of substances of natural origin as excipients                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>10 Hours</b> |



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|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|   | <p>– colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors &amp; perfumes.</p> <p><b>Herbal formulations:</b><br/> Market overview, Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |
| 4 | <p><b>UNIT- IV</b><br/> <b>Evaluation of Drugs</b> WHO &amp; ICH guidelines for the assessment of herbal drugs<br/> Stability testing of herbal drugs.<br/> <b>Patenting and Regulatory requirements of natural products:</b><br/> a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy<br/> b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma &amp; Neem.<br/> <b>Regulatory Issues</b> - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs &amp; Cosmetics Act for ASU drugs.<br/> <b>Other issues related to export of natural products</b> (such as CITES Certificate, DGFT Notification, Negative list of herbs, TRAFFIC)</p> | 12 Hrs   |
| 5 | <p><b>UNIT-V</b><br/> <b>General Introduction to Herbal Industry</b><br/> · Herbal drugs industry: Present scope and future prospects.<br/> · A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.<br/> <b>Schedule T – GoodManufacturing Practice of Indian systems of medicine</b><br/> Components of GMP (Schedule – T) and its objectives<br/> · Infrastructural requirements, working space, storage area, machinery and equipments,<br/> standard operating procedures, health and hygiene, documentation and records.</p>                                                                                                                                                                               | 05 Hours |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopergaon**

**SUBJECT: BP604T Biopharmaceutics & Pharmacokinetics  
(THEORY 45 HOURS)**

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**Teaching Scheme**

Lectures: 04Hr/Week

Practical:

Tutorials: 00Hr/Week

Credits: 4

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**Examination Scheme:**

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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**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.

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

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.
4. Understand various pharmacokinetic parameters, their significance & applications.
5. Therapeutic Drug Monitoring (TDM) enhances their clinical management practices.

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                | Bloom Taxonomy |                                                     |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------|
|      |                                                                                                                                                                                | Level          | Descriptor                                          |
| CO 1 | Comprehending the diverse concepts of biopharmaceutics and their uses in the creation of formulations                                                                          | 1,2,3,6        | Remembering, Understanding, Applying and Creating   |
| CO 2 | Examine pharmacokinetic processes and how they relate to dose form efficacy.                                                                                                   | 2,3,4,5        | Understanding, Applying, Analyzing and Evaluating   |
| CO 3 | Learn the concepts of bioavailability and bioequivalence studies                                                                                                               | 1,2,3,5        | Remembering, Understanding, Applying and Evaluating |
| CO 4 | Understand different non-compartmental analysis techniques and compartmental models.                                                                                           | 3,4,5,6        | Applying, Analyzing, Evaluating and Creating        |
| CO 5 | Recognize the idea, the mechanisms of dissolution, and the correlation between in vitro and in vivo.                                                                           | 3,4,5,6        | Applying, Analyzing, Evaluating and Creating        |
| CO 6 | Gaining an understanding of Compartmental analysis and TDM knowledge improves one's capacity to handle bio analytical data, which is increasingly crucial in clinical settings | 3,4,5,6        | Applying, Analyzing, Evaluating and Creating        |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 1   | -   | -   | -   | 2   | 2   | 1   | 2   | -    | 2    |
| CO2 | 3   | 1   | -   | 2   | -   | 2   | 2   | 1   | 2   | -    | 2    |
| CO3 | 3   | 1   | 2   | 2   | -   | 2   | 3   | 1   | 1   | -    | 2    |
| CO4 | 3   | 1   | 3   | 2   | -   | 1   | -   | 1   | 2   | -    | 2    |
| CO5 | 3   | 1   | 3   | 3   | -   | 1   | 1   | 1   | 2   | -    | 2    |
| CO6 | 3   | 1   | 3   | 2   | -   | 1   | 1   | 1   | 2   | -    | 2    |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaoon**

**COURSE CONTENTS**

| Unit         | Details                                                                                                                                                                                                                      | Hours     |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1            | • Biopharmaceutics –Absorption of Drugs from gastrointestinal tract, Drug Distribution and Drug Elimination                                                                                                                  | 12        |
| 2            | • Bioavailability and Bioequivalence – Objectives, Measurement, In vitro In vivo Correlations, Study Protocol ( Aim, Subject selection, single dose and Multiple Dose Study, Study Design, Interpretation of Data etc.)      | 08        |
| 3            | • Pharmacokinetics – Introduction, Compartment Modeling for OCOM (IV Bolus, IV infusion and Extravascular Administration) and Non Compartment analysis ( statistical moment theory, MRT for various model and PBPK model)    | 10        |
| 4            | • Multi-compartment Modeling - 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.         | 04        |
| 5            | • Nonlinear Pharmacokinetics: Introduction, Factors causing Non-linearity. Michaelis-menton method of estimating parameters, Explanation with example of drugs.                                                              | 06        |
| 6            | • Therapeutic Drug Monitoring and Clinical Management – Purpose and objectives of TDM, Analytical and Practical Issues in TDM, Role of Pharmacist in Clinical Practices. (Case Study for any one drug which is in question). | 05        |
| <b>TOTAL</b> |                                                                                                                                                                                                                              | <b>45</b> |

**Reference Books (Latest Editions to be adopted) :**

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. Pharmacokinetics: By Milo Gibaldi Donald, R. Marcel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
9. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Robert F Notari Marcel Dekker Inc, New York and Basel, 1987.
10. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvania
11. Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications: By Malcolm Rowland and Thomas, N. Tozen, August 2019.
12. Biopharmaceutics and Pharmacokinetics P.L. Madan.
13. Kang JS, Lee MH. Overview of therapeutic drug monitoring. Korean J Intern Med. 2009 Mar;24(1):1-10. doi: 10.3904/kjim.2009.24.1.1. PMID: 19270474; PMCID: PMC2687654.



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaoon**

**BP605T PHARMACEUTICAL BIOTECHNOLOGY-**  
**(THEORY 45 HOURS)**

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**Teaching Scheme**

Lectures: 04Hr/Week

Practical:

Tutorials: 00Hr/Week

Credits: 4

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**Examination Scheme:**

In SEM Exam:25 Marks

End SEM Exam:75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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**Scope**

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

**Course Objectives:**

**Upon completion of the course a student shall be able to understand:**

1. Understand the importance of immobilized enzyme in pharmaceutical industries.
2. Genetic engineering application in relation to production of pharmaceuticals.
3. Importance of monoclonal antibodies in industries.
4. Appreciate the use of microorganism in fermentation technology.

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                     | Bloom Taxonomy |                              |
|------|-------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------|
|      |                                                                                                                                     | Level          | Descriptor                   |
| CO 1 | Define Biotechnology & its state its scope in pharmacy                                                                              | 1,2,3          | Remember, understand, apply  |
| CO 2 | Know the basics of biotechnology techniques and the various systems used.                                                           | 2,3,4          | Apply, analyze understand    |
| CO 3 | Know the method of genetic engineering for production of rDNA products including                                                    | 3,4,5          | Apply, analyze, evaluate     |
| CO 4 | Know the information about the application of genetic engineering in animals.                                                       | 2,3,4          | Understand, analyze, apply   |
| CO 5 | Have a know-how of enzymes and their uses by immobilization.                                                                        | 4,5,6          | Evaluate, analyze, evaluate  |
| CO 6 | Illustrate use of Fermenter for production of fermentation products and information about their purification by downstream process. | 2,3,4<br>6     | Handle, understand, analyze. |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 2   | 3   | 2   | -   | 2   | 3   | -   | 2   | -    | 3    |
| CO2 | 3   | 2   | 2   | 3   | -   | 2   | 2   | 1   | 2   | -    | 3    |
| CO3 | 3   | 2   | 3   | 3   | -   | 2   | 2   | -   | 2   | 2    | 3    |
| CO4 | 3   | 2   | 3   | 3   | -   | 2   | 2   | -   | 2   | 2    | 3    |
| CO5 | 3   | 3   | 3   | 3   | -   | 1   | 2   | -   | 2   | 2    | 3    |
| CO6 | 3   | 3   | 3   | 3   | -   | 2   | 2   | -   | 2   | 1    | 3    |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**COURSE CONTENTS**

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Hrs          |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1    | Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. Enzyme Biotechnology- Methods of enzyme immobilization and applications. Biosensors- Working and applications of biosensors in Pharmaceutical Industries. Brief introduction to Protein Engineering. Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. Basic principles of genetic engineering.<br><br>Introduction and applications of bioinformatics    | 10<br><br>03 |
| 2    | Study of cloning vectors, restriction endonucleases and DNA ligase. Recombinant DNA technology. Application of genetic engineering in medicine. Application of r DNA technology and genetic engineering in the production of:<br><br>i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin. Brief introduction to PCR.                                                                                                                                                                                                    | 10           |
| 3    | Types of immunity- humoral immunity, cellular immunity. Structure of Immunoglobulins. Structure and Function of MHC. Hypersensitivity reactions, Immune stimulation and Immune suppressions. General method of the preparation of bacterial infections, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. Storage conditions and stability of official vaccines. Hybridoma technology- Production, Purification and Applications, Blood products and Plasma Substitutes. | 10           |
| 4    | Immuno-blotting techniques- ELISA, Western blotting, Southern blotting. Genetic organization of Eukaryotes and Prokaryotes. Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. Introduction to Microbial biotransformation and applications. Mutation: Types of mutation/mutants.                                                                                                                                                                                                   | 08           |
| 5    | Fermentation methods and general requirements, study of media, equipment's, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of - Penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin. Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.                                                                                                                 | 07           |
|      | <b>TOTAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>45</b>    |

**Reference Books (Latest Editions to be adopted):**

- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Glick and J.J. Pasternak, ASM Press Washington D.C.
- Kuby Immunology by R.A. Goldsby et. al., W.H. Freeman and Company, NY.
- Biotechnology by U. Satyanarayan, Books and allied Pvt. Ltd., Kolkata.
- Industrial Microbiology by L.E. Casida Jr., New Age International Pub., New Delhi.
- Crueger's Biotechnology- A textbook of Industrial Microbiology by Crueger and Aneja, Medtech, New Delhi.
- Monoclonal Antibodies by J.W. Goding, Academic Press. • Molecular Biology and Biotechnology by J.M. Walker and E.B. Gingold, Royal Society of Chemistry.
- Immobilized Enzymes by Zaborsky, CRC Press, Ohio.
- Molecular Biotechnology by S.B. Primrose, Blackwell Scientific Publication.
- Principles of Fermentation Technology by Stanbury F.P., Whitakar A., and Hall J.S., 2nd ed., Aditya books Ltd., New Delhi.
- Pharmaceutical Biotechnology: Concepts and Applications by G. Walsh, Wiley and Sons Pvt. Ltd., USA.
- Pharmaceutical Biotechnology: Biochemistry and Biotechnology by G. Walsh, Wiley and Sons Pvt. Ltd., USA.



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**SUBJECT: BP606TPHARMACEUTICAL QUALITY ASSURANCE**  
**(THEORY 45 HOURS)**

**Teaching Scheme**

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

**Examination Scheme:**

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

**Scope:** This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

1. Understand the cGMP aspects in a pharmaceutical industry
2. Appreciate the importance of documentation
3. Understand the scope of quality certifications applicable to pharmaceutical industries
4. Understand the responsibilities of QA & QC departments

| COS  | Course Outcomes                                                         | Bloom Taxonomy |                          |
|------|-------------------------------------------------------------------------|----------------|--------------------------|
|      |                                                                         | Level          | Descriptor               |
| CO 1 | Understand the cGMP aspects                                             | 3              | Apply                    |
| CO 2 | importance of documentation                                             | 2              | Explain ideas or concept |
| CO 3 | Scope of quality certifications applicable to pharmaceutical industries | 3              | Apply                    |
| CO 4 | Understand the responsibilities of QA                                   | 3              | Apply                    |
| CO 5 | Understand the responsibilities of QC                                   | 3              | Apply                    |
| CO 6 | Understand about validation, calibration                                | 2              |                          |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 1   | -   | -   | -   | -   | -   | -   | -    | 1    |
| CO2 | 2   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | 2    |
| CO3 | 2   | -   | 1   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO4 | 2   | -   | 1   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO5 | 2   | -   | 1   | 2   | -   | -   | -   | -   | -   | -    | 1    |
| CO6 | 2   | -   | 1   | 2   | -   | -   | -   | -   | -   | -    | 1    |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaoon**

**COURSE CONTENTS**

| Unit | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Hrs | References                                                                                                                                                                                                                                                                                                                                    |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <b>UNIT – I</b><br>Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP, <b>Quality agreements, Site Master files</b><br>Total Quality Management (TQM): Definition, elements, philosophies,,<br>ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM,with special emphasis on Q-series guidelines, ICH stability testing guidelines, <b>Pharmaceutical audit</b><br>Quality by design (QbD): Definition, overview,elements of QbD program, tools ISO 9000 & ISO14000: Overview, Benefits, Elements, <b>stepsfor registration</b><br>NABL accreditation : Principles and procedures, <b>Application</b> | 10  | 1. Quality Assurance Guideby organization of Pharmaceutical Products of India.<br>2. Good Laboratory PracticeRegulations, 2nd Edition, Sandy Weinberg Vol. 69.                                                                                                                                                                                |
| 2    | <b>UNIT - II</b><br>Organization and personnel: Personnel responsibilities, training, hygiene and personalrecords.<br>Premises: Design, construction and plant layout, maintenance, sanitation, environmental<br>control, utilities and maintenance of sterile areas,control of contamination.<br>Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of storesfor raw materials <b>vendor selection and qualification</b>                                                                                                                                                                                                       | 10  | 1. Quality Assurance of Pharmaceuticals- A compendium of Guide linesand Related materials Vol I WHO Publications.<br>A guide to Total Quality Management- Kushik Maitraand Sedhan K Ghosh<br>2.How to Practice GMP's – PP Sharma                                                                                                              |
| 3    | <b>UNIT – III</b><br>Quality Control: Quality control test for containers, rubber closures and secondary packingmaterials. <b>Microbiological testing.</b><br>Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities,Equipment,Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, <b>Disqualification of Testing Facilities</b>                                                                                                                                                                                                                                                             | 10  | 1.ISO 9000 and Total QualityManagement – Sadhank G Ghosh<br>2. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms 8.Good laboratory Practices – Marcel Deckker Series<br>3. ICH guidelines, ISO 9000 and 14000 guidelines |



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**Sanjivani College of Pharmaceutical Education and Research, Kopergaon**

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                                                                                                                                                                                                                                                                                                                                                                                 |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | <b>UNIT – IV</b><br><br>Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.<br><br>Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records, <b>Data Integrity</b> .                                                                                                                          | 8 | 1. Quality Assurance Guide by organization of Pharmaceutical Products of India.<br>2. Sandy Weinberg , Good Laboratory Practice Regulations, in Drugs and ThePharmaceutical Sciences, Vol. 69. 3 rd edition revised and expanded, Marcel Dekker, Inc.,2002.<br>3. Quality Assurance of Pharmaceuticals- A compendium of Guidelines andRelated materials Vol I, 1 st edition, WHO , Geneva, 1997 |
| 5 | <b>UNIT – V</b><br><br>Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scopeof validation, types of validation, validation master plan.<br><br>Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical <b>Method Validation, Cleaning validation, Sterilization process validation</b><br><br>Warehousing: Good warehousing practice, materials management | 7 | 1.A.F. Hirsch, Good laboratory Practices, Drugs and the Pharmaceutical Sciences, 1 st edition, Marcel Dekker Inc, 1989<br><br>2. Cole Graham, Pharmaceutical Production Facilities, Design and Applications, 2nd edition, CRC Press, 2019. 11. Nash Robert A., Berry Ira R , PharmaceuticalProcess Validation.                                                                                  |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**BP607P. MEDICINAL CHEMISTRY III (Practical)**

**4 Hours / Week**

**(PRACTICAL 60 HOURS)**

| Teaching Scheme      | Examination Scheme:    |
|----------------------|------------------------|
| Lectures:            | In SEM Exam:15 Marks   |
| Practical: 04Hr/Week | End SEM Exam:35 Marks  |
| Tutorials:           | Continuous Assessment: |
| Credits: 2           | Total Marks: 50 Marks  |

**Course Objectives:**

To impart to the Learner, the principles and techniques for multistep drug synthesis, purification, and assay of the synthesized drugs/ drug intermediates, on a small scale. To teach the Learners the methods to calculate/predict physicochemical parameters using computational tools.

**Course Outcomes:**

Upon completion of the laboratory training the learner should be able to:

1. Set up single and multi-step synthetic reactions
2. Monitor chemical reactions using TLC
3. Purify the crude products of reaction workup.
4. Quantify the purity of the synthesized compounds using Pharmacopoeial assay methods
5. Apply green procedures via use of microwave reactions
6. Draw and visualize 3D structures of the drugs/ API and their interactions with proteins / peptides using Chemdraw software
7. Calculate physicochemical parameters of the drugs/ API using computational tools

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                     | Bloom Taxonomy |                    |
|------|-------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------|
|      |                                                                                                                                     | Level          | Descriptor         |
| CO 1 | Make correct use of various equipments                                                                                              | 1              | Understand         |
| CO 2 | Take safety measures while working in medicinal chemistry laboratory                                                                | 2              | Remember           |
| CO 3 | Develop skills involved in thin layer chromatography techniques and purification of synthesized compounds by column chromatography. | 3              | Apply              |
| CO 4 | Develop skills involved in Synthesized compound's recrystallization                                                                 | 3              | Apply              |
| CO 5 | Understand reaction mechanisms involved in synthesis of medicinally important organic compounds.                                    | 3              | Understand & Apply |
| CO 6 | To interpret the spectral characterizations made by IR and <sup>1</sup> H-NMRs of synthesized compounds                             | 3              | Apply              |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | 1   | 1   | 2   | -   | 1   | 2   | 2   | 1   | 1    | 2    |
| CO2 | 3   | 1   | 1   | 2   | 2   | 1   | 2   | 2   | 1   | 1    | 2    |
| CO3 | 2   | 1   | 1   | 2   | -   | 1   | 2   | 2   | 1   | 1    | 2    |
| CO4 | 2   | 1   | 1   | 2   | 3   | 1   | 2   | 2   | 1   | 1    | 2    |
| CO5 | 1   | 1   | 2   | 2   | -   | 2   | 2   | 1   | 1   | 2    | 1    |
| CO6 | 2   | -   | 1   | 2   | -   | 2   | -   | 1   | -   | -    | 1    |



### COURSE CONTENT

| Sr. No.    | Name of Experiment                                                                                                                                                                                                                                                        | Duration (hrs) | References                                                                                                                                                                                                                                                                                                                                                            |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>I</b>   | I Preparation of drugs and intermediates (Any six)<br>1. Sulphanilamide<br>2. 7-Hydroxy, 4-methyl coumarin<br>3. Chlorobutanol<br>4. Triphenyl imidazole<br>5. Tolbutamide<br>6. Hexamine<br><b>7 Paracetamol</b><br><b>8. Methyl salicylate</b><br><b>9. Caprolactum</b> | 24             | Martindale's extra pharmacopoeia.<br>Organic Chemistry by I. L. Finar Vol II<br>The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.<br>Indian Pharmacopoeia<br>Text book of practical organic chemistry- A.I.Vogel.<br>Medicinal Chemistry By Ashutosh Kar<br>Practical Pharmaceutical Chemistry: Part II Fourth Edition, A. H. Beckett, J. B. Stenlake. |
| <b>II</b>  | Assay of drugs<br>1. Isonicotinic acid hydrazide<br>2. Chloroquine<br>3. Metronidazole<br>4. Dapsone<br>5. Chlorpheniramine maleate<br>Benzyl penicillin                                                                                                                  | 20             | Martindale's extra pharmacopoeia.<br>Organic Chemistry by I. L. Finar Vol II<br>The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.<br>Indian Pharmacopoeia<br>Text book of practical organic chemistry- A.I.Vogel.<br>Medicinal Chemistry By Ashutosh Kar<br>Practical Pharmaceutical Chemistry: Part II Fourth Edition, A. H. Beckett, J. B. Stenlake. |
| <b>III</b> | Preparation of medicinally important compounds or intermediates by Microwave irradiation technique                                                                                                                                                                        | 4              | Martindale's extra pharmacopoeia.<br>Organic Chemistry by I. L. Finar Vol II<br>The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.<br>Text book of practical organic chemistry- A.I.Vogel.<br>Medicinal Chemistry By Ashutosh Kar<br>Practical Pharmaceutical Chemistry: Part II Fourth Edition, A. H. Beckett, J. B. Stenlake.                         |
| <b>IV.</b> | Drawing structures and reactions using chem draw®                                                                                                                                                                                                                         | 4              | Martindale's extra pharmacopoeia.<br>Indian Pharmacopoeia<br>Text book of practical organic chemistry- A.I.Vogel.<br>Medicinal Chemistry By Ashutosh Kar<br>Practical Pharmaceutical Chemistry: Part II Fourth Edition, A. H. Beckett, J. B. Stenlake.                                                                                                                |
| <b>V</b>   | Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)                                         | 8              | Martindale's extra pharmacopoeia.<br>Indian Pharmacopoeia<br>Text book of practical organic chemistry- A.I.Vogel.<br>Practical Pharmaceutical Chemistry: Part II Fourth Edition, A. H. Beckett, J. B. Stenlake.                                                                                                                                                       |



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaon**

**SUBJECT: BP608P PHARMACOLOGY III (Practical)**  
**4 Hours / Week**  
**(PRACTICAL 60 HOURS)**

**Teaching Scheme**

Lectures:  
Practical: 04Hr/Week  
Tutorials:  
Credits: 2

**Examination Scheme:**

In SEM Exam:15 Marks  
End SEM Exam:35 Marks  
Continuous Assessment:  
Total Marks: 50 Marks

**Course Outcomes:**

| CO's | Course Outcomes                                                                                                                                                                                   | Bloom Taxonomy |                          |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------|
|      |                                                                                                                                                                                                   | Level          | Descriptor               |
| CO 1 | Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model and study of effect of drugs on gastrointestinal motility                             | 2              | Explain ideas or concept |
| CO 2 | Effect of agonist and antagonists on guinea pig ileum, estimation of serum biochemical parameters by using semi- autoanalyzer, and effect of saline purgative on frog intestine                   | 3              | Apply                    |
| CO 3 | Hypoglycemic effect of insulin in rabbit and test for pyrogens (rabbit method)                                                                                                                    | 3              | Apply                    |
| CO 4 | Determination of acute oral toxicity (LD50) of a drug from a given data, determination of acute skin irritation / corrosion and acute eye irritation / corrosion of test substance                | 3              | Apply                    |
| CO 5 | Calculation of pharmacokinetic parameters from a given data, biostatistics methods in experimental pharmacology (student's t test, ANOVA, Chi square test, Wilcoxon, and Signed Rank test)        | 3              | Apply                    |
| CO 6 | Bioassay of serotonin using rat fundus strip by three point bioassay, Bioassay of acetylcholine using rat ileum/colon by four point bioassay, Study of mydriatic and miotic effects on rabbit eye | 2              | Explain ideas or concept |

**Mapping of Course Outcomes to Program Outcomes:**

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO2 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO3 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO4 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO5 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |
| CO6 | 3   | -   | 2   | 3   | -   | -   | -   | -   | -   | -    | 1    |



### **COURSE CONTENT**

1. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
2. Study of effect of drugs on gastrointestinal motility
3. Effect of agonist and antagonists on guinea pig ileum
4. Estimation of serum biochemical parameters by using semi- autoanalyser
5. Effect of saline purgative on frog intestine
6. Hypoglycemic effect of insulin in rabbit
7. Test for pyrogens (rabbit method)
8. Determination of acute oral toxicity (LD50) of a drug from a given data
9. Determination of acute skin irritation / corrosion of a test substance
10. Determination of acute eye irritation / corrosion of a test substance
11. Calculation of pharmacokinetic parameters from a given data
12. Biostatistics methods in experimental pharmacology (student's t test, ANOVA)
13. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)
14. Bioassay of serotonin using rat fundus strip by three-point bioassay
15. Bioassay of acetylcholine using rat ileum/colon by four-point bioassay
16. Study of mydriatic and miotic effects on rabbit eye

#### **Reference Books (Latest Editions to be adopted):**

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
2. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.
3. Goyal RK. Practicals in Pharmacology, BS Shaha Prakashan.
4. Kasture SB. A handbook of experiments in pre-clinical pharmacology, Career Publications.
5. Bikas Medhi, Ajay Prakash. Practical Manual of Experimental and Clinical Pharmacology. Jaypee Publications.

Note: we feel that above bioassay practical's using isolated tissue preparations like goat tracheal chain need to be done along with using simulation software for clarifying theoretical aspects



Sanjivani Rural Education Society'  
**Sanjivani College of Pharmaceutical Education and Research, Kopargaoon**

**SUBJECT: BP609P Herbal Drug Technology (PRACTICAL 60 HOURS)**

**Teaching Scheme**

Lectures:  
 Practical: 04Hr/Week  
 Tutorials:  
 Credits: 2

**Examination Scheme:**

In SEM Exam:15 Marks  
 End SEM Exam:35 Marks  
 Continuous Assessment:  
 Total Marks: 50 Marks

**Scope**

The subject involves the fundamentals of Herbal Drug Technology like Monograph of drug, Alcohol content, extraction and addition of extract in herbal formulation

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

1. To perform chemical test
2. To perform isolation and detection of phytoconstituent
3. Able to detect phytoconstituent by TLC
4. Able to analyze phytoconstituent by chemical reaction
- 5.
6. **Course Outcomes:**

| CO's | Course Outcomes                                        | Bloom Taxonomy |                                |
|------|--------------------------------------------------------|----------------|--------------------------------|
|      |                                                        | Level I        | Descriptor                     |
| CO 1 | To perform macroscopy and microscopy of drug           | 1              | Recall facts and basic concept |
| CO 2 | To perform isolation and detection of phytoconstituent | 3              | Apply                          |
| CO 3 | To separate sugar by chromatography                    | 3              | Apply                          |
| CO 4 | To perform isolation of volatile oil by distillation   | 3              | Apply                          |
| CO 5 | To perform TLC                                         | 2              | Apply                          |
| CO 6 | To perform chemical tests                              | 2              | Explain ideas or concept       |

**Mapping of Course Outcomes to Program Outcomes:**

| The students should be able to:                                    | PO 1     | PO 2     | PO 3     | PO 4        | PO 5     | PO 6     | PO 7     | PO 8     | PO 9     | PO 10    | PO 11    |
|--------------------------------------------------------------------|----------|----------|----------|-------------|----------|----------|----------|----------|----------|----------|----------|
| CO 1. Analyse phyto constituent from extract                       | 3        | 3        | 2        | 0           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| CO 2. Evaluate alcohol content from formulation                    | 3        | 3        | 2        | 2           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| CO 3. Evaluate component from natural origin                       | 3        | 3        | 2        | 2           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| CO 4. Judge how much quantity of extract should add in formulation | 3        | 3        | 2        | 2           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| CO 5 Determine phenol, alkaloid and tannin content in formulation  | 3        | 3        | 2        | 1           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| CO 6. Standardized herbal formulation.                             | 3        | 3        | 2        | 1           | 0        | 0        | 1        | 0        | 3        | 0        | 2        |
| <b>Average</b>                                                     | <b>3</b> | <b>3</b> | <b>2</b> | <b>1.33</b> | <b>0</b> | <b>0</b> | <b>1</b> | <b>0</b> | <b>3</b> | <b>0</b> | <b>2</b> |



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| Expt No. | Chapter/Topic                                                                                                                                                 | Duration (hrs) |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1        | . To perform preliminary phytochemical screening of crude drugs.                                                                                              | 4              |
| 2        | Determination of the alcohol content of Asava and Arista                                                                                                      | 4              |
| 3        | Evaluation of excipients of natural origin                                                                                                                    | 4              |
| 4        | Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions, shampoos and their evaluation.                              | 4              |
| 5        | Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements. | 4              |
| 6        | Monograph analysis of herbal drugs from recent Pharmacopoeias                                                                                                 | 4              |
| 7        | Determination of Aldehyde content                                                                                                                             | 4              |
| 8        | Determination of Phenol content                                                                                                                               | 4              |
| 9        | Determination of total alkaloids                                                                                                                              | 4              |



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# SYLLABUS FOR ELECTIVES



**BP607ET: Pharmaceutical Marketing**

**(15 hrs. 1hr/week)**

**Scope:**

The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing groom the people for taking a challenging role in Sales and Product management.

**Objective:**

The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

| <b>Sr. No.</b> | <b>Name of Topic</b>                                                                                                                                                                                                                                                                       | <b>Hours</b> |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 1.             | <b>Fundamentals of Marketing:</b><br>Market and marketing, Value of marketing,<br>Characteristics of Market,<br>Chart, Structure and organization of pharma market<br>Nature, evaluation, principle and functions of marketing.<br>Marketing Management<br>Heirarcy of Marketing personnel | 03           |
| 2.             | <b>Studying of Pharmaceutical Market:</b><br>Research of the market of medical products<br>Studying quantitative characteristics of Market<br>Market Segmentation<br>Study needs and demand for medical products.                                                                          | 03           |
| 3.             | <b>Product Decisions and Pricing:</b><br>Product line, product life cycle, product positioning, product branding, Product management in pharma industry.<br>Drug product pricing strategy, importance and pricing authorities.                                                             | 05           |
| 4.             | <b>Foundational Skills for Marketers and marketing theories:</b><br>Communication, Problem solving, Leadership, professional etiquettes and technical skills, theories of marketing.                                                                                                       | 04           |



## **BP608ET: Pharmaceutical Manufacturing Technology**

(15 HOURS, 1 hr/week)

### **Scope**

This course is designed to impart knowledge and skills necessary to train the students with the industrial activities during Pharmaceutical Manufacturing.

### **Objectives**

At completion of this course it is expected that students will be able to Understand -

- The common practice in the pharmaceutical industry developments, plant layout and production planning
- Will be familiar with the principles and practices of aseptic process technology.
- Have a better understanding of principles and implementation of Quality by design (QbD) and process analytical technology (PAT) in pharmaceutical manufacturing

| Sr. No | Content                                                                                                                                            |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | <b>Pharmaceutical industry developments:</b> Legal requirements and Licenses for API and formulation industry. Plant location- Factors influencing |
| 2      | <b>Plant location-</b> Factors influencing                                                                                                         |
| 3      | <b>Plant layout:</b> Factors influencing, Special provisions.                                                                                      |
| 4      | Storage space requirements, sterile and aseptic area layout.                                                                                       |
| 5      | <b>Aseptic process technology:</b> Manufacturing, manufacturing flowcharts.                                                                        |
| 6      | <b>Advanced sterile product manufacturing technology :</b> Area planning & environmental control.                                                  |
| 7      | wall and floor treatment,                                                                                                                          |
| 8      | fixtures and machineries, change rooms, personnel flow,                                                                                            |
| 9      | utilities & utilities equipment location, engineering and maintenance.                                                                             |
| 10     | Introduction to various regulatory agencies like MHRA, USFDA etc                                                                                   |
| 11     | Process Automation in Pharmaceutical Industry : An Introduction                                                                                    |
| 12     | <b>Quality by design (QbD) and process analytical technology (PAT):</b> Current approach and its limitations. Why QbD is required, Advantages      |
| 13     | <b>Elements of QbD, Terminology:</b> An introduction                                                                                               |
| 14     | FDA initiative on process analytical technology.                                                                                                   |
| 15     | PAT as a driver for improving quality and reducing costs.                                                                                          |



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**REFERENCES**

1. Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy, 3<sup>rd</sup> ed., Varghese Publishers, Mumbai 1991.
2. Sinko PJ. Martin's physical pharmacy and pharmaceutical sciences, 5<sup>th</sup> ed., B.I. Publications Pvt. Ltd, Noida, 2006.
3. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms: tablets Vol. I- III, 2<sup>nd</sup> ed., CBS Publishers & distributors, New Delhi, 2005.
4. Banker GS, Rhodes CT. Modern Pharmaceutics, 4<sup>th</sup> ed., Marcel Dekker Inc, New York, 2005.
5. Sidney H Willing, Murray M, Tuckerman. Williams Hitchings IV, Good manufacturing of pharmaceuticals (A Plan for total quality control) 3<sup>rd</sup> Edition. Bhalani publishing house Mumbai.
6. Indian Pharmacopoeia. Controller of Publication. Delhi, 1996.
7. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2008.
8. United States Pharmacopoeia. United States Pharmacopeial Convention, Inc, USA, 2003.
9. Dean D A, Evans E R and Hall I H. Pharmaceutical Packaging Technology. London, Taylor & Francis, 1st Edition. UK.
10. Edward J Bauer. Pharmaceutical Packaging Handbook. 2009. Informa Health care USA Inc. New York.
11. Shaybe Cox Gad. Pharmaceutical Manufacturing Handbook. John Willey and Sons, New Jersey, 2008.



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**BPE609ET Subject: Drug Regulatory Affairs**

**B. Pharm SEM-VI Syllabus**

**Course Contents:**

**Module 1:**

**15 hrs**

1. USFDA Current Good Manufacturing Practices
2. EU GMP
3. ICH Stability Guideline (ICH Q1)
4. ICH Q7 Guideline



## **BP610ET Medical Writing (15 Hrs, 1 Hr/Week)**

### **Scope:**

This course is designed to impart knowledge and expertise necessary to train the students with regulatory requirements and publication writing for medical communication or promotion and continuing medical education.

**Objective:** Upon completion of this course the students should be able to

- Understand about regulatory medical writing or educational medical writing
- Acquire skills and expertise for medical and scientific writing to record data
- To present scientific information clearly and concisely in well-structured documents
- Appreciate correlation of pharmacy with related medical sciences

### **Course Contents**

#### **1. Introduction to Scientific Publishing (1 Hr)**

#### **2. Different forms of publications in scientific journals (4 Hrs)**

- a) Different forms of journal and book publications and highlighting each in concise manner.
- b) Assessment of the Different Forms of Scientific Publications
- c) Identification of Publications: ISBN, ISSN, and DOI
- d) Publishing houses, Publishing Fees, and journal access
- e) Index Databases (Web of Knowledge, Scopus, Google Scholar)
- f) Concept of Impact Factor, Hirsch-Index or h-Index etc.

#### **3. Best Practice Guidelines (2 Hrs)**

- a) Best Practice Guidelines on Publication Ethics: a Publisher's Perspective
- b) International committee of medical journal editors
- c) Principles of Transparency and Best Practice in Scholarly Publishing

#### **4. How to make scientific writing effective (3 Hrs)**

- a) Formulating the Right Title for a Research Article.
- b) Writing an Abstract for a Research Manuscript
- c) Describing the Methodology
- d) Using Tables and Graphs for Reporting Data
- e) Results: Unraveling the Findings
- f) Citing the Literature
- g) Tips for Authors of Scientific Articles

#### **5. Publishing in Scientific Journals: What to consider. (2hrs)**

- a) Time Frame of Publication
- b) Peer Review Approaches
- c) The Basic Structure of a Manuscript
- d) Submission of a Manuscript
- e) Choosing the Right Journal for a Scientific Paper

#### **6. Ethical Guidelines for Publishing (2Hrs)**

- a) Plagiarism
- b) Data Fabrication and Falsification
- c) Multiple Submission



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- d) Redundant Publication
- e) Authorship
- f) Conflicts of Interest
- g) Consequences

**7. Strategies to Publish (1Hr)**



**BP610ET Entrepreneurship Development**  
(15HOURS, 1hr/week)

**Course Description**

This course is to create awareness about entrepreneurship among students. This course focuses on motivating students for entrepreneurship. The more focus is given on creativity and innovation.

**Course Objectives:**

**Upon completion of the course a student shall be able to understand –**

1. Introduce various qualities required for entrepreneurship
2. Explain various entrepreneurship models
3. Organize interaction with successful entrepreneurs
4. Introduce to various tools as Six hat techniques, Five S

**Course Outcomes:**

| CO's | Course Outcomes                                        | Bloom Taxonomy |            |
|------|--------------------------------------------------------|----------------|------------|
|      |                                                        | Level          | Descriptor |
| CO 1 | Identify qualities of entrepreneurs                    |                |            |
| CO 2 | Write project proposal                                 |                |            |
| CO 3 | Use various entrepreneurship models                    |                |            |
| CO 4 | Understand various schemes supporting entrepreneurship |                |            |
| CO 5 | Think creative and innovative                          |                |            |

**Mapping of Course Outcomes to Program Outcomes:**

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

**COURSE CONTENTS**

| Unit | Details                                                    |
|------|------------------------------------------------------------|
| I    | Introduction to entrepreneurship, concept of Market Survey |
| II   | Introduction to various types of entrepreneurship          |
| III  | Introduction to import-export                              |

**Text Books:**

1. Dr. Gupta and Dr. Srinivasan, Entrepreneurship development in India
2. Vasant Desai, Dynamics of Entrepreneurial Development and Management
3. Sarugadharan and Resia Begum, Women Entrepreneurship; institutional support and problems
4. M.W.Deshpande, Entrepreneurship of small Scale Industries
5. D.L. Saxon and RW Smilor (eds), The Art and Science of Entrepreneurs

**Reference Books:**

1. Venkateshwara Rao and Udai Pareek,(Eds)Developing Entrepreneurship-A Handbook
2. Raja Gopal, Agriculture Business and Entrepreneurship
3. H.Sadhak, industrial development in Backward Regions in India
4. Ravi J. Mathai, Rural Entrepreneurship A Frame Work in Development Entrepreneurship –A handbook



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**SCHEME OF EXAMINATION FOR ELECTIVES**

| <b>Name of Elective course</b>                                                                                                                          | <b>Part – 1<br/>(Internal Course owner)</b> | <b>Part – 2<br/>(Expert from industry)</b>       | <b>Total</b>    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------|-----------------|
| 1. Pharma Marketing<br>2. Pharmaceutical Manufacturing Technology<br>3. Drug Regulatory Affair<br>4. Medical writing<br>5. Entrepreneurship Development | a. MCQ- 10<br>b. short answer- 20           | c. Case study /<br>Presentation / Oral -<br>= 20 |                 |
|                                                                                                                                                         | <b>30 Marks</b>                             | <b>20 Marks</b>                                  | <b>50 Marks</b> |

*Passing criteria is 50% marks [i.e. minimum 25 marks out of 50 marks (part 1 plus part 2)]*