



# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

## BACHELOR OF PHARMACY (B.PHARM.)

### Course Structure & I Year Syllabus (R-26 Regulations)

Applicable from AY 2026-2027 Batch

#### I YEAR I SEMESTER

| Course Code  | Name of the course                                                | No. of hours per week (L/P) | Credits   |
|--------------|-------------------------------------------------------------------|-----------------------------|-----------|
| BP101T       | Basics of Python Programming for Pharmaceutical Sciences (Theory) | 2                           | 2         |
| BP102T       | General Pharmacy (Theory)                                         | 3                           | 3         |
| BP103T       | Healthcare Psychology and Communication Skills (Theory)           | 1                           | 1         |
| BP104T       | Human Anatomy, Physiology and Pathophysiology - I (Theory)        | 4                           | 4         |
| BP105T       | Introduction to Pharmacognosy (Theory)                            | 3                           | 3         |
| BP106T       | Pharmaceutical Inorganic and Analytical Chemistry (Theory)        | 3                           | 3         |
| BP107P       | General Pharmacy (Practical)                                      | 3                           | 1         |
| BP108P       | Healthcare Psychology and Communication Skills (Practical)        | 2                           | 1         |
| BP109P       | Human Anatomy, Physiology and Pathophysiology I (Practical)       | 3                           | 1         |
| BP110P       | Introduction to Pharmacognosy (Practical)                         | 3                           | 1         |
| BP111P       | Pharmaceutical Inorganic and Analytical Chemistry (Practical)     | 3                           | 1         |
| <b>Total</b> |                                                                   | <b>30</b>                   | <b>21</b> |

#### I YEAR II SEMESTER

| Course Code | Name of the course                                                            | No. of hours per week (L/P) | Credits |
|-------------|-------------------------------------------------------------------------------|-----------------------------|---------|
| BP201T      | Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory) | 2                           | 2       |
| BP202T      | Biochemistry (Theory)                                                         | 3                           | 3       |
| BP203T      | Human Anatomy, Physiology and Pathophysiology II (Theory)                     | 4                           | 4       |
| BP204T      | Pharmaceutical Organic Chemistry (Theory)                                     | 4                           | 4       |
| BP205T      | Pharmacognosy and Phytochemistry (Theory)                                     | 4                           | 4       |
| BP206T      | Physical Pharmaceutics (Theory)                                               | 3                           | 3       |
| BP207P      | Biochemistry (Practical)                                                      | 3                           | 1       |
| BP208P      | Human Anatomy, Physiology and Pathophysiology - II (Practical)                | 3                           | 1       |
| BP209P      | Pharmaceutical Organic Chemistry (Practical)                                  | 3                           | 1       |
| BP210P      | Pharmacognosy and Phytochemistry (Practical)                                  | 3                           | 1       |
| BP211P      | Physical Pharmaceutics (Practical)                                            | 3                           | 1       |
| BP212P      | BP212P SEC1: Communication Skills (Practical)                                 | 2                           | 1       |
| SEC*        | BP212P SEC2: Mental Well-Being, Stress &                                      |                             |         |

|              |                                                              |           |           |
|--------------|--------------------------------------------------------------|-----------|-----------|
|              | Conflict Management (Practical)                              |           |           |
|              | BP212P SEC3: Fundamentals of Computer Operations (Practical) |           |           |
| <b>Total</b> |                                                              | <b>37</b> | <b>26</b> |

**Note:** SEC\* is Skill Enhancement Course, should be treated on par with other Practical Courses. Only one course must be selected from the three courses listed.

## II YEAR I SEMESTER

| Course Code            | Name of the course                                                   | No. of hours per week (L/P) | Credits   |
|------------------------|----------------------------------------------------------------------|-----------------------------|-----------|
| <b>BP301T</b>          | Introduction to Machine Learning in Pharmaceutical Sciences (Theory) | 2                           | 2         |
| <b>BP302T</b>          | Environmental Sciences (Theory)                                      | 1                           | 1         |
| <b>BP303T</b>          | Ethics and Universal Human Values (Theory)                           | 1                           | 1         |
| <b>BP304T</b>          | General Pharmacology (Theory)                                        | 3                           | 3         |
| <b>BP305T</b>          | Heterocyclic Compounds and Stereochemistry (Theory)                  | 3                           | 3         |
| <b>BP306T</b>          | Pharmaceutical Dosage Forms I (Theory)                               | 3                           | 3         |
| <b>BP307T</b>          | Pharmaceutical Engineering (Theory)                                  | 3                           | 3         |
| <b>BP308T</b>          | Pharmaceutical Microbiology (Theory)                                 | 3                           | 3         |
| <b>BP309P</b>          | General Pharmacology (Practical)                                     | 4                           | 2         |
| <b>BP310P</b>          | Heterocyclic Compounds and Stereochemistry (Practical)               | 4                           | 2         |
| <b>BP311P</b>          | Pharmaceutical Dosage Forms I (Practical)                            | 3                           | 1         |
| <b>BP312P<br/>AEC*</b> | BP312P AEC1: Nutraceuticals and Functional Foods (Practical)         | 2                           | 1         |
|                        | BP312P AEC2: Food Analysis (Practical)                               |                             |           |
|                        | BP312P AEC3: Yoga and Life Sciences (Practical)                      |                             |           |
| <b>Total</b>           |                                                                      | <b>32</b>                   | <b>25</b> |

**Note:** AEC\* is Ability Enhancement Course, should be treated on par with other Practical Courses. Only one course must be selected from the three courses listed.

## II YEAR II SEMESTER

| Course Code   | Name of the course                            | No. of hours per week (L/P) | Credits   |
|---------------|-----------------------------------------------|-----------------------------|-----------|
| <b>BP401T</b> | Herbal Drug Technology (Theory)               | 3                           | 3         |
| <b>BP402T</b> | Medicinal Chemistry (Theory)                  | 3                           | 3         |
| <b>BP403T</b> | Pharmaceutical Biotechnology (Theory)         | 3                           | 3         |
| <b>BP404T</b> | Social Pharmacy and Public Health (Theory)    | 2                           | 2         |
| <b>BP405T</b> | Systemic Pharmacology I (Theory)              | 3                           | 3         |
| <b>BP406P</b> | Herbal Drug Technology (Practical)            | 3                           | 1         |
| <b>BP407P</b> | Medicinal Chemistry (Practical)               | 3                           | 1         |
| <b>BP408P</b> | Pharmaceutical Biotechnology (Practical)      | 3                           | 1         |
| <b>BP409P</b> | Social Pharmacy and Public Health (Practical) | 2                           | 1         |
| <b>BP410P</b> | Systemic Pharmacology I (Practical)           | 3                           | 1         |
| <b>BP411I</b> | Internship (Mandatory)                        | 8                           | 4         |
| <b>Total</b>  |                                               | <b>28</b>                   | <b>23</b> |

**III YEAR I SEMESTER**

| Course Code   | Name of the course                        | No. of hours per week (L/P) | Credits   |
|---------------|-------------------------------------------|-----------------------------|-----------|
| <b>BP501T</b> | Biomedical Chemistry (Theory)             | 3                           | 3         |
| <b>BP502T</b> | Industrial Pharmacognosy (Theory)         | 3                           | 3         |
| <b>BP503T</b> | Innovation and Startup Ecosystem (Theory) | 2                           | 2         |
| <b>BP504T</b> | Pharmaceutical Dosage Form II (Theory)    | 2                           | 2         |
| <b>BP505T</b> | Pharmaceutical Quality Assurance (Theory) | 3                           | 3         |
| <b>BP506T</b> | Systemic Pharmacology II (Theory)         | 3                           | 3         |
| <b>BP507P</b> | Biomedical Chemistry (Practical)          | 4                           | 2         |
| <b>BP508P</b> | Industrial Pharmacognosy (Practical)      | 3                           | 1         |
| <b>BP509P</b> | Pharmaceutical Dosage Form II (Practical) | 3                           | 1         |
| <b>BP510P</b> | Systemic Pharmacology II (Practical)      | 4                           | 2         |
| <b>Total</b>  |                                           | <b>30</b>                   | <b>22</b> |

**III YEAR II SEMESTER**

| Course Code        | Name of the course                                                                     | No. of hours per week (L/P) | Credits   |
|--------------------|----------------------------------------------------------------------------------------|-----------------------------|-----------|
| <b>BP601T</b>      | Advanced Pharmacognosy (Theory)                                                        | 3                           | 3         |
| <b>BP602T</b>      | Biopharmaceutics and Pharmacokinetics (Theory)                                         | 3                           | 3         |
| <b>BP603T</b>      | Intellectual Property Rights (Theory)                                                  | 2                           | 2         |
| <b>BP604T</b>      | AI applications in Pharmaceutical Sciences (Theory)                                    | 2                           | 2         |
| <b>BP605T</b>      | Pharmaceutical Analysis (Theory)                                                       | 3                           | 3         |
| <b>BP606T</b>      | Pharmaceutical Jurisprudence (Theory)                                                  | 3                           | 3         |
| <b>BP607T AEC*</b> | BP607T AEC1: Green Chemistry                                                           | 1                           | 1         |
|                    | BP607T AEC2: Materiovigilance and Hemovigilance                                        |                             |           |
|                    | BP607T AEC3: Scientific Writing                                                        |                             |           |
|                    | BP607T AEC4: Drug Store and Business Management                                        |                             |           |
|                    | BP607T AEC5: Career Building in Cultivation of Medicinal Plants                        |                             |           |
|                    | BP607T AEC6: Active Pharmaceutical Ingredients and Excipient Sciences                  |                             |           |
| <b>BP608P</b>      | Biopharmaceutics and Pharmacokinetics (Practical)                                      | 3                           | 1         |
| <b>BP609P</b>      | Pharmaceutical Analysis (Practical)                                                    | 4                           | 2         |
| <b>BP610P SEC*</b> | BP610P SEC1: Computer-Aided Drug Design                                                | 2                           | 1         |
|                    | BP610P SEC2: Analytical Method Development and Validation                              |                             |           |
|                    | BP610P SEC3: Principles of Preclinical Studies                                         |                             |           |
|                    | <b>BP611P VAC1:</b> Professional Skills                                                |                             |           |
|                    | <b>BP611P VAC2:</b> Process Analytical Technology (PAT) and QbD in Formulation Science |                             |           |
| <b>BP612I</b>      | Internship (Mandatory)                                                                 | 8                           | 4         |
| <b>Total</b>       |                                                                                        | <b>28</b>                   | <b>26</b> |

**IV YEAR I SEMESTER**

| Course Code | Name of the course | No. of hours per week (L/P) | Credits |
|-------------|--------------------|-----------------------------|---------|
|-------------|--------------------|-----------------------------|---------|

|                       |                                                                   |           |           |
|-----------------------|-------------------------------------------------------------------|-----------|-----------|
| <b>BP701T</b>         | Biostatistics Research methodology (Theory)                       | 3         | 3         |
| <b>BP702T</b>         | Cosmetics and Cosmeceuticals (Theory)                             | 2         | 2         |
| <b>BP703T</b>         | AI in Clinical applications (Theory)                              | 2         | 2         |
| <b>BP704T</b>         | Modern Analytical Techniques (Theory)                             | 3         | 3         |
| <b>BP705T</b>         | Pharmacovigilance (Theory)                                        | 3         | 3         |
| <b>BP706T</b>         | Pharmacy Practice (Theory)                                        | 3         | 3         |
| <b>BP707T</b>         | Regulatory Affairs (Theory)                                       | 2         | 2         |
| <b>BP708T<br/>AEC</b> | BP708T AEC1: Current Good Manufacturing Practices (cGMP)          | 1         | 1         |
|                       | BP708T AEC2: Pharmaceutical Automation                            |           |           |
|                       | BP708T AEC3: Modern Techniques in Cellular Biology                |           |           |
|                       | BP708T AEC4: Medical Devices                                      |           |           |
|                       | BP708T AEC5: Transformation of Food Waste into Medicinal Products |           |           |
|                       | BP708T AEC6: Biosimilars, Vaccines & Macromolecules               |           |           |
| <b>BP709P</b>         | Modern Analytical Techniques (Practical)                          | 3         | 1         |
| <b>BP710RP</b>        | Research Project                                                  | -         | 6         |
| <b>Total</b>          |                                                                   | <b>22</b> | <b>26</b> |

**IV YEAR II SEMESTER**

| <b>Course Code</b>     | <b>Name of the course</b>                                                        | <b>No. of hours per week (L/P)</b> | <b>Credits</b> |
|------------------------|----------------------------------------------------------------------------------|------------------------------------|----------------|
| <b>BP801T</b>          | Ethical Considerations and Translational Applications of AI in Pharmacy (Theory) | 2                                  | 2              |
| <b>BP802T</b>          | Clinical Pharmacotherapeutics (Theory)                                           | 2                                  | 2              |
| <b>BP803T</b>          | Industrial Pharmacy and Facility Design (Theory)                                 | 3                                  | 3              |
| <b>BP804T</b>          | Pharmaceutical Management (Theory)                                               | 2                                  | 2              |
| <b>BP805T</b>          | Sterile Dosage Forms and Novel Drug Delivery System (Theory)                     | 3                                  | 3              |
| <b>BP806T<br/>AEC*</b> | BP806T AEC1: Pharmaceutical Packaging                                            | 2                                  | 2              |
|                        | BP806T AEC2: Supply Chain Management                                             |                                    |                |
|                        | BP806T AEC3: Industrial Safety and Waste Management                              |                                    |                |
|                        | BP806T AEC4: Traditional Healing Practices of India                              |                                    |                |
|                        | BP806T AEC5: Futuristic Pharma through AR/VR: Pharma 4.0                         |                                    |                |
|                        | BP806T AEC6: Herbal Cosmetics for Industry Perspective                           |                                    |                |
| <b>BP807P</b>          | Pharmaceutical Marketing Skills (Practical)                                      | 2                                  | 1              |
| <b>BP808P</b>          | Sterile Dosage Forms and Novel Drug Delivery System (Practical)                  | 4                                  | 2              |
| <b>BP810RP</b>         | Research Project                                                                 | -                                  | 6              |
| <b>Total</b>           |                                                                                  | <b>22</b>                          | <b>24</b>      |

## BP101T: Basics of Python Programming for Pharmaceutical Sciences (Theory)

**Course Objectives:** The objectives of this course are to:

1. Introduce the fundamentals of Python programming for pharmaceutical sciences.
2. Develop basic programming skills using control structures, functions, and data structures.
3. Provide knowledge of data handling techniques for structured dataset management.
4. Familiarize students with data analysis tools such as NumPy and Pandas for healthcare datasets.
5. Enable students to visualize and interpret pharmaceutical data.

**Course Outcomes (CO):** Upon successful completion of this course, the students will be able to:

1. Explain the fundamentals of Python programming, including variables, data types, operators, and libraries.
2. Analyze program logic using control structures and functions.
3. Organize, manipulate, and retrieve data using data structures and file handling techniques.
4. Analyze pharmaceutical datasets using Python libraries.
5. Visualize and interpret pharmaceutical data using graphical tools.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No. of Lectures |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Introduction to Python programming</b> <ul style="list-style-type: none"> <li>Installing Python and an Integrated Development Environment (IDE) [Jupyter Notebook, PyCharm, VS Code etc.], Advantages of IDEs over text editors.</li> <li>Python variables and data types (integers, floats, strings, booleans), Type casting and basic operators (arithmetic, comparison, logical), Input and output operations.</li> <li>Basic string operations and manipulation techniques. Introduction to standard libraries and third-party libraries, installing and uninstalling libraries.</li> </ul> | 6 Hours         |
| II       | <b>Control Structures &amp; Functions</b> <ul style="list-style-type: none"> <li>Conditional statements (if, if-else, if-elif-else), nested conditions</li> <li>Loops (for loop, while loop).</li> <li>Break and continue statements.</li> <li>Defining and calling functions, passing arguments and returning values.</li> <li>Writing modular programs for simple pharmaceutical applications- dosage calculation and BMI calculation.</li> </ul>                                                                                                                                                | 6 hours         |
|          | <b>Data Structures &amp; File Handling</b> <ul style="list-style-type: none"> <li>Lists, tuples, and dictionaries.</li> <li>Indexing and slicing lists, basic operations on lists and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                   |                 |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| III | <p>dictionaries, string manipulation techniques.</p> <ul style="list-style-type: none"> <li>• Introduction to NumPy arrays, basic operations using NumPy (array creation, arithmetic operations).</li> <li>• Reading and writing CSV files.</li> <li>• Understanding structured healthcare datasets.</li> <li>• Importing small pharmaceutical datasets and performing basic data access and manipulation tasks.</li> </ul>                                                                                                                         | 6 hours |
| IV  | <p><b>Data Handling with Pandas</b></p> <ul style="list-style-type: none"> <li>• Introduction to Pandas library.</li> <li>• Pandas Series and DataFrame structures.</li> <li>• Reading CSV and Excel files-PK study datasets and ADR reports</li> <li>• Inspecting datasets using functions such as head(), tail(), info(), and describe().</li> <li>• Data cleaning techniques and handling missing values.</li> <li>• Filtering and selecting data based on conditions.</li> <li>• Grouping data and performing aggregation functions.</li> </ul> | 6 Hours |
| V   | <p><b>Data Visualization with Matplotlib</b></p> <ul style="list-style-type: none"> <li>• Introduction to Matplotlib.</li> <li>• Creating line plots, histograms, scatter plots, and box plots.</li> <li>• Labeling axes, titles, and legends.</li> <li>• Create plots and visualize pharmaceutical datasets - concentration-time curves for oral and IV administration, ADR reporting rates across drugs, dissolution profiles.</li> <li>• Scientific interpretation of plots.</li> </ul>                                                          | 6 Hours |

**Recommended References (*Preferably Latest Editions*):**

1. Weiss, C.J., 2017. *Scientific Computing for Chemists with Python*. Available at: <https://weisscharlesj.github.io/SciCompforChemists/notebooks/introduction/intro.html>
2. Perkovic, L., 2015. *Introduction to Computing Using Python: An Application Development Focus*. 2nd ed. Hoboken: Wiley.
3. Sweigart, A., 2025. *Automate the Boring Stuff with Python*. 3rd ed. Available at: <https://automatetheboringstuff.com/>
4. W3Schools, n.d. *Python Tutorial*. Available at: <https://www.w3schools.com/python/>
5. Datasets for Education and Research: Mentors and students can access healthcare datasets from sources such as Kaggle (healthcare records), government agencies (healthdata.gov, WHO, <https://www.data.gov.in/>), and clinical trial registries (<https://ctri.nic.in/>, <https://clinicaltrials.gov/>). Always use data responsibly.

## BP102T: General Pharmacy (Theory)

**Course Objectives:** The objectives of this course are to:

1. Provide knowledge about evolution and development of Pharmacy profession in India and the growth of the Pharmaceutical Industries over the years.
2. Provide understanding of different types of pharmacopoeias and other official books in maintaining the standards of medicines.
3. Provide knowledge about the basic pharmaceutical calculations used in dispensing and compounding.
4. Understand the role of active pharmaceutical ingredients and pharmaceutical excipients in drug formulations
5. Impart basic knowledge about formulation and preparation of Various solid, liquid and semisolid dosage forms

**Course Outcomes (CO):** Upon successful completion of this course, the students will be able to:

1. Describe the history and evolution of the pharmacy profession, including pharmacopeial practices and prescription handling.
2. Perform accurate pharmaceutical calculations required in the formulation and preparation of various types of dosage forms.
3. Explain the properties and functions of active pharmaceutical ingredients (APIs) and excipients and demonstrate the methods of preparation of solid dosage forms.
4. Illustrate the formulation principles of liquid dosage forms by analyzing the role of APIs and excipients involved.
5. Compare and evaluate the formulation of semisolid dosage forms based on the characteristics of APIs, excipients, and preparation methods.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No. of Lectures |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Introduction to the Profession of Pharmacy</b> <ul style="list-style-type: none"> <li>History of the Profession of Pharmacy in India: In relation to pharmacy education, pharmaceutical industries and organizations – evolution, development and milestones.</li> <li>Scope of the Pharmacy Profession: Role and responsibilities of pharmacists in retail/community pharmacy, hospital and clinical pharmacy, and industrial pharmacy including research and development.</li> <li>Pharmacopoeias: Introduction to IP, BP, USP, BPC, International Pharmacopoeia, other pharmacopoeias and the National Formulary of India; structure and content of the Indian Pharmacopoeia; study of one model IP monograph.</li> <li>Introduction to Prescription: Structure and format/parts of prescription, handling of prescriptions, Latin terminology related to prescriptions.</li> </ul> | 9 hours         |
|          | <b>Introduction to Pharmaceutical Calculations and Dosage Forms</b> <ul style="list-style-type: none"> <li>Metric system of weights and measures; calculations based on alligation, proof spirit, isotonic solutions, dilute solutions (percentage and ratio) and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |

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|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| II  | <p>geometric dilution; scientific notation of units and measures.</p> <ul style="list-style-type: none"> <li>• Posology: Definition and dose calculation based on age, body weight and body surface area.</li> <li>• Introduction to Dosage Forms: Routes of administration and classification of dosage forms.</li> <li>• Introduction to Active Pharmaceutical Ingredients and Excipients: Definition, ideal characteristics and importance.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9 hours |
| III | <p><b>Solid Dosage Forms</b></p> <ul style="list-style-type: none"> <li>• Powders: Classification, advantages and disadvantages; dusting powders, effervescent powders, efflorescent powders, hygroscopic powders and eutectic mixtures; introduction to excipients and methods of preparation.</li> <li>• Tablets: Definition, types of tablets including moulded tablets and pills with examples; advantages and disadvantages; introduction to excipients and methods of preparation.</li> <li>• Capsules: Definition, types of capsules, advantages and disadvantages, capsule sizes; introduction to excipients and methods of preparation.</li> </ul>                                                                                                                                                                                                                                                                                        | 9 hours |
| IV  | <p><b>Monophasic, Biphasic Liquids and Introduction to Galenicals</b></p> <ul style="list-style-type: none"> <li>• For internal use – aromatic waters, syrups, elixirs and linctus (definition and preparation).</li> <li>• For external use and body cavities – liniments, lotions, throat paints, applications, gargles, mouthwashes, enemas, eye drops, ear drops, nasal drops and tinctures with examples.</li> <li>• Study of official preparations- Introduction to excipients and methods of preparation.</li> <li>• Suspensions- Definition and types (flocculated and deflocculated), advantages and disadvantages, formulation excipients and general methods of preparation.</li> <li>• Emulsions- Definition and types, emulsifying agents, tests for identification of types of emulsions, formulation excipients and general methods of preparation.</li> <li>• Tinctures, Infusions, Decoctions, Fluid and Dry Extracts.</li> </ul> | 9 hours |
| V   | <p><b>Semisolid Dosage Forms</b></p> <ul style="list-style-type: none"> <li>• Definitions, classification, advantages and disadvantages, ointment bases and other excipients used in semisolid dosage forms; general methods of preparation of ointments, pastes, creams and gels.</li> <li>• Suppositories / Pessaries: Definition, types of suppositories, advantages and disadvantages, formulation excipients used in suppositories, properties of ideal suppository bases, types of suppository bases, displacement value and general method of preparation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                       | 9 hours |

**Recommended References (Preferably Latest Editions):**

1. Ansel, H.C., Allen, L.V. and Popovich, N.G., *Pharmaceutical Dosage Forms and Drug Delivery Systems*. Lippincott Williams & Wilkins, New Delhi.
2. Carter, S.J., *Cooper and Gunn's Dispensing for Pharmaceutical Students*. CBS

Publishers, New Delhi.

3. Indian Pharmacopoeia Commission, *Indian Pharmacopoeia*. Ghaziabad.
4. Indian Pharmacopoeia Commission, National Formulary of India. Ghaziabad, India.
5. British Pharmacopoeia Commission, *British Pharmacopoeia*. London.
6. United States Pharmacopeial Convention, *United States Pharmacopeia (USP–NF)*. Rockville, Maryland, USA.
7. Lachman, L., Lieberman, H.A. and Kanig, J.L., *The Theory and Practice of Industrial Pharmacy*. Lea & Febiger, University of Michigan.
8. Gennaro, A.R., *Remington: The Science and Practice of Pharmacy*. Lippincott Williams & Wilkins, New Delhi.
9. Rawlins, E.A., *Bentley's Textbook of Pharmaceutics*. Elsevier Health Sciences, USA.
10. Nieloud, F. and Marti-Mestres, G., *Pharmaceutical Emulsions and Suspensions*. Marcel Dekker Inc., New York.

## BP103T: Healthcare Psychology and Communication Skills (Theory)

**Course Objectives:** The objectives of this course are to:

1. Introduce the fundamental concepts and branches of psychology relevant to healthcare.
2. Help students understand human behavior, development, and psychological responses to illness.
3. Develop awareness of common psychological disorders and coping mechanisms in healthcare contexts.
4. Equip students with effective health communication skills for clinical and community settings.
5. Promote professional interaction with patients, caregivers, and healthcare teams through ethical and empathetic communication.

**Course Outcomes (CO):** Upon successful completion of this course, the students will be able to:

1. Explain the fundamental concepts of psychology and their relevance in healthcare settings.
2. Describe the stages of human development, personality traits, and behavioral responses associated with illness and recovery.
3. Apply effective communication models and techniques in clinical and interdisciplinary healthcare scenarios.
4. Demonstrate professional communication skills including active listening, empathetic interaction, and accurate clinical documentation.
5. Analyze psychological and behavioral interventions that promote mental health, treatment adherence, and stigma reduction.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                 | No. of Lectures |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Introduction to Psychology in Healthcare</b><br>Definition, scope, and relevance of psychology in health sciences. Branches of psychology with healthcare relevance: clinical, health, behavioural, and developmental psychology. Sensation, perception, and attention in clinical assessment. Learning and memory: reinforcement in health behaviour change. Emotion and motivation: theories and implications in health contexts. | 3 hours         |
| II       | <b>Developmental and Behavioural Psychology</b><br>Human developmental stages and healthcare needs. Personality theories and patient interaction styles. Psychological factors affecting illness perception and recovery. Common psychological disorders in healthcare: anxiety, depression, and somatization. Coping strategies, resilience, and stress management techniques.                                                        | 3 hours         |
| III      | <b>Foundations of Health Communication</b><br>Elements and models of communication in healthcare. Types of communication: interpersonal, group, mass, and telehealth communication. Barriers to effective communication in clinical settings. Active listening,                                                                                                                                                                        | 3 hours         |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                         |         |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|    | questioning techniques, and empathy. Culturally appropriate and inclusive communication.                                                                                                                                                                                                                                                                                                                                |         |
| IV | <b>Professional Communication in Healthcare Settings</b> Communication with patients, caregivers, and interdisciplinary teams. Delivering difficult news and handling emotionally charged situations. Legal and ethical issues in health communication (confidentiality, consent). Writing patient records, reports, and discharge summaries. Use of technology and digital communication tools in healthcare services. | 3 hours |
| V  | <b>Health Psychology and Behavioural Interventions</b><br>Health belief models and illness behaviour. Psychosomatic illnesses and the mind–body connection. Behaviour change theories (e.g., CBT, TTM) in treatment adherence. Psychological first aid and crisis communication. Mental health promotion and stigma reduction through communication.                                                                    | 3 hours |

**Recommended References (*Preferably Latest Editions*):**

1. Feldman, R.S., Understanding Psychology. McGraw-Hill Education, New York.
2. Taylor, S.E., Health Psychology. McGraw-Hill Education, New York.
3. Hargie, O., The Handbook of Communication Skills. Routledge, London.
4. Nevid, J.S., Rathus, S.A. and Greene, B., Psychology and the Challenges of Life: Adjustment and Growth. Wiley, New York.
5. Atkinson, R.L., Atkinson, R.C., Smith, E.E., Bem, D.J. and Nolen-Hoeksema, S., Introduction to Psychology. Wadsworth Publishing, Belmont.
6. Kumar, A., Communication Skills for Health Professionals. Jaypee Brothers Medical Publishers, New Delhi.
7. Park, K., Park's Textbook of Preventive and Social Medicine. Banarsidas Bhanot Publishers, Jabalpur.

## BP104T: Human Anatomy, Physiology and Pathophysiology – I (Theory)

**Course Objectives:** The objectives of this course are to:

1. Understand the structural organization of the human body from cells to systems.
2. Comprehend physiological functions of various body systems and the principles of homeostasis.
3. Learn the cellular basis of disease including injury, adaptation, and inflammation.
4. Recognize common pathological conditions related to skin, bones, joints, blood, cardiovascular system, and special senses.
5. Establish the groundwork for clinical interpretation of symptoms and disease mechanisms relevant to pharmacy and therapeutics.

**Course Outcomes (CO):** Upon successful completion of this course, the students will be able to:

1. Explain the fundamental concepts of Human Anatomy, Physiology and Pathophysiology.
2. Explain the gross morphology, structure and functions of various organs of the human body.
3. Understand the etiology and pathogenesis of diseases/disorders associated with integumentary system, peripheral nervous system and cardiovascular system
4. Understand the basic mechanism behind inflammation
5. Identify and differentiate the various tissues and organs of different systems of human body.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | No. of Lectures |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <p><b>Introduction to human body</b><br/>           Cellular and tissue level of organization.<br/>           Definition and scope of anatomy, physiology and pathophysiology. Levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminologies.<br/>           Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, forms of intracellular signalling-<br/>           a) Contact-dependent, b) Paracrine, c) Synaptic, d) Endocrine<br/>           Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.</p> <p><b>Basic principles of cell injury and adaptation</b><br/>           Components and types of feedback systems, causes of cellular injury, pathogenesis (cell membrane damage, mitochondrial damage, ribosome damage and nuclear damage), morphology of cell injury – adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia), cell swelling, intra cellular accumulation and cell death.<br/>           Definitions of commonly used relevant medical terminologies.</p> | 12 hours        |
|          | <p><b>Integumentary system and wound healing</b><br/>           Structure and functions of skin. Skin disorders: Psoriasis and dermatitis and pathophysiology of Leprosy. Basic principles of wound healing.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |

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| II  | <b>Skeletal system and joints</b><br>Divisions of skeletal system, types of bones, salient features and functions of bones of axial and appendicular skeletal system.<br>Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction. Structural and functional classification of joints.<br><b>Diseases of bones and joints</b><br>Pathophysiology of rheumatoid arthritis, osteoporosis and gout.                                                                                                                                                                                                                                                              | 12 hours |
| III | <b>Body fluids, blood and lymphatic system</b><br>Body fluids, composition and functions of blood, hemopoiesis, formation of haemoglobin, mechanisms of coagulation, blood grouping, Rh factors and transfusion. Lymphatic organs and tissues, lymphatic vessels, lymph formation, circulation and functions of lymphatic system.<br><b>Basic mechanism of inflammation and repair</b><br>Introduction, classification and pathophysiology of inflammation, mediators of inflammation.<br><b>Haematological diseases</b><br>Pathophysiology of iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, Thalassemia, hereditary acquired anaemia and haemophilia. | 12 hours |
| IV  | <b>Peripheral nervous system</b><br>Classification of peripheral nervous system: structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.<br><b>Special senses</b><br>Structure and functions of eye, ear, nose and tongue. Pathophysiology of special sense disorders- glaucoma, cataract, myopia, otitis externa, otitis media, vertigo and anosmia                                                                                                                                                                                                                                                                     | 12 hours |
| V   | <b>Cardiovascular system</b><br>Anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heartbeat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram.<br>Pathophysiology of hypertension, cardiac arrhythmias, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and coronary artery disease).                                                                                                                                                                  | 12 hours |

**Recommended References (Preferably Latest Editions):**

1. Sembulingam, K. and Sembulingam, P., Essentials of Medical Physiology. Jaypee Brothers Medical Publishers, New Delhi.
2. Guyton, A.C. and Hall, J.E., Textbook of Medical Physiology. Elsevier Saunders, Philadelphia, USA.
3. Tortora, G.J. and Grabowski, S.R., Principles of Anatomy and Physiology. Wiley, Palmetto, GA, USA.
4. Kumar, V., Cotran, R.S. and Robbins, S.L., Basic Pathology. W.B. Saunders Company.

## BP105T: Introduction to Pharmacognosy (Theory)

**Course Objectives:** The objectives of this course are to:

1. Explain the origin, history, and classification of natural drugs.
2. Understand cultivation and conservation methods for medicinal plants.
3. Study quality control and evaluation of crude drugs.
4. Study primary and secondary metabolites with their therapeutic relevance
5. Introduce traditional systems of medicine and phyto-therapeutic agents.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Describe the historical development, classification, and scope of Pharmacognosy.
2. Explain cultivation, processing, and conservation techniques for medicinal plants.
3. Apply quality evaluation methods to crude drugs using organoleptic, microscopic, and chemical parameters.
4. Identify primary and secondary metabolites with their therapeutic relevance.
5. Recognize traditional systems of medicine and commonly used phyto-therapeutic agents.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | No. of Lectures |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <p><b>Fundamentals of Pharmacognosy</b></p> <p>(a) Definition, history, present status, scope and development of pharmacognosy.</p> <p>(b) <b>Sources of drugs:</b> Plants, animals, microbial, marine, mineral and plant tissue culture.</p> <p>(c) <b>Historical milestones in drug discovery:</b> Morphine, quinine, aspirin, warfarin, penicillin, cephalosporin, taxol and artemisinin.</p> <p>(d) <b>Introduction to different herbal / traditional pharmacopoeias:</b> Indian Pharmacopoeia, British Herbal Pharmacopoeia, United States Pharmacopoeia – Herbal Medicines and Dietary Supplements, Ayurvedic Pharmacopoeia of India, Unani Pharmacopoeia of India and American Herbal Pharmacopoeia.</p> <p>(e) <b>Official and non-official; codified and non-codified drugs.</b></p> <p>Classification of crude drugs: alphabetical, morphological, taxonomical, chemical, pharmacological and chemotaxonomic classification along with their merits and limitations.</p> | 10 hours        |
| II       | <p><b>Cultivation, Collection, Processing and Storage of Drugs of Natural Origin</b></p> <p>Methods of plant cultivation and Good Agricultural and Collection Practices (WHO / GAP / GCP guidelines) for medicinal plants. Factors influencing cultivation, collection and storage of medicinal plants.</p> <p>Plant hormones and their applications in cultivation of medicinal plants.</p> <p>Application of polyploidy, mutation and hybridization concepts with reference to secondary metabolites. Ex-situ and in-situ conservation and strategies for value addition of medicinal plants. Role of eco-pharmacognosy in sustainable conservation of endangered medicinal plants such as kutki and chirata.</p>                                                                                                                                                                                                                                                                | 8 hours         |

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| III | <b>Quality Control of Drugs of Natural Origin (WHO Guidelines)</b><br>Adulteration of drugs of natural origin. Evaluation of drugs using organoleptic, microscopic (qualitative and quantitative), physical, chemical and biological methods. Physicochemical parameters: extractive values, moisture content, foreign organic matter, ash values, bitterness value, foaming index, haemolytic potential, swelling index, viscosity, optical rotation, refractive index, acid value and saponification value. DNA barcoding.                                                                               | 8 hours  |
| IV  | <b>Introduction to Metabolites of Plant Origin</b><br>Definition and general properties of plant metabolites. Primary and secondary metabolites such as carbohydrates, proteins, lipids, alkaloids, glycosides, flavonoids, tannins, terpenoids, volatile oils and resins.<br><b>Traditional Systems of Medicine</b> Basic principles of treatment of diseases in different systems of medicine including AYUSH and TCM. Types of dosage forms in AYUSH medicines. Role of pharmacognosy in allopathy and traditional systems of medicine such as AYUSH and TCM.                                           | 12 hours |
| V   | <b>Phyto-therapeutic Agents</b><br>Biological source, major constituents and uses of the following classes of drugs:<br>• Adaptogens and Immunomodulators: Ashwagandha, Tulsi, Amla •<br>Hepatoprotectives: Milk thistle, Kutki • Cardiovascular drugs: Garlic, Arjuna •<br>Antidiabetics: Gymnema, Fenugreek • Anti-inflammatory and analgesics: Turmeric, Boswellia • CNS drugs: Brahmi • Antimicrobial and antivirals: Giloy, Neem, Andrographis • Gastrointestinal drugs: Psyllium •<br>Dermatological agents: Aloe • Drugs used in women's health: Chasteberry, Shatavari • Respiratory drugs: Vasaka | 7 hours  |

**Recommended References (Preferably latest editions):**

1. Evans, W.C., *Trease and Evans Pharmacognosy*. 16th ed. London: W.B. Saunders & Co., 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., *Pharmacognosy*. 9th ed. Philadelphia: Lea & Febiger, 1988.
3. Wallis, T.E., *Textbook of Pharmacognosy*. London: J. & A. Churchill Ltd.
4. World Health Organization (2002) *WHO traditional medicine strategy 2002–2005*. Geneva: World Health Organization
5. World Health Organization (1998) *Quality control methods for medicinal plant materials*. Geneva: World Health Organization.
6. World Health Organization (2003) *WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants*. Geneva: World Health Organization.

## BP106T: Pharmaceutical Inorganic and Analytical Chemistry (Theory)

**Course Objectives:** The objectives of this course are to:

1. Understand the importance of errors, impurities in pharmaceuticals.
2. Comprehend the principles of buffer systems.
3. Develop skills in performing and interpreting limit tests and titrimetric analysis.
4. Emphasize the importance of inorganic compounds and radiopharmaceuticals in Pharmacy
5. Explain synthesis and analysis of inorganic compounds/products of pharmaceutical importance

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Identify sources and types of errors in pharmaceutical analysis, and impurities products
2. Apply concepts of acid-base chemistry, buffer systems with importance of electrolytes
3. Describe and differentiate various analytical techniques used in pharmaceutical analysis, including titrimetric methods, and their specific applications in quality assessment.
4. Analyze the properties, mechanisms, and therapeutic uses of gastrointestinal agents, radiopharmaceuticals, expectorants, antidotes, and other pharmaceutical compounds, illustrating their roles in therapy and safety considerations.
5. Describe the drugs used in expectorants, emetics, haemintics, poison and antidote and astringents.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | No. of Lectures |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Introduction to pharmaceutical analysis</b><br>Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples.<br><b>Errors</b><br>Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.<br><b>Impurities</b><br>Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate. | 7 hours         |
| II       | <b>Acid-Base Chemistry and Buffer Systems in Pharmacy</b><br>Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. Isotonicity and its application in IV Fluids and Ophthalmic Solutions.<br><b>Major extra and intracellular electrolytes</b><br>Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance.                                           | 8 hours         |
|          | <b>Acid base titrations</b><br>Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids                                                                                                                                                                                                                                                                                                            |                 |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| III | <p>and bases, neutralization curves. Assay of Ammonium hydroxide.</p> <p><b>Non-aqueous titrations</b><br/>Types of solvents used, acidimetric and alkalimetric titration using non-aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic substances using non-aqueous titrants, estimation of Sodium benzoate.</p> <p><b>Precipitation titrations and gravimetry</b><br/>Principle and steps involved in gravimetric analysis, Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry.</p> <p><b>Complexometric titrations</b><br/>Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*.</p> <p><b>Redox titrations</b><br/>Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate.</p> | 14 hours |
| IV  | <p><b>Gastrointestinal agents</b><br/>Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*.</p> <p>Agents promote bowel movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate and magnesium trisilicate.</p> <p>Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.</p> <p><b>Radiopharmaceuticals</b><br/>Basics of radioactivity, applications of radioisotopes of Sodium Iodide I-131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety.</p>                                                                                                                                                                                                                        | 10 hours |
| V   | <p><b>Miscellaneous Compounds</b><br/><b>Expectorants:</b> Potassium iodide, Ammonium chloride*. <b>Emetics:</b> Copper sulphate*, Sodium potassium tartrate. <b>Haematinics:</b> Ferrous sulphate*, Ferrous gluconate. <b>Poison and Antidote:</b> Definition, classification of antidotes, Sodium thiosulphate</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 06 hours |

**Recommended References (Preferably latest editions):**

1. Bentley, R. and Driver, J., Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford: Oxford University Press.
2. Vogel, A.I., Vogel's Textbook of Quantitative Chemical Analysis. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry. Part I & II. London: The Athlone Press, University of London.
4. Schroff, M.L., Inorganic Pharmaceutical Chemistry. New Delhi: Oxford Book Company.
5. Indian Pharmacopoeia Commission, Indian Pharmacopoeia. Ghaziabad, India.

**BP107P: General Pharmacy (Practical)****Course Objectives: The objectives of this course are to:**

1. Familiarize students with essential pharmaceutical calculations including dilution, concentration, and allegation methods required for accurate formulation of dosage forms.
2. Impart practical skills in the preparation of official and non-official dosage forms such as solutions, syrups, powders, granules, suppositories, semisolids, gargles, and mouthwashes in accordance with pharmacopeial standards.
3. Develop understanding of formulation principles related to selection of ingredients, dosage form design, stability, and patient acceptability.
4. Train students in the application of pharmacopoeial specifications (IP, BPC, WHO) during compounding, labeling, and evaluation of pharmaceutical preparations.
5. Enhance hands-on competency and professional confidence required for dispensing practice and pharmaceutical compounding in hospital and community pharmacy settings.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Perform accurate pharmaceutical calculations using dilution and allegation principles for the preparation of various dosage forms.
2. Prepare and dispense liquid dosage forms such as solutions, syrups, gargles, and mouthwashes following official pharmacopeial procedures.
3. Formulate solid dosage forms including powders, divided powders, dusting powders, and effervescent granules as per standard guidelines.
4. Prepare semisolid and specialized dosage forms such as ointments, liniments, and suppositories using appropriate bases and techniques.
5. Compile and evaluate a compendium of marketed dosage forms, demonstrating compliance with pharmacopeial standards, labeling requirements, and patient-centric considerations

**Detailed Syllabus:**

| List of practical                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Pharmaceutical Calculations</b><br>Solutions based on allegation and dilution methods                                                   |
| <b>2. Solutions</b><br>a) Strong solution of ammonium acetate – IP<br>b) Cresol with soap solution – IP<br>c) Lugol's solution – BPC          |
| <b>3. Syrups</b><br>a) Simple Syrup – IP                                                                                                      |
| <b>4. Powders &amp; Granules</b><br>a) ORS powder – WHO<br>b) Effervescent granules – IP<br>c) Dusting powder – IP<br>d) Divided powders – IP |
| <b>5. Suppositories</b><br>a) Glycerogelatin suppository – BPC<br>b) Cocoa butter suppository – IP                                            |

c) Zinc Oxide suppository – IP

**6. Semisolids**

a) Sulphur ointment – IP

b) Non-staining iodine ointment with methyl salicylate – BPC

**7. Gargles & Mouthwashes**

a) Iodine gargle – BPC

b) Chlorhexidine mouthwash – IP

**Note:**

a) *Preparation of compendia of dosage forms (marketed products), is recommended.*

b) *Any other practical relevant to the syllabus can be introduced.*

c) *Minimum 12 experiments must be performed covering all dosage forms.*

**Recommended References (Preferably latest editions):**

1. Carter, S.J., *Cooper and Gunn's Dispensing for Pharmaceutical Students*. 12th ed. New Delhi: CBS Publishers.
2. Indian Pharmacopoeia Commission, *Indian Pharmacopoeia*, Vol. I. Ghaziabad: IPC.
3. United States Pharmacopeial Convention, *United States Pharmacopeia–National Formulary (USP–NF)*. Rockville, MD, USA.
4. British Pharmacopoeia Commission, *British Pharmacopoeia Codex*. London: The Stationery Office.
5. World Health Organization, *Oral Rehydration Salts (ORS) Formulation Guidelines*. Geneva: WHO.

## BP108P: Healthcare Psychology and Communication Skills (Practical)

### Course Objectives: The objectives of this course are:

1. To develop effective communication skills essential for diverse clinical and community health scenarios.
2. To enhance empathetic interaction through role plays, simulations, and reflective practices.
3. To promote collaborative learning and peer feedback in communication-based tasks.
4. To encourage application of psychological principles in real-life healthcare contexts.
5. To build confidence in delivering health education and awareness activities in community settings.

### Course Outcomes: Upon successful completion of this course, the students will be able to:

1. Demonstrate patient-centered communication through role plays and clinical simulations.
2. Analyze healthcare communication challenges using case study discussions.
3. Practice reflective listening, paraphrasing, and team-based communication strategies.
4. Design and deliver effective health education messages for the community.
5. Reflect on personal emotional growth and improvement in communication competencies.

### Detailed Syllabus:

| List of practical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| <ol style="list-style-type: none"> <li>1. <b>Role Plays and Simulations</b> Counselling a patient with chronic illness Breaking bad news in a clinical setting<br/>Empathetic listening in crisis response</li> <li>2. <b>Case Study Discussions</b><br/>Mental health cases in primary care<br/>Impact of miscommunication in healthcare errors</li> <li>3. <b>Peer-to-Peer Practice Sessions</b><br/>Reflective listening and paraphrasing<br/>Effective team communication and decision-making</li> <li>4. <b>Community Engagement Tasks</b><br/>Designing IEC materials for public health awareness Conducting mock health education sessions</li> <li>5. <b>Journaling &amp; Self-Reflection Logs</b><br/>Weekly reflection on emotional responses during care simulations Growth in communication skill development over the semester</li> </ol> |

### Recommended References (Preferably latest editions):

1. Morgan, C.T. and King, R.A., Introduction to Psychology. New York: McGraw-Hill.
2. Taylor, S.E., Health Psychology. New York: McGraw-Hill Education.
3. Hargie, O., Skilled Interpersonal Communication: Research, Theory and Practice. London: Routledge.
4. Balzer-Riley, J., Communication in Nursing and Healthcare. Boston: Pearson.
5. Weinman, J., Petrie, K.J. and Moss-Morris, R., The Psychology of Health and Illness. London: Routledge.

**BP109P: Human Anatomy, Physiology and Pathophysiology - I (Practical)**

**Course Objectives:** The objectives of this course are to:

1. Provide fundamental knowledge of the structure and functions of various organ systems of the human body.
2. Understand the mechanisms of homeostasis and their role in maintaining normal physiological functions.
3. Introduce the basic concepts of pathophysiology and the causes of diseases affecting different organ systems.
4. Explain the body's physiological responses to disease-producing agents.
5. Lay the foundation for understanding clinical conditions through the study of functional alterations in organs and systems.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Explain the principles, applications, and experimental use of microscopy techniques, and perform basic laboratory experiments related to the nervous system and special senses.
2. Describe the gross morphology, microscopic structure, and coordinated functioning of major human organs and organ systems, emphasizing their roles in maintaining normal physiology.
3. Estimate and interpret key hematological parameters, and explain the mechanisms of homeostasis along with related physiological and pathological disorders.
4. Discuss the etiology and pathogenesis of selected disease states, linking structural and functional changes to clinical manifestations.
5. Identify and explain common diseases with respect to their signs and symptoms, risk factors, diagnostic methods, preventive measures, treatment strategies, and possible complications.

**Detailed Syllabus:****List of practical**

*(Minimum 12 experiments must be performed)*

Practical HAPP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated videos, models and charts.

1. Study of compound microscopes.
2. Microscopic study of epithelial and connective tissue.
3. Microscopic study of muscular and nervous tissue.
4. Identification of axial bones.
5. Identification of appendicular bones.
6. Introduction to hemocytometry.
7. Demonstration of total blood count by cell analyser.
8. Enumeration and interpretation of white blood cell (WBC) count, differential count.
9. Enumeration and interpretation of total red blood corpuscles (RBC) count.
10. Determination of bleeding time and clotting time.
11. Estimation and interpretation of hemoglobin content.
12. Determination of blood group.
13. Determination and interpretation of erythrocyte sedimentation rate (ESR).
14. Determination of pulse rate, heart rate and blood pressure.
15. Recording and interpretation of ECG.
16. To study the cardiovascular system and integumentary system.

17. Hands-on training in cardiopulmonary resuscitation (CPR).
18. Case studies/files of patients with anaemia, thalassemia, haemophilia, leprosy, gout, hypertension and ischemic heart disease.

**Recommended References (*Preferably latest editions*):**

1. Wilson, K.J.W., *Anatomy and Physiology in Health and Illness*. New York: Churchill Livingstone.
2. Guyton, A.C. and Hall, J.E., *Textbook of Medical Physiology*. Philadelphia: Elsevier.
3. Tortora, G.J. and Grabowski, S.R., *Principles of Anatomy and Physiology*. New York: Wiley.

**BP110P: Introduction to Pharmacognosy (Practical)**

**Course Objectives:** The objectives of this course are to:

1. Identify medicinal plants and crude drugs using morphological and microscopical characters.
2. Analyze powdered drugs and perform quantitative microscopy.
3. Evaluate crude drugs using physicochemical parameters.
4. Introduce standardization and quality control of herbal materials.
5. Collect medicinal plants and prepare voucher specimens.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Identify medicinal plants and crude drugs using morphological and microscopical characters.
2. Analyze powdered drugs microscopically to identify diagnostic cell contents.
3. Perform quantitative microscopy for stomatal and vein parameters.
4. Evaluate quality and purity of crude drugs using physicochemical parameters.
5. Collect medicinal plants and prepare voucher specimens during field visits.

**Detailed Syllabus:**

| List of practices                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <i>(Minimum 12 experiments must be performed)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <ol style="list-style-type: none"><li>1. Morphological study of medicinal plants (as mentioned in Unit V Theory).</li><li>2. Organoleptic evaluation and powder microscopical characters of the following drugs: Tulsi and Ashwagandha.</li><li>3. Organoleptic evaluation and powder microscopical characters of the following drugs: Amla and Arjuna.</li><li>4. Organoleptic evaluation and powder microscopical characters of the following drugs: Turmeric and Psyllium husk.</li><li>5. Organoleptic evaluation and powder microscopical characters of the following drugs: Brahmi and Fenugreek.</li><li>6. Determination of moisture content of crude drugs.</li><li>7. Determination of swelling index and foaming index of crude drugs.</li><li>8. Determination of stomatal number and stomatal index of leaf.</li><li>9. Determination of vein islet and vein termination number of leaf.</li><li>10. Determination of ash value and extractive values of crude drugs.</li><li>11. Determination of foreign organic matter of crude drugs.</li><li>12. Determination of dimensions of calcium oxalate crystals and phloem fibers by eyepiece micrometry.</li><li>13. Determination of percentage purity of powder drug using lycopodium spore method.</li></ol> <p>Experiential learning-based experiments involving collection, identification of medicinal plant material, preparation of voucher specimens and excursion visits to medicinal plant garden.</p> |

**Recommended References (Preferably Latest Editions):**

1. Evans, W.C., 2009. *Trease and Evans Pharmacognosy*. 16th ed. London: W.B. Saunders & Co.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., 1988. *Pharmacognosy*. 9th ed. Philadelphia: Lea & Febiger.
3. Wallis, T.E., *Textbook of Pharmacognosy*. London: J. & A. Churchill Ltd.

## BP111P: Pharmaceutical Inorganic and Analytical Chemistry (Practical)

**Course Objectives:** The objectives of this course are to:

1. Gain practical knowledge on various volumetric titration techniques.
2. Learn the principles of volumetric analysis.
3. Study the preparation and assessment of inorganic compounds.
4. Determine the assay of various inorganic compounds in pharmaceutical use.
5. Develop analytical skill for the qualitative and quantitative analysis of various inorganic compounds.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Perform limit tests to detect and identify impurities in pharmaceutical substances.
2. Prepare various pharmaceutical inorganic compounds following standard procedures.
3. Analyze the significance of quality control in pharmaceutical products and raw materials.
4. Demonstrate proficiency in titrimetric analysis using different volumetric techniques.
5. Competence in applying analytical skills to qualitative and quantitative data.

### Detailed Syllabus:

| List of practical                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                       |
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| 1. <b>Limit tests (Any 4 Experiments)</b>                                                                     | a. Limit test and modified limit test for Chloride as per Indian Pharmacopoeia b. Limit test and modified limit test for sulphate as per Indian Pharmacopoeia c. Limit test for Iron d. Limit test for Lead e. Limit test for arsenic                                                                                                                                                 |
| 2. <b>Preparation of inorganic pharmaceuticals (Any 3 Experiments)</b>                                        | a. Preparation of Aluminium hydroxide b. Preparation of potash alum c. Preparation of ferrous sulphate d. Preparation of Magnesium sulphate from magnesium hydroxide or magnesium carbonate                                                                                                                                                                                           |
| 3. <b>Test for Purity (Any 2 Experiments)</b>                                                                 | a. Assessment of swelling power of bentonite as per Indian Pharmacopoeia b. Evaluation of acid neutralizing capacity of aluminium hydroxide gel c. Determination of potassium iodate and iodine in potassium Iodide                                                                                                                                                                   |
| 4. <b>Assay of the following inorganic compounds including standardization of titrant (Any 5 Experiments)</b> | a. Assay of ammonium chloride by acid base titration, b. Assay of Ferrous sulphate by Cerimetry, c. Assay of Copper sulphate by Iodometry, d. Assay of Calcium gluconate by Complexometry, e. Assay of Hydrogen peroxide by Permanganometry, f. Assay of Sodium benzoate by non-aqueous titration, g. Assay of Sodium Chloride by precipitation titration (Modified Volhard's method) |

### Recommended References (*Preferably Latest Editions*):

1. Bentley, R. and Driver, J., *Bentley and Driver's Textbook of Pharmaceutical Chemistry*. Oxford: Oxford University Press.
2. Vogel, A.I., *Vogel's Textbook of Quantitative Chemical Analysis*. Essex: Pearson Education Limited.
3. Beckett, A.H. and Stenlake, J.B., *Practical Pharmaceutical Chemistry*. Part I & II. London: The Athlone Press, University of London.
4. Kennedy, J.H., *Analytical Chemistry: Principles*. New York: Saunders College Publishing.
5. Schroff, M.L., *Inorganic Pharmaceutical Chemistry*. New Delhi: Oxford Book Company.
6. Indian Pharmacopoeia Commission, *Indian Pharmacopoeia*. Ghaziabad, India.

## BP201T: Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)

### Course Objectives: The objectives of this course are to:

1. Explain fundamental statistical concepts relevant to pharmaceutical sciences.
2. Develop the ability to interpret clinical and experimental data scientifically.
3. Apply statistical methods for analysing pharmaceutical and biomedical data.
4. Demonstrate the use of Python-based tools for statistical analysis and data handling.
5. Recognize the role of statistical analysis in evidence-based decision making and machine learning applications in healthcare.

### Course Outcomes: Upon successful completion of this course, the students will be able to:

1. Classify pharmaceutical data using appropriate descriptive statistics.
2. Apply probability concepts and statistical distributions in clinical and pharmaceutical contexts.
3. Perform sampling and hypothesis testing for decision-making in research.
4. Analyze correlation and regression relationships in pharmaceutical datasets.
5. Demonstrate statistical analysis using Python and interpret outputs appropriately.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | No. of Lectures |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Descriptive Statistics</b> <ul style="list-style-type: none"> <li>Types of data in pharmaceutical sciences (nominal, ordinal, interval, ratio)</li> <li>Sources of data in pharmacy: clinical trials, pharmacovigilance, quality control, PK studies</li> <li>Measures of central tendency: mean, median, mode, their calculation and interpretation</li> <li>Measures of dispersion (range, variance, standard deviation) and their interpretation using pharmaceutical data</li> <li>Skewness and understanding distribution shape in biological measurements</li> <li>Perform descriptive statistical analysis using Python libraries such as NumPy and Pandas, with focus on Interpretation of results</li> </ul>                     | 6 hours         |
| II       | <b>Probability &amp; Statistical Distributions in Healthcare</b> <ul style="list-style-type: none"> <li>Basic probability concepts and laws (addition and multiplication rules), conditional probability and its interpretation</li> <li>Bayes' theorem and its application in clinical decision-making</li> <li>Concept of random variables (discrete and continuous)</li> <li>Normal distribution and its importance in biological and pharmaceutical measurements,</li> <li>Binomial distribution demonstrating applications in clinical trial outcomes</li> <li>Poisson distribution for modeling rare events such as adverse drug reactions</li> <li>Graphical visualization of these probability distributions using Python</li> </ul> | 6 hours         |

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| III | <b>Sampling &amp; Statistical Inference</b> <ul style="list-style-type: none"> <li>Population versus sample, sampling techniques used in clinical research, Sampling error and bias</li> <li>Conceptual understanding of the Central Limit Theorem</li> <li>Confidence intervals and their interpretation</li> <li>Hypothesis testing framework (null and alternative hypotheses)</li> <li>Type I and Type II errors, p-value and statistical significance</li> <li>Demonstration, calculation and interpretation of these parameters using python with pharmaceutical data</li> </ul>          | 6 hours |
| IV  | <b>Basics of Correlation &amp; Regression</b><br>Conceptual understanding of the following concepts with emphasis on their interpretation- <ul style="list-style-type: none"> <li>correlation and Pearson correlation coefficients</li> <li>Interpretation of positive and negative correlations</li> <li>Scatter plots and trend visualization using pharmaceutical data such as dose-response relationships</li> <li>Simple linear regression concept, interpretation of regression coefficients</li> <li>Introduction to odds ratio and its application in clinical risk analysis</li> </ul> | 6 hours |
| V   | <b>Statistical Analysis Using Python – Case based learning</b> <ul style="list-style-type: none"> <li>Demonstration of descriptive statistics, correlation analysis and linear regression using Python libraries- SciPy / Statsmodels / Scikit-learn on pharmaceutical datasets</li> <li>Interpretation of the output summaries and p-values</li> <li>Preparation of statistical reports</li> </ul>                                                                                                                                                                                             | 6 hours |

**Recommended References (*Preferably Latest Editions*):**

1. Lane, D.M., Introduction to Statistics. Houston: Rice University. Available at: <https://onlinestatbook.com/2/index.html>
2. Walters, S.J., Campbell, M.J. and Machin, D., Medical Statistics: A Textbook for the Health Sciences. Hoboken, NJ: Wiley-Blackwell.
3. Rowe, P., Essential Statistics for the Pharmaceutical Sciences. London: Pharmaceutical Press.
4. Bolton, S. and Bon, C., Pharmaceutical Statistics: Practical and Clinical Applications. New York: Informa Healthcare.
5. De Muth, J.E., Basic Statistics and Pharmaceutical Statistical Applications. Boca Raton, FL: CRC Press.

## BP202T: Biochemistry (Theory)

**Course Objectives:** The objectives of this course are to:

1. Know about enzymology and various tests in clinical chemistry
2. Understand the biochemical pathways and clinical relevance of carbohydrate, lipid and protein metabolism.
3. Describe energetics and biological oxidation.
4. Explain amino acid and protein metabolism
5. Understand Nucleic acid metabolism and genetic information.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Explain the principles of enzymology and various tests in clinical chemistry
2. Describe the classification, the classification, structure, and functions of major biomolecules such as carbohydrates, lipids, proteins, nucleic acids, enzymes, and vitamins.
3. Explain the principles of bioenergetics, biological oxidation, and the overview of metabolic pathways of biomolecules, along with their clinical significance.
4. Understand metabolism of lipid and its significance.
5. Understand metabolism of proteins & its significance and monitoring of metabolic and organ-specific disorders.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No. of Lectures |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Enzymology</b><br>a. Introduction, properties, nomenclature, and IUB classification of enzymes and coenzymes. Enzyme kinetics (Michaelis plot, Lineweaver–Burk plot). Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzyme regulation. Therapeutic and diagnostic application of enzymes and isoenzymes. Factors affecting enzyme activity. Digestion, absorption function of dietary Macro and Micronutrients, including Vitamins and Minerals, Biochemical functions of vitamins and associated diseases.<br>b. Clinical Chemistry: Liver function tests (routinely performed tests based on liver function). Renal function tests (routinely performed tests based on kidney function, ELISA test)                                                                                                                                                                                          | 10 hours        |
| II       | a. Introduction about biomolecules – Introduction of carbohydrate, lipids, nucleic acids, amino acids and proteins.<br>b. Bioenergetics: Concept of free energy; relationship between free energy, enthalpy, and entropy; redox potential; energy-rich compounds (ATP, GTP, etc.) and their biological significance.<br>c. Carbohydrate Metabolism and their role in diabetes mellitus: Overview and significance of major pathways: Glycolysis, Citric Acid Cycle (TCA), Gluconeogenesis, Hexose Monophosphate (HMP) shunt, and Glycogen metabolism; regulation of blood glucose levels; metabolic adaptations during fed state, fasting, and prolonged starvation; metabolic derangements in diabetes mellitus and related disorders.<br>d. Biological Oxidation: Electron Transport Chain (ETC), oxidative phosphorylation, and mechanisms of ATP synthesis; regulation and clinical implications of mitochondrial dysfunction and oxidative stress. | 10 hours        |

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| III | <b>Lipid metabolism</b><br>a. Classification, functions, and properties of lipids and lipoproteins (HDL, LDL, VLDL, chylomicrons)<br>b. $\beta$ -oxidation and de-novo synthesis of fatty acids: Ketone bodies: synthesis, utilization, and clinical significance<br>c. Biological significance of cholesterol, lipid profile, and its clinical significance<br>d. Disorders associated with lipid metabolism: Hyperlipidaemias and hypercholesterolemia, lipid storage diseases, atherosclerosis, fatty liver disease, and obesity                                                                                                                                                                                                                                                                                                                                                                                                   | 7 hours  |
| IV  | <b>Amino acids and protein metabolism</b><br>a. Classification and Biological Functions: Classification and physiological roles of amino acids. Structure and functions of proteins and plasma proteins<br>b. General Metabolism of Amino Acids: Transamination, oxidative and non-oxidative deamination, decarboxylation. Urea cycle – nitrogen disposal and detoxification. Fate of carbon skeletons of amino acids (glucogenic vs ketogenic).<br>c. Catabolism of Specific Amino Acids and Related Disorders: Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia) and Inborn errors of branched chain and aromatic amino acids<br>d. Biochemical significance of neurotransmitters and hormones derived from amino acids:<br>5-HT (serotonin), melatonin, dopamine, noradrenaline, adrenaline<br>e. Catabolism of heme and related disorders (jaundice). | 10 hours |
| V   | <b>Nucleic acid metabolism and genetic information transfer</b><br>a. Nucleotide Metabolism and their related disorders: Biosynthesis of purine and pyrimidine nucleotides. Catabolism of purine nucleotides (uric acid formation). Clinical significance of Hyperuricemia and Gout.<br>b. Genome Structure and Central Dogma: Organization of the mammalian genome. Introduction to DNA replication, Transcription, and Translation.<br>c. Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins)<br>d. DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Overview of clinical disorders associated with faulty DNA repair.                                                                                                                                                                                        | 8 hours  |

**Recommended References (Preferably latest editions):**

1. Nelson, D.L., Cox, M.M. and Hoskins, A., *Lehninger Principles of Biochemistry*. New York: W.H. Freeman.
2. Kennelly, P.J., Rodwell, V.W., Bender, D.A., Botham, K.M. and Weil, P.A., *Harper's Illustrated Biochemistry*. New York: McGraw-Hill Education.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Weil, P.A., *Harper's Biochemistry*. New York: McGraw-Hill.
4. Voet, D. and Voet, J.G., *Biochemistry*. New York: John Wiley & Sons.
5. Devlin, T.M., *Textbook of Biochemistry with Clinical Correlations*. New York: Wiley-Liss.
6. Satyanarayana, U. and Chakrapani, U., *Biochemistry*. Kolkata: Books and Allied (P) Ltd.
7. Stryer, L., *Biochemistry*. New York: W.H. Freeman.

**BP203T: Human Anatomy, Physiology and Pathophysiology - II (Theory)**

**Course Objectives:** The objectives of this course are to:

1. Understand the anatomy and physiology of major body systems.
2. Learn mechanisms of neurological, gastrointestinal, respiratory, renal, endocrine, and reproductive functions.
3. Identify common pathophysiological conditions affecting each organ system.
4. Correlate structural and functional abnormalities with disease symptoms.
5. Equip students with foundational knowledge for interpreting disease processes and planning rational pharmacotherapy.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Describe the structural organization of the nervous, gastrointestinal, respiratory, urinary, endocrine and reproductive systems.
2. Explain the physiological mechanisms that regulate the functions of nervous, endocrine and reproductive systems.
3. Illustrate the etiology and development of common diseases affecting different organ systems including cancer.
4. Analyze the pathophysiological alterations associated with disorders of the nervous, gastrointestinal, respiratory, renal and endocrine systems.
5. Interpret clinical manifestations and case findings related to organ system dysfunctions.

**Detailed Syllabus:**

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No. of Lectures |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Nervous System</b><br>a) Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse and neurotransmitters.<br>Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem and cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity).<br>b) Pathophysiology of epilepsy, Parkinson's disease, stroke, migraine, depression, schizophrenia, Alzheimer's disease and meningitis. | 14 hours        |
| II       | <b>Gastrointestinal System</b><br>a) Anatomy of GI tract with special reference to anatomy and functions of stomach (acid production in the stomach and its regulation through parasympathetic nervous system; role of pepsin in protein digestion). Anatomy and functions of small intestine and large intestine. Anatomy and functions of salivary glands, pancreas and liver. Movements of GIT, digestion and absorption of nutrients.<br>b) Pathophysiology of inflammatory bowel diseases, peptic ulcer, jaundice, hepatitis, typhoid and alcoholic and non alcoholic fatty liver disease                                 | 12 hours        |
|          | a) <b>Respiratory System</b><br>Anatomy of respiratory system with special reference to anatomy of lungs. Mechanism of respiration and regulation of respiration. Lung volumes and capacities, transport of respiratory gases, artificial respiration and resuscitation                                                                                                                                                                                                                                                                                                                                                        |                 |

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| III | <p>methods.</p> <p>b) Pathophysiology of asthma, chronic obstructive pulmonary diseases and tuberculosis.</p> <p>c) <b>Urinary System</b><br/>Anatomy of urinary tract with special reference to anatomy of kidney and nephrons. Functions of kidney and urinary tract. Physiology of urine formation, micturition reflex and role of kidneys in acid–base balance.<br/>Role of Renin Angitensin Aldosterone System in kidney.</p> <p>d) Pathophysiology of acute and chronic renal failure and urinary tract infections.</p> | 12 hours |
| IV  | <p><b>Endocrine System</b></p> <p>a) Classification of hormones and mechanism of hormone action. Structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland and thymus.</p> <p>b) Pathophysiology of diabetes, hypothyroidism, hyperthyroidism, goitre and polycystic ovary syndrome.</p>                                                                                                                                                                            | 10 hours |
| V   | <p><b>Reproductive System and Cancer</b></p> <p>a) Anatomy of male and female reproductive system. Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition.</p> <p>b) Pathophysiology of sexually transmitted diseases: AIDS, syphilis and gonorrhea.</p> <p>c) Etiology and pathogenesis of cancer.</p>                                                                                                             | 12 hours |

**Recommended References (Preferably latest editions):**

1. Wilson, K.J.W., *Ross and Wilson Anatomy and Physiology in Health and Illness*. Churchill Livingstone, New York.
2. Tortora, G.J. and Grabowski, S.R., *Principles of Anatomy and Physiology*. Palmetto, GA, U.S.A.
3. Guyton, A.C. and Hall, J.E., *Textbook of Medical Physiology*. Elsevier.
4. Chatterjee, C.C., *Human Physiology (Vol. I & II)*. Academic Publishers, Kolkata.
5. Mohan, H., *Textbook of Pathology*. Jaypee Publishers.
6. Porth, C.M., *Pathophysiology: Concepts of Altered Health States*. Lippincott Williams & Wilkins.
7. Kumar, V., Abbas, A.K., Aster, J.C. and Deyrup, A.T., *Robbins and Kumar Basic Pathology*. Elsevier.

## BP204T: Pharmaceutical Organic Chemistry (Theory)

### Course Objectives: The objectives of this course are to:

1. Develop a clear understanding of the chemistry of saturated hydrocarbons.
2. Study the chemistry and reactions of unsaturated hydrocarbons.
3. Understand the chemistry and reaction mechanisms of alkyl halides.
4. Explain the chemistry of aromatic hydrocarbons and their derivatives.
5. Provide an understanding of carbonyl compounds and fundamental organic reaction mechanisms relevant to pharmaceuticals.

### Course Outcomes: Upon successful completion of this course, the students will be able to:

1. Describe the chemical reactions and mechanisms of aliphatic saturated hydrocarbons.
2. Explain the reactions and mechanisms of aliphatic unsaturated hydrocarbons.
3. Understand nucleophilic substitution and elimination reactions of alkyl halides.
4. Explain electrophilic aromatic substitution reactions and the effect of substituents.
5. Apply knowledge of carbonyl compounds and reaction mechanisms in pharmaceutical chemistry.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No. of Lectures |
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| I        | <b>Aliphatic Saturated Hydrocarbons – Alkanes</b> <ul style="list-style-type: none"> <li>• Methods of preparation: Wurtz reaction, Kolbe's reaction, Clemmensen reduction, Wolff–Kishner reduction</li> <li>• Chemical reactions of alkanes</li> <li>• Mechanism of free radical substitution (halogenation)</li> <li>• Pharmaceutical applications of alkanes: Liquid paraffin, soft paraffin, hard paraffin</li> </ul> <b>Cycloalkanes</b> <ul style="list-style-type: none"> <li>• Baeyer's strain theory and its limitations</li> <li>• Coulson–Moffitt modification</li> <li>• Sachse–Mohr theory</li> </ul>                                                                                                                                                                                    | 12 hours        |
| II       | <b>Aliphatic Unsaturated Hydrocarbons – Alkenes</b> <ul style="list-style-type: none"> <li>• Methods of preparation:               <ul style="list-style-type: none"> <li>◦ Dehydration of alcohols</li> <li>◦ Dehydrohalogenation of alkyl halides</li> <li>◦ Dehalogenation of vicinal dihalides</li> <li>◦ Wittig reaction</li> </ul> </li> <li>• Chemical reactions of alkenes</li> <li>• Mechanism of electrophilic addition reactions</li> <li>• Markovnikov's and anti-Markovnikov's rule</li> <li>• Ozonolysis</li> </ul> <b>Conjugated Dienes</b> <ul style="list-style-type: none"> <li>• Stability of conjugated dienes</li> <li>• Mechanism of Diels–Alder reaction</li> <li>• Electrophilic and free radical addition reactions</li> <li>• 1, 2- and 1, 4-addition reactions</li> </ul> | 12 hours        |

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| III | <b>Alkyl Halides</b> <ul style="list-style-type: none"> <li>Nucleophilic substitution reactions: <b>SN1 and SN2</b> <ul style="list-style-type: none"> <li>Mechanism, kinetics, substrate structure, solvent effect, stereochemistry</li> </ul> </li> <li>Elimination reactions: <b>E1 and E2</b> <ul style="list-style-type: none"> <li>Mechanism, kinetics, substrate structure, solvent effect, stereochemistry</li> </ul> </li> <li>Zaitsev's (Saytzeff's) rule with examples</li> <li>Comparison of substitution vs elimination reactions</li> </ul>                                                                                  | 12 hours |
| IV  | <b>Benzene and Its Derivatives – -</b> <ul style="list-style-type: none"> <li>IUPAC nomenclature of mono- and di-substituted benzene derivatives</li> <li>Structure of benzene</li> <li>Molecular orbital picture and resonance</li> <li>Aromaticity and Hückel's rule</li> <li>Electrophilic aromatic substitution reactions:               <ul style="list-style-type: none"> <li>Nitration</li> <li>Halogenation</li> <li>Friedel–Crafts alkylation and its limitations</li> <li>Friedel–Crafts acylation</li> <li>Sulphonation and desulphonation</li> </ul> </li> <li>Effect of substituents on reactivity and orientation</li> </ul> | 12 hours |
| V   | <b>Carbonyl Compounds - Aldehydes and Ketones</b> <ul style="list-style-type: none"> <li>Preparation and properties of carbonyl compounds</li> <li>Nucleophilic addition reactions</li> <li>Aldol condensation and crossed aldol condensation</li> <li>Cannizzaro and crossed Cannizzaro reactions</li> <li>Benzoin and Perkin condensation</li> <li>Oxidation and reduction reactions</li> <li>Pharmaceutical applications of carbonyl compounds: Chloral, Paraldehyde, Ketoprofen</li> </ul>                                                                                                                                             | 12 hours |

**Recommended References (*Preferably latest editions*):**

- Morrison, R.T., Boyd, R.N. and Bhattacharjee, S.K., *Organic Chemistry*. Pearson Education India.
- Finar, I.L., *Organic Chemistry, Vol. I*. Pearson Books.
- Bahl, B.S. and Bahl, A., *Textbook of Organic Chemistry*. S. Chand & Company.
- Furniss, B.S., *Vogel's Textbook of Practical Organic Chemistry*.

## BP205T: Pharmacognosy and Phytochemistry (Theory)

**Course Objectives:** The objectives of this course are to:

1. Understand major metabolic pathways and the biogenetic origin of primary and secondary phytoconstituents, including the use of modern tools for pathway studies.
2. Study and interpret the pharmacognostic features of crude drugs containing primary metabolites such as carbohydrates, proteins/enzymes, and lipids.
3. Study and interpret the pharmacognostic features of crude drugs containing secondary metabolites such as alkaloids, glycosides, tannins, resins, volatile oils, flavonoids, phenolics, and terpenoids.
4. Impart knowledge of conventional and modern extraction techniques and enable selection of appropriate extraction methods.
5. Develop competency in isolation, identification, characterization, and quality evaluation of medicinal plants and botanicals.

**Course Outcomes (CO):** Upon successful completion of this course, the students will be able to:

1. Describe biosynthetic pathways and genetic tools involved in phytoconstituent production.
2. Classify and explain drugs containing primary and secondary metabolites.
3. Apply traditional and modern extraction and isolation methods.
4. Explain qualitative and quantitative analysis of plant metabolites.
5. Evaluate identity, purity, and quality of herbal raw materials.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | No. of Lectures |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Metabolic Pathways and Biogenetic Studies –</b><br>Brief study of basic metabolic pathways and biosynthesis of secondary metabolites including: <ul style="list-style-type: none"> <li>• Shikimic acid pathway</li> <li>• Acetate pathway</li> <li>• Amino acid pathways</li> </ul> Utilization of radioactive isotopes in biogenetic studies.<br>Introduction to pathway prediction tools and modern genetic tools such as <b>CRISPR/Cas9</b> .                                                             | 10 hours        |
| II       | <b>Primary Metabolites –</b><br><b>General classification and identification tests</b><br><b>Pharmacognostic study</b> (biological source, distribution, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of:<br><b>Carbohydrates:</b> <ul style="list-style-type: none"> <li>• Acacia,</li> <li>• Agar</li> <li>• Tragacanth</li> <li>• Honey</li> </ul> <b>Proteins and Enzymes:</b> <ul style="list-style-type: none"> <li>• Gelatin</li> </ul> | 12 hours        |

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|     | <ul style="list-style-type: none"> <li>• Casein</li> <li>• Proteolytic enzymes: Papain, Bromelain, Serratiopeptidase, Urokinase, Streptokinase, Pepsin</li> </ul> <p><b>Lipids (Waxes, Fats, Fixed Oils):</b></p> <ul style="list-style-type: none"> <li>• Castor oil</li> <li>• Olive oil</li> <li>• Cocoa butter</li> <li>• Wool fat</li> <li>• Beeswax</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |
| III | <p><b>Secondary Metabolites –</b><br/> <b>General classification and identification tests</b><br/> <b>Pharmacognostic study</b> (biological source, distribution, cultivation of underlined drugs, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of:</p> <p><b>Alkaloids:</b></p> <ul style="list-style-type: none"> <li>• Vinca</li> <li>• Rauwolfia</li> <li>• Opium</li> </ul> <p><b>Volatile Oils:</b></p> <ul style="list-style-type: none"> <li>• Lemongrass</li> <li>• Clove</li> <li>• Cinnamon</li> <li>• Fennel</li> </ul> <p><b>Tannins:</b></p> <ul style="list-style-type: none"> <li>• Myrobalans</li> <li>• Catechu</li> <li>• Pomegranate</li> </ul> <p><b>Resins:</b></p> <ul style="list-style-type: none"> <li>• Guggul</li> <li>• Asafoetida</li> </ul> <p><b>Glycosides:</b></p> <ul style="list-style-type: none"> <li>• Senna</li> <li>• Liquorice</li> <li>• Digitalis</li> </ul> <p><b>Phenylpropanoids and Flavonoids:</b></p> <ul style="list-style-type: none"> <li>• Green Tea</li> <li>• Ginkgo</li> <li>• Flax seed</li> </ul> <p><b>Iridoids, Other Terpenoids and Naphthoquinones:</b></p> <ul style="list-style-type: none"> <li>• Gentian</li> <li>• Artemisia</li> </ul> | 12 hours |
|     | <p><b>Extraction Methods for Medicinal Plants –</b><br/> <b>Conventional Methods of Extraction:</b></p> <ul style="list-style-type: none"> <li>• Infusion</li> <li>• Decoction</li> <li>• Digestion</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |

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| IV | <ul style="list-style-type: none"> <li>• Maceration</li> <li>• Percolation</li> <li>• Reflux</li> <li>• Distillation</li> <li>• Soxhlet extraction</li> <li>• Successive solvent extraction</li> </ul> <p><b>Modern Methods of Extraction:</b></p> <ul style="list-style-type: none"> <li>• Supercritical fluid extraction</li> <li>• Microwave-assisted extraction</li> <li>• Ultrasonic-assisted extraction</li> <li>• Enzyme-assisted extraction</li> <li>• Pressurized liquid extraction</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                   | 12 hours |
| V  | <p><b>Overview of Isolation, Identification and Characterization Techniques–</b></p> <p><b>Separation and Isolation Techniques:</b></p> <ul style="list-style-type: none"> <li>• Planar chromatography</li> <li>• Column chromatography</li> <li>• Preparative TLC</li> <li>• Flash chromatography</li> </ul> <p><b>Identification Techniques:</b></p> <ul style="list-style-type: none"> <li>• Phytochemical tests</li> <li>• Chromatographic techniques</li> <li>• Spectroscopic techniques</li> </ul> <p>Fingerprinting of medicinal plants using <b>TLC/HPTLC</b>.<br/>Types and significance of <b>markers (phytochemical reference standards)</b>.<br/>Screening and analysis of major metabolites:</p> <ul style="list-style-type: none"> <li>• Alkaloids</li> <li>• Glycosides</li> <li>• Saponins</li> <li>• Tannins</li> <li>• Resins</li> <li>• Flavonoids</li> <li>• Phenolics</li> <li>• Steroids</li> </ul> | 14 hours |

**Recommended References (*Preferably latest editions*):**

1. Dewick, P.M., *Medicinal Natural Products: A Biosynthetic Approach*. John Wiley & Sons.
2. Evans, W.C., *Trease and Evans' Pharmacognosy*. W.B. Saunders & Co., London.
3. Wagner, H., and Bladt, S., *Plant Drug Analysis: A Thin Layer Chromatography Atlas*. Springer-Verlag.
4. Harborne, J.B., *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Chapman & Hall.

## BP206T: Physical Pharmaceutics (Theory)

**Course Objectives:** The objectives of this course are to:

1. Provide a comprehensive understanding of the theory and principles of pharmaceutical processes and unit operations involved in drug manufacturing.
2. Impart knowledge of physicochemical phenomena such as solubility, dissolution, interfacial phenomena, rheology, and micromeritics relevant to dosage form design.
3. Develop understanding of colloidal and coarse dispersions, including suspensions and emulsions, and their pharmaceutical applications.
4. Familiarize students with rheological and micromeritic properties of powders and dispersions and their role in formulation development and evaluation.
5. Build a strong foundation for formulation development, process optimization, and quality control of pharmaceutical dosage forms.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Explain and interpret the fundamental principles governing pharmaceutical manufacturing processes and unit operations.
2. Analyze physicochemical properties of drugs and excipients and correlate them with formulation stability, quality, and performance.
3. Apply concepts of interfacial phenomena, colloids, and dispersions in the design and evaluation of pharmaceutical dosage forms.
4. Evaluate and optimize pharmaceutical processes by controlling variables related to rheology, micromeritics, and dispersion systems.
5. Demonstrate foundational competency required for advanced studies in formulation development, industrial pharmacy, and pharmaceutical research.

### Detailed Syllabus:

| Unit No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No. of Lectures |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| I        | <b>Solubility distribution phenomenon &amp; buffers</b><br>Solubility expression, Solute solvent interactions, Solubility of liquid and liquids, Solubility of solids and liquids, Solubility of Gas in Liquids, Raoult's Law. Factors affecting solubility, Measurement of saturation Solubility, Effect of pH on solubility, Partition Coefficient – Measurement and significance, Critical Solution Temperature and Applications.<br>Introduction to buffers, Buffers in pharmaceutical and biological system, pH determination methods (Electrometry and colorimetry). Buffer equation / Factor influencing the pH of buffer solutions, Factor influencing Buffer capacity, General procedure for preparing buffers, Indicators. | 9 hours         |
| II       | <b>Interfacial phenomenon</b><br>Liquid interface: Surface and interfacial tension, surface free energy, Measurement of surface and interfacial tension, Spreading coefficient, surface active agent, HLB, detergency, types of monolayers at liquid surface. Adsorption at solid interface, Liquid Interface (contact angle, activated charcoal and Wetting). Adsorption of surface-active agents. Electric properties of interface / Electric double layer, Nernst and zeta potential effect of electrolytes                                                                                                                                                                                                                       | 8 hours         |
|          | <b>Colloidal and Coarse Dispersion</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| III | <p>Colloidal dispersions: Types of colloidal dispersions (Lyophobic, Lyophilic, Association colloids), Optical properties of colloids, Kinetic properties of colloids, Electrical properties of colloids, Size and shape of colloidal systems, Stability of colloidal system (peptization and protective action), Application of Colloidal System.</p> <p>Coarse Dispersions: Suspensions, stokes law (Theory of sedimentation), Effect of Brownian movement / Sedimentation of flocculated particles, sedimentation parameters. Flocculation and controlled structure flocculation. Theories of emulsification and stabilization (DLVO Theory, Monomolecular adsorption, Multimolecular adsorption, Film formation, Solid particle adsorption). Physical instabilities of emulsions (creaming, coalescence and breaking, and phase inversion).</p> | 12 hours |
| IV  | <p><b>Rheological studies</b></p> <p>Newtonian systems and non-Newtonian systems. Thixotropy – measurement / Bulges and spurs. Negative thixotropy, Determination of rheological properties (Viscometers / single and multi-point). Viscoelasticity, psycho-rheology. Applications of rheology in pharm</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 8 hours  |
| V   | <p><b>Micromeritics</b></p> <p>Particle size and size distribution, Particle Shape and Surface area: Methods for determination and significance. Flow properties of powders: determination, significance and methods of enhancement. Advanced flow properties of powders (Powder flow tester).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 8 hours  |

**Recommended References (*Preferably latest editions*):**

1. Sinko, P.J., *Martin's Physical Pharmacy and Pharmaceutical Sciences*.
2. Allen, L.V. and McPherson, T.B., *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems*.
3. Adejare, A., *Remington: The Science and Practice of Pharmacy*.
4. Aulton, M.E. and Taylor, K.M.G., *Aulton Pharmaceutics: The Design and Manufacture of Medicines*. Elsevier.
5. Lachman, L. and Libbermann, H.A., *The Theory and Practice of Industrial Pharmacy*. Mendham, J., Denney, R.C., Barnes, J.D. and Thomas, M.J.K., *Vogel's Textbook of*
6. *Quantitative Chemical Analysis*.
7. Myers, D., *Surfaces, Interfaces, and Colloids: Principles and Applications*. Ladisch, M.R., *Rheology of Fluid and Semisolid Foods*. Springer.

**BP207P: Biochemistry (Practical)**

**Course Objectives:** The objectives of this course are:

1. To develop skills to identify and differentiate carbohydrates and proteins through classical qualitative biochemical tests.
2. To apply biochemical techniques for analysis of pathological conditions using urine and blood samples.
3. To perform estimations of clinically important biomolecules such as glucose, cholesterol, urea, creatinine, uric acid, and proteins in biological fluids.
4. To demonstrate enzymatic activity and study factors affecting enzyme function, including substrate concentration and temperature.
5. To interpret biochemical results and correlate them with clinical conditions such as diabetes, renal dysfunction, and lipid disorders.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Identify proteins and carbohydrates using qualitative biochemical tests and explain their physiological relevance.
2. Detect normal and abnormal constituents in urine and interpret their diagnostic significance.
3. Estimate and interpret levels of glucose, cholesterol, urea, creatinine, uric acid, and serum proteins, and correlate results with clinical conditions.
4. Demonstrate enzyme–substrate reactions and evaluate the effect of temperature and substrate concentration on enzymatic activity.
5. Analyze, record, and report biochemical results accurately and relate practical findings to theoretical knowledge and clinical application.

**Detailed Syllabus:**

| List of practical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>(Minimum 12 experiments must be performed)</i> <ol style="list-style-type: none"><li>1. Identification tests for proteins (Albumin and Casein).</li><li>2. Qualitative analysis of carbohydrates* (Glucose, Fructose, Lactose, Sucrose, and Starch).</li><li>3. Qualitative analysis of urine for normal and abnormal constituents.</li><li>4. Estimation of blood glucose.</li><li>5. Estimation of total cholesterol and HDL cholesterol.</li><li>6. Estimation of urea, creatinine, and uric acid in serum.</li><li>7. Estimation of serum total protein and albumin.</li><li>8. Study of enzymatic hydrolysis of starch.</li><li>9. Study of the effect of temperature on salivary amylase activity.</li><li>10. Study of the effect of substrate concentration on salivary amylase activity.</li><li>11. Estimation of hemoglobin in blood by Sahli's method / Cyanmethemoglobin method.</li><li>12. Estimation of serum bilirubin (total and direct bilirubin).</li><li>13. Estimation of glycogen content</li><li>14. Estimation of SGOT and SGPT</li></ol> |

**Recommended References (Preferably latest editions):**

1. Plummer, D. T. An Introduction to Practical Biochemistry. McGraw-Hill, New York.
2. Wilson, K., and Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

3. Varley, H., Gowenlock, A. H., Bell, M., and Bell, J. L. Varley's Practical Clinical Biochemistry. Heinemann Medical Books.
4. Burtis, C. A., Ashwood, E. R., and Bruns, D. E. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Elsevier.
5. Rodwell, V. W., Bender, D. A., Botham, K. M., Kennelly, P. J., and Weil, P. A. Harper's Illustrated Biochemistry. McGraw-Hill.
6. Freifelder, D. Essential Molecular Biology: A Practical Approach. Oxford University Press.

## BP208P: Human Anatomy, Physiology and Pathophysiology - II (Practical)

**Course Objectives:** The objectives of this course are to:

1. Provide foundational knowledge of the structure and functions of major organ systems of the human body.
2. Develop understanding of physiological mechanisms responsible for maintenance of homeostasis.
3. Explain the pathophysiology of diseases affecting different organ systems.
4. Explore causes of diseases and the body's responses to pathological conditions.
5. Build a strong base for clinical learning through the study of functional and structural changes in disease states.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Explain the gross morphology, structures, and functions of various organs and organ systems of the human body.
2. Demonstrate basic emergency response procedures such as cardiopulmonary resuscitation (CPR).
3. Describe the etiology and pathogenesis of selected disease states.
4. Identify signs and symptoms, risk factors, diagnostic methods, prevention, treatment strategies, and complications of diseases.
5. Understand coordinated working patterns of different organs of each system and perform experiments related to special senses and nervous system.

### Detailed Syllabus:

#### List of practical

*(Minimum of 12 experiments must be performed)*

Practical HAPP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated videos, models, and charts.

1. Study of nervous system using specimens and models.
2. Study of respiratory system using models.
3. Study of gastrointestinal system using models.
4. Study of reproductive system using models.
5. Demonstration of general neurological examination.
6. Demonstration of function of olfactory nerve.
7. Examination of different types of taste.
8. Demonstration of visual acuity.
9. Demonstration of reflex activity.
10. Recording of body temperature.
11. Determination of tidal volume and vital capacity.
12. Recording of body mass index (BMI).
13. Study of family planning devices and pregnancy diagnosis tests.
14. Understanding pathophysiology of IBD, peptic ulcer, jaundice, hepatitis, typhoid, asthma, tuberculosis, diabetes, and thyroid disorders through case files / case reports.

### Recommended References (*Preferably latest editions*):

1. Wilson, K. J. W., and Waugh, A. *Anatomy and Physiology in Health and Illness*. Churchill Livingstone, New York.
2. Best, C. H., and Taylor, N. B. *The Physiological Basis of Medical Practice*. Williams & Wilkins, Baltimore.

3. Guyton, A. C., and Hall, J. E. *Textbook of Medical Physiology*. Elsevier / W.B. Saunders, Philadelphia.
4. Tortora, G. J., and Grabowski, S. R. *Principles of Anatomy and Physiology*. John Wiley & Sons.
5. Brunton, L., Chabner, B., and Knollmann, B. *Goodman & Gilman's The Pharmacological Basis of Therapeutics*. McGraw-Hill, New York.
6. Colledge, N. R., Walker, B. R., and Ralston, S. H. *Davidson's Principles and Practice of Medicine*. Churchill Livingstone, London.

**BP209P: Pharmaceutical Organic Chemistry (Practical)****Course Objectives: The objectives of this course are to:**

1. Understand and follow essential laboratory safety protocols for handling chemicals, glassware, and equipment.
2. Identify and analyze organic compounds through their physical properties and functional group reactivity.
3. Apply ball-and-stick molecular models to visualize and interpret the structure of organic compounds.
4. Perform purification techniques such as crystallization to isolate and refine organic substances.
5. Synthesize simple organic compounds and their derivatives using standard laboratory methods.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Recall and outline the preliminary qualitative tests used for identifying water-insoluble and immiscible organic compounds.
2. Understand the synthesis methods for preparing simple organic compounds and their derivatives.
3. Apply crystallization techniques to purify organic compounds effectively.
4. Analyze experimentally to detect elements and functional groups to identify unknown organic compounds.
5. Interpret and analyze organic compounds through systematic qualitative analysis to confirm their chemical nature.

**Detailed Syllabus:****List of practical**

*(Minimum 12 experiments to be performed)*

1. **Systematic qualitative analysis of minimum of five water-insoluble or water-immiscible unknown organic compounds from different chemical classes:**
  - a. Preliminary tests: Color, odour, Solubility tests, test for aromaticity, test for saturation/unsaturation etc.
  - b. Detection of elements such as nitrogen, sulphur and halogens by Lassaigne's test
  - c. Determination of Functional group tests such as phenols, amides, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons and nitro compounds.
  - d. Preparation of the derivatives and confirmation of the unknown organic compound by melting point / boiling point.
2. **Building Molecular Models:**

Students will use ball-and-stick models to create structures of molecules and understand their shapes and bonding.
3. **Crystallization Method**

Students will learn how to purify three organic compounds using the crystallization technique.

**Recommended References (*Preferably latest editions*):**

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G. and Tatchell, A. R. *Vogel's Textbook of Practical Organic Chemistry*. Longman Scientific & Technical, London.
2. Mann, F. G. and Saunders, B. C. *Practical Organic Chemistry*. Pearson Education.
3. Shriner, R. L., Hermann, C. K. F., Morrill, T. C., Curtin, D. Y. and Fuson, R. C. *The*

*Systematic Identification of Organic Compounds.* John Wiley & Sons.

4. Vogel, A. I. *Elementary Practical Organic Chemistry.* Longman Group Ltd.
5. Pavia, D. L., Lampman, G. M., Kriz, G. S. and Engel, R. *Introduction to Organic Laboratory Techniques.* Cengage Learning.

**BP210P: Pharmacognosy and Phytochemistry (Practical)****Course Objectives: The objectives of this course are to:**

1. Perform chemical tests for the identification of gums, resins, oils, fats, waxes, and unorganized drugs.
2. Examine crude drugs using transverse section and powder microscopy for correct identification.
3. Apply suitable extraction techniques and study their effect on yield of crude extracts.
4. Isolate and identify important phytoconstituents and volatile oils using standard procedures.
5. Evaluate herbal raw materials collected from field/market sources as per Pharmacopoeial standards.

**Course Outcomes: Upon successful completion of this course, the students will be able to:**

1. Identify unorganized crude drugs using specific chemical tests.
2. Analyze organized crude drugs through microscopy and powder analysis.
3. Select and perform appropriate extraction methods for herbal drugs.
4. Isolate and characterize phytoconstituents using laboratory techniques and TLC.
5. Assess and compare the quality and purity of herbal raw materials with official standards.

**Detailed Syllabus:****List of practical**

*(Minimum 12 experiments must be performed)*

1. Chemical tests for identification of Agar, Acacia, Tragacanth, Honey.
2. Chemical tests for identification of Castor oil, Olive oil, Wool fat, Beeswax.
3. Chemical tests for identification of Asafoetida, Catechu, Aloe.
4. Transverse section and powder microscopy of a vinca leaf.
5. Transverse section and powder microscopy of a cinnamon bark.
6. Transverse section and powder microscopy of a fennel fruit.
7. Transverse section and powder microscopy of a clove flower bud.
8. Transverse section and powder microscopy of a Tulsi stem.
9. Transverse section and powder microscopy of a Liquorice roots.
10. Study of effect on different extraction techniques on yield of crude extract (maceration, decoction, soxhlation).
11. Isolation of volatile oil and it's TLC.
12. Isolation of caffeine from tea.
13. Isolation of Hesperidin from lemon peel.
14. Isolation of Glycyrrhizin from liquorice roots.
15. Isolation of Pectin from orange peel.
16. Experiential learning based experiment involving evaluation and comparison of field/market collected herbal raw materials with Pharmacopoeial standards.

**Recommended References (Preferably latest editions):**

1. Trease, G. E. and Evans, W. C. *Pharmacognosy*. Elsevier.
2. Harborne, J. B. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Springer.
3. Wallis, T. E. *Textbook of Pharmacognosy*. CBS Publishers & Distributors, New Delhi.
4. Tyler, V. E., Brady, L. R. and Robbers, J. E. *Pharmacognosy*. Lea & Febiger.

**BP211P: Physical Pharmaceutics (Practical)**

**Course Objectives:** The objectives of this course are to:

1. Introduce basic laboratory techniques for determining physicochemical properties such as surface tension, viscosity, and density in pharmaceutical systems.
2. Develop understanding of interfacial phenomena and surfactant behavior, including micelles, critical micellar concentration (CMC), and HLB in formulation design.
3. Train students in evaluating disperse systems through sedimentation studies and the effect of suspending agents.
4. Provide practical experience in powder characterization, including particle size distribution, density, flow properties, porosity, and the role of glidants.
5. Develop skills in determining solubility, partition coefficient, buffer capacity, and related equilibria relevant to drug formulation.

**Course Outcomes:** Upon successful completion of this course, the students will be able to:

1. Demonstrate practical knowledge of principles and procedures involved in measuring surface tension, viscosity, density, and related physical properties using standard laboratory apparatus.
2. Determine and interpret surfactant-related parameters such as CMC and HLB and explain their significance in formulation stability and performance.
3. Conduct experiments and analyze results related to sedimentation volume and evaluate the influence of type and concentration of suspending agents on dispersion stability.
4. Evaluate micromeritic and flow properties of powders by determining particle size distribution, bulk density, tapped density, Hausner ratio, Carr's index, angle of repose, true density, and porosity, and interpret the effect of glidants.
5. Perform and assess experiments on solubility, partition coefficient, critical solution temperature, adsorption studies, and buffer capacity, and apply findings to formulation decisions.

**Detailed Syllabus:**

| List of practical                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>(Minimum 12 experiments must be performed)</i> <ol style="list-style-type: none"><li>1. Determination of surface tension of given liquids by drop count method and drop weight method.</li><li>2. Determination of critical micellar concentration (CMC) of surfactants.</li><li>3. Determination of viscosity of liquids using Ostwald's viscometer and Brookfield viscometer.</li><li>4. Determination of HLB value of a surfactant.</li><li>5. Calculation of isotonicity by different methods (Sodium Chloride Equivalent Method).</li><li>6. Determination of particle size and particle size distribution using sieving method.</li><li>7. Determination of particle size and particle size distribution using microscopic method.</li><li>8. Determination of densities and derived properties of powders (bulk density, tapped density, Hausner ratio, Carr's compressibility index), true density, and porosity.</li><li>9. Determination of angle of repose and influence of glidants on angle of repose.</li><li>10. Determination of solubility of a drug at different pH/buffer systems at room temperature.</li><li>11. Determination of partition coefficient of a drug in n-octanol and water system.</li><li>12. Determination of partition coefficient of a drug in benzene and water system.</li><li>13. Determination of critical solution temperature and composition of phenol–water</li></ol> |

system.

14. Determination of specific surface area of charcoal by adsorption of acetic acid on activated charcoal.

15. Determination of buffer capacity at various stages of titration of a weak acid against a strong base and determination of pKa.

**Note:**

Compare the values of various physicochemical properties with marketed formulations wherever possible.

**Recommended References (*Preferably latest editions*):**

1. Sinko, P. J. Martin's Physical Pharmacy and Pharmaceutical Sciences. Lippincott Williams & Wilkins.
2. Aulton, M. E. and Taylor, K. M. G. Aulton's Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.
3. Lachman, L., Lieberman, H. A. and Kanig, J. L. The Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors.
4. Allen, L. V., Popovich, N. G. and Ansel, H. C. Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems. Lippincott Williams & Wilkins.
5. Cooper, S. J. and Gunn, C. Cooper and Gunn's Tutorial Pharmacy. CBS Publishers & Distributors.