

B.PHARMACY SYLLABUS (PCI / NEP 2020)

SEMESTER I

Subject Name: Basics of Python Programming for Pharmaceutical Sciences (Theory)

Subject Code: BP101T

UNIT I: Introduction to Python programming (6 Hours)

- Installing Python and an Integrated Development Environment (IDE) [Jupyter Notebook, PyCharm, VS Code etc.], Advantages of IDEs over text editors.
- Python variables and data types (integers, floats, strings, booleans), Type casting and basic operators (arithmetic, comparison, logical), Input and output operations.
- Basic string operations and manipulation techniques. Introduction to standard libraries and third-party libraries, installing and uninstalling libraries.

UNIT II: Control Structures & Functions (6 hours)

- Conditional statements (if, if-else, if-elif-else), nested conditions
- Loops (for loop, while loop).
- Break and continue statements.
- Defining and calling functions, passing arguments and returning values.
- Writing modular programs for simple pharmaceutical applications- dosage calculation and BMI calculation.

UNIT III: Data Structures & File Handling (6 hours)

- Lists, tuples, and dictionaries.
- Indexing and slicing lists, basic operations on lists and dictionaries, string manipulation techniques.
- Introduction to NumPy arrays, basic operations using NumPy (array creation, arithmetic operations).
- Reading and writing CSV files.
- Understanding structured healthcare datasets.
- Importing small pharmaceutical datasets and performing basic data access and manipulation tasks.

UNIT IV: Data Handling with Pandas (6 Hours)

- Introduction to Pandas library.
- Pandas Series and DataFrame structures.
- Reading CSV and Excel files- PK study datasets and ADR reports
- Inspecting datasets using functions such as head(), tail(), info(), and describe().
- Data cleaning techniques and handling missing values.
- Filtering and selecting data based on conditions.
- Grouping data and performing aggregation functions.

UNIT V: Data Visualization with Matplotlib (6 Hours)

- Introduction to Matplotlib.
- Creating line plots, histograms, scatter plots, and box plots.
- Labeling axes, titles, and legends.
- Create plots and visualize pharmaceutical datasets - concentration-time curves for oral and IV administration, ADR reporting rates across drugs, dissolution profiles.
- Scientific interpretation of plots.

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Subject Name: General Pharmacy (Theory)**Subject Code: BP102T****UNIT I: Introduction to the Profession of Pharmacy (9 hours)**

- History of the Profession of Pharmacy in India: In relation to pharmacy education, pharmaceutical industries and organizations – evolution, development and milestones.
- 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.
- 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.
- Introduction to Prescription: Structure and format/parts of prescription, handling of prescriptions, Latin terminology related to prescriptions.

UNIT II: Introduction to Pharmaceutical Calculations and Dosage Forms (9 hours)

- Metric system of weights and measures; calculations based on alligation, proof spirit, isotonic solutions, dilute solutions (percentage and ratio) and geometric dilution; scientific notation of units and measures.
- Posology: Definition and dose calculation based on age, body weight and body surface area.
- Introduction to Dosage Forms: Routes of administration and classification of dosage forms.
- Introduction to Active Pharmaceutical Ingredients and Excipients: Definition, ideal characteristics and importance.

UNIT III: Solid Dosage Forms (9 hours)

- Powders: Classification, advantages and disadvantages; dusting powders, effervescent powders, efflorescent powders, hygroscopic powders and eutectic mixtures; introduction to excipients and methods of preparation.
- Tablets: Definition, types of tablets including moulded tablets and pills with examples; advantages and disadvantages; introduction to excipients and methods of preparation.
- Capsules: Definition, types of capsules, advantages and disadvantages, capsule sizes; introduction to excipients and methods of preparation.

UNIT IV: Monophasic and Biphasic Liquids (9 hours)

- For internal use – aromatic waters, syrups, elixirs and linctus (definition and preparation).
- For external use and body cavities – liniments, lotions, throat paints, applications, gargles, mouthwashes, enemas, eye drops, ear drops, nasal drops and tinctures with examples.
- Study of official preparations - Introduction to excipients and methods of preparation.
- Suspensions - Definition and types (flocculated and deflocculated), advantages and disadvantages, formulation excipients and general methods of preparation.
- Emulsions - Definition and types, emulsifying agents, tests for identification of types of emulsions, formulation excipients and general methods of preparation.

UNIT V: Semisolid Dosage Forms (9 hours)

- 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.
- 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.

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Subject Name: Healthcare Psychology and Communication Skills (Theory)

Subject Code: BP103T

UNIT I: Introduction to Psychology in Healthcare (3 hours)

- 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.

UNIT II: Developmental and Behavioural Psychology (3 hours)

- 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.

UNIT III: Foundations of Health Communication (3 hours)

- 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, questioning techniques, and empathy.
- Culturally appropriate and inclusive communication.

UNIT IV: Professional Communication in Healthcare Settings (3 hours)

- 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.

UNIT V: Health Psychology and Behavioural Interventions (3 hours)

- 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.
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Subject Name: Human Anatomy, Physiology and Pathophysiology I (Theory)**Subject Code: BP104T****UNIT I: Introduction to human body (12 hours)**

- Cellular and tissue level of organization.
- Definition and scope of anatomy, physiology and pathophysiology.
- Levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminologies.
- Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, forms of intracellular signalling- a) Contact-dependent, b) Paracrine, c) Synaptic, d) Endocrine.
- Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.
- Basic principles of cell injury and adaptation.
- 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.
- Definitions of commonly used relevant medical terminologies.
- Integumentary system and wound healing.
- Structure and functions of skin. Skin disorders: Psoriasis and dermatitis and pathophysiology of Leprosy. Basic principles of wound healing.

UNIT II: Skeletal system and joints (12 hours)

- Divisions of skeletal system, types of bones, salient features and functions of bones of axial and appendicular skeletal system.
- Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction. Structural and functional classification of joints.
- Diseases of bones and joints.
- Pathophysiology of rheumatoid arthritis, osteoporosis and gout.
- Body fluids, blood and lymphatic system.
- 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.

UNIT III: Basic mechanism of inflammation and repair (12 hours)

- Introduction, classification and pathophysiology of inflammation, mediators of inflammation.
- Haematological diseases.
- Pathophysiology of iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, Thalassemia, hereditary acquired anaemia and haemophilia.

UNIT IV: Peripheral nervous system (12 hours)

- Classification of peripheral nervous system: structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.
- Special senses.

- Structure and functions of eye, ear, nose and tongue. Pathophysiology of special sense disorders- glaucoma, cataract, myopia, otitis externa, otitis media, vertigo and anosmia.

UNIT V: Cardiovascular system (12 hours)

- 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.
 - Pathophysiology of hypertension, cardiac arrhythmias, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and coronary artery disease).
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Subject Name: Introduction to Pharmacognosy (Theory)**Subject Code: BP105T****UNIT I: Fundamentals of Pharmacognosy (10 hours)**

- (a) Definition, history, present status, scope and development of pharmacognosy.
- (b) Sources of drugs: Plants, animals, microbial, marine, mineral and plant tissue culture.
- (c) Historical milestones in drug discovery: Morphine, quinine, aspirin, warfarin, penicillin, cephalosporin, taxol and artemisinin.
- (d) Introduction to different herbal / traditional pharmacopoeias: 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.
- (e) Official and non-official; codified and non-codified drugs. Classification of crude drugs: alphabetical, morphological, taxonomical, chemical, pharmacological and chemotaxonomic classification along with their merits and limitations.

UNIT II: Cultivation, Collection, Processing and Storage of Drugs of Natural Origin (8 hours)

- 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.
- Plant hormones and their applications in cultivation of medicinal plants. 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.

UNIT III: Quality Control of Drugs of Natural Origin (WHO Guidelines) (8 hours)

- 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.

UNIT IV: Introduction to Metabolites of Plant Origin (12 hours)

- 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.
- Traditional Systems of Medicine: 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.

UNIT V: Phyto-therapeutic Agents (7 hours)

- Biological source, major constituents and uses of the following classes of drugs:
- Adaptogens and Immunomodulators: Ashwagandha, Tulsi, Amla
- Hepatoprotectives: Milk thistle, Kutki
- Cardiovascular drugs: Garlic, Arjuna
- Antidiabetics: Gymnema, Fenugreek
- Anti-inflammatory and analgesics: Turmeric, Boswellia
- CNS drugs: Brahmi
- Antimicrobial and antivirals: Giloy, Neem, Andrographis
- Gastrointestinal drugs: Psyllium

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- Dermatological agents: Aloe
 - Drugs used in women's health: Chasteberry, Shatavari
 - Respiratory drugs: Vasaka
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Subject Name: Pharmaceutical Inorganic and Analytical Chemistry (Theory)**Subject Code: BP106T****UNIT I: Introduction to pharmaceutical analysis (7 hours)**

- Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples.
- Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.
- Impurities: 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.

UNIT II: Acid-Base Chemistry and Buffer Systems in Pharmacy (8 hours)

- 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.
- Major extra and intracellular electrolytes: 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.

UNIT III: Acid base titrations, Non-aqueous titrations, Precipitation titrations and gravimetry, Complexometric titrations, Redox titrations (14 hours)

- Acid base titrations: 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 and bases, neutralization curves. Assay of Ammonium hydroxide.
- Non-aqueous titrations: 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.
- Precipitation titrations and gravimetry: Principle and steps involved in gravimetric analysis, Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry.
- Complexometric titrations: Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*.
- Redox titrations: Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate.

UNIT IV: Gastrointestinal agents, Radiopharmaceuticals (10 hours)

- Gastrointestinal agents – Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*. Agents promote bowel movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate and magnesium trisilicate. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.
- Radiopharmaceuticals: 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.

UNIT V: Miscellaneous Compounds (06 hours)

- Expectorants: Potassium iodide, Ammonium chloride*.
- Emetics: Copper sulphate*, Sodium potassium tartrate.

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- Haematinics: Ferrous sulphate*, Ferrous gluconate.
 - Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate.
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Subject Name: General Pharmacy (Practical)**Subject Code: BP107P****PRACTICAL**

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

Subject Name: Healthcare Psychology and Communication Skills (Practical)**Subject Code: BP108P****PRACTICAL**

- 1. Role Plays and Simulations
 - Counselling a patient with chronic illness
 - Breaking bad news in a clinical setting
 - Empathetic listening in crisis response
- 2. Case Study Discussions
 - Mental health cases in primary care
 - Impact of miscommunication in healthcare errors
- 3. Peer-to-Peer Practice Sessions
 - Reflective listening and paraphrasing

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- Effective team communication and decision-making
- 4. Community Engagement Tasks
 - Designing IEC materials for public health awareness
 - Conducting mock health education sessions
- 5. Journaling & Self-Reflection Logs
 - Weekly reflection on emotional responses during care simulations
 - Growth in communication skill development over the semester

Subject Name: Human Anatomy, Physiology and Pathophysiology I (Practical)

Subject Code: BP109P

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. Case studies/files of patients with anaemia, thalassemia, haemophilia, leprosy, gout, hypertension and ischemic heart disease.

Subject Name: Introduction to Pharmacognosy (Practical)

Subject Code: BP110P

PRACTICAL

(Minimum 12 experiments must be performed)

- 1. Morphological study of medicinal plants (as mentioned in Unit V Theory).
- 2. Organoleptic evaluation and powder microscopical characters of the following drugs: Tulsi and Ashwagandha.
- 3. Organoleptic evaluation and powder microscopical characters of the following drugs: Amla and Arjuna.
- 4. Organoleptic evaluation and powder microscopical characters of the following drugs: Turmeric and Psyllium husk.

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- 5. Organoleptic evaluation and powder microscopical characters of the following drugs: Brahmi and Fenugreek.
- 6. Determination of moisture content of crude drugs.
- 7. Determination of swelling index and foaming index of crude drugs.
- 8. Determination of stomatal number and stomatal index of leaf.
- 9. Determination of vein islet and vein termination number of leaf.
- 10. Determination of ash value and extractive values of crude drugs.
- 11. Determination of foreign organic matter of crude drugs.
- 12. Determination of dimensions of calcium oxalate crystals and phloem fibers by eyepiece micrometry.
- 13. Determination of percentage purity of powder drug using lycopodium spore method.
- 14. Experiential learning-based experiments involving collection, identification of medicinal plant material, preparation of voucher specimens and excursion visits to medicinal plant garden.

Subject Name: Pharmaceutical Inorganic and Analytical Chemistry (Practical)

Subject Code: BP111P

PRACTICAL

- 1. Limit tests (Any 4 Experiments)
 - 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. Preparation of inorganic pharmaceuticals (Any 3 Experiments)
 - 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. Test for Purity (Any 2 Experiments)
 - 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. Assay of the following inorganic compounds including standardization of titrant (Any 5 Experiments)
 - 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)

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