Course Structure For B.Pharmacy

Table-I: Course of study for semester I

Course Code	Name of the course	No.of hours Per week (L/P)	Credit points
26NBPH11T	General Pharmacy	3	3
26NBPH12T	Human Anatomy, Physiology and Pathophysiology I	4	4
26NBPH13T	Introduction to Pharmacognosy	3	3
26NBPH14T	Pharmaceutical Inorganic and Analytical Chemistry	3	3
26NBPH15T	Healthcare Psychology and Communication Skills	1	1
26NBPH16T	Basics of Python Programming for Pharmaceutical Sciences	2	2
26NBPH11L	General Pharmacy	3	1
26NBPH12L	Human Anatomy, Physiology and Pathophysiology I	3	1
26NBPH13L	Introduction to Pharmacognosy	3	1
26NBPH14L	Pharmaceutical Inorganic and Analytical Chemistry	3	1
26NBPH15L	Healthcare Psychology and Communication Skills	2	1
Total		**30**	**21**

Table-II: Course of study for semester II

Course Code	Name of the course		No. of hours per week(L/P)	Credit points
26NBPH21T	Biochemistry		3	3
26NBPH22T	Human Anatomy, Physiology and Pathophysiology II		4	4
26NBPH23T	Pharmaceutical Organic Chemistry		4	4
26NBPH24T	Pharmacognosy and Phytochemistry		4	4
26NBPH25T	Physical Pharmaceutics		3	3
26NBPH26T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences		2	2
26NBPH21L	Biochemistry		3	1
26NBPH22L	Human Anatomy, Physiology and Pathophysiology II		3	1
26NBPH23L	Pharmaceutical Organic Chemistry		3	1
26NBPH24L	Pharmacognosy and Phytochemistry		3	1
26NBPH25L	Physical Pharmaceutics		3	1
26NBPH27S (LABORATORY)	**26NBPH27AS**	Communication Skills	2	1
	26NBPH27BS	Mental Well Being, Stress & Conflict Management		
	26NBPH27CS	Fundamentals of Computer Operations		
Total			**37**	**26**

Table-III: Course of study for semester III

Course Code	Name of the course		No. of hours per week(L/P)	Credit points
26NBPH31T	General Pharmacology		3	3
26NBPH32T	Heterocyclic Compounds and Stereochemistry		3	3
26NBPH33T	Pharmaceutical Dosage Forms I		3	3
26NBPH34T	Pharmaceutical Engineering		3	3
26NBPH35T	Pharmaceutical Microbiology		3	3
26NBPH36T	Introduction to Machine Learning in Pharmaceutical Sciences		2	2
26NBPH37T	Environmental Sciences		1	1
26NBPH38T	Ethics and Universal Human Values		1	1
26NBPH31L	General Pharmacology		4	2
26NBPH32L	Heterocyclic Compounds and Stereochemistry		4	2
26NBPH33L	Pharmaceutical Dosage Forms I		3	1
26NBPH39E (LABORATORY)	**26NBPH39AE**	Nutraceuticals and Functional Foods	2	1
	26NBPH30BE	Food Analysis		
	26NBPH39CE	Yoga and Life Sciences		
Total			**32**	**25**

Table-IV: Course of study for semester IV

Course Code	Name of the course	No.of hours per week (L/P)	Credit points
26NBPH41T	Herbal Drug Technology	3	3
26NBPH42T	Medicinal Chemistry	3	3
26NBPH43T	Pharmaceutical Biotechnology	3	3
26NBPH44T	Social Pharmacy and Public Health	2	2
26NBPH45T	Systemic Pharmacology I	3	3
26NBPH41L	Herbal Drug Technology	3	1
26NBPH42L	Medicinal Chemistry	3	1
26NBPH43L	Pharmaceutical Biotechnology	3	1
26NBPH44L	Social Pharmacy and Public Health	2	1
26NBPH45L	Systemic Pharmacology I	3	1
26NBPH46I	Internship (Mandatory)	8	4
Total		**28**	**23**

Table-V:Course of study for semester V

Course Code	Name of the course	No.of hours Per week(L/P)	Credit points
26NBPH51T	Biomedicinal Chemistry	3	3
26NBPH52T	Industrial Pharmacognosy	3	3
26NBPH53T	Pharmaceutical Dosage Form II	2	2
26NBPH54T	Systemic Pharmacology II	3	3
26NBPH55T	Pharmaceutical Quality Assurance	3	3
26NBPH56T	Innovation and Startup Ecosystem	2	2
26NBPH51L	Biomedicinal Chemistry	4	2
26NBPH52L	Industrial Pharmacognosy	3	1
26NBPH53L	Pharmaceutical Dosage Form II	3	1
26NBPH54L	Systemic Pharmacology II	4	2
Total		**30**	**22**

Table-VI: Course of study for semester VI

Course Code	Name of the course		No. of hours per week(L/P)	Credit points
26NBPH61T	Biopharmaceutics and Pharmacokinetics		3	3
26NBPH62T	Pharmaceutical Analysis		3	3
26NBPH3T	Advanced Pharmacognosy		3	3
26NBPH64T	Intellectual Property Rights		2	2
26NBPH65T	AI applications in Pharmaceutical Sciences		2	2
26NBPH66T	Pharmaceutical Jurisprudence		3	3
26NBPH67E (THEORY)	**26NBPH67AE**	Green Chemistry	1	1
	26NBPH67BE	Materiovigilance and Hemovigilance		
	26NBPH67CE	Scientific Writing		
	26NBPH67DE	Drug Store and Business Management		
	26NBPH67EE	Career Building in Cultivation of Medicinal Plants		
	26NBPH67FE	Active Pharmaceutical Ingredients and Excipient Sciences		
26NBPH61L	Biopharmaceutics and Pharmacokinetics		3	1
26NBPH62L	Pharmaceutical Analysis		4	2
26NBPH68S (LABORATORY)	**26NBPH68AS**	Computer-Aided Drug Design	2	1
	26NBPH68BS	Analytical Method Development and Validation		
	26NBPH68CS	Principles of Preclinical Studies		
26NBPH69V (LABORATORY)	**26NBPH69AV**	Professional Skills	2	1
	26NBPH69BV	Process Analytical Technology(PAT) and QbD in Formulation Science		
26NBHP6AI	Internship(Mandatory)		8	4
Total			**28**	**26**

Table-VII: Course of study for semester VII

Course Code	Name of the course		No. of hours per week(L/P)	Credit points
26NBPH71T	Modern Analytical Techniques		3	3
26NBPH72T	Biostatistics Research methodology		3	3
26NBPH73T	Cosmetics and Cosmeceuticals		2	2
26NBPH74T	AI in Clinical applications		2	2
26NBPH75T	Pharmacovigilance		3	3
26NBPH76T	Pharmacy Practice		3	3
26NBPH77T	Regulatory Affairs		2	2
26NBPH78E (THEORY)	**26NBPH78AE**	Current Good Manufacturing Practices (cGMP)	1	1
	26NBPH78BE	Pharmaceutical Automation		
	26NBPH78CE	Modern Techniques in Cellular Biology		
	26NBPH78DE	Medical Devices		
	26NBPH78EE	Transformation of Food Waste into Medicinal Products		
	26NBPH78FE	Biosimilars, Vaccines &Macromolecules		
26NBPH71L	Modern Analytical Techniques(Practical)		3	1
26NBPH79P	Research Project		-	6
Total			**22**	**26**

Table-VIII:Course of study for semester VIII

Course Code	Name of the course		No. of hours Per week (L/P)	Credit points
26NBPH81T	Ethical Considerations and Translational Applications of AI in Pharmacy		2	2
26NBPH82T	Clinical Pharmacotherapeutics		2	2
26NBPH83T	Industrial Pharmacy and Facility Design		3	3
26NBPH84T	Pharmaceutical Management		2	2
26NBPH85T	Sterile Dosage Forms and Novel Drug Delivery System		3	3
26NBPH86E (THEORY)	**26NBPH86AE**	Pharmaceutical Packaging	2	2
	26NBPH86BE	Supply Chain Management		
	26NBPH86CE	Industrial Safety and Waste Management		
	26NBPH86DE	Traditional Healing Practices Of India		
	26NBPH86EE	Futuristic Pharma through AR/VR: Pharma 4.0		
	26NBPH86FE	Herbal Cosmetics for Industry Perspective		
26NBPH87L	Pharmaceutical Marketing Skills (Practical)		2	1
26NBPH88L	Sterile Dosage Forms and Novel Drug Delivery System (Practical)		4	2
26NBPH89V (PRACTICAL)	**26NBPH89AV**	Cleaning Validation	2	1
	26NBPH89BV	Basic Training in Aseptic Handling Techniques		
	26NBPH89CV	Impurity Profiling		
26NBPH8AP	Research Project		-	6
Total			**22**	**24**

Table-IX:Total Credits per Semester

Semester	Total Credits
I	21
II	26
III	25
IV	23
V	22
VI	26
VII	26
VIII	24
Total	193

Course Structure For B.Pharmacy
I YEAR I SEMESTER

S. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	C
1	**26NBPH11T**	General Pharmacy	3	0	0	3
2	**26NBPH12T**	Human Anatomy, Physiology and Pathophysiology I	4	0	0	4
3	**26NBPH13T**	Introduction to Pharmacognosy	3	0	0	3
4	**26NBPH14T**	Pharmaceutical Inorganic and Analytical Chemistry	3	0	0	3
5	**26NBPH15T**	Healthcare Psychology and Communication Skills	1	0	0	1
6	**26NBPH16T**	Basics of Python Programming for Pharmaceutical Sciences	2	0	0	2
7	**26NBPH11L**	General Pharmacy	0	0	3	1
8	**26NBPH12L**	Human Anatomy, Physiology and Pathophysiology I	0	0	3	1
9	**26NBPH13L**	Introduction to Pharmacognosy	0	0	3	1
10	**26NBPH14L**	Pharmaceutical Inorganic and Analytical Chemistry	0	0	3	1
11	**26NBPH15L**	Healthcare Psychology and Communication Skills	0	0	2	1
Total credits						**21**

Course Code	Course Title			Course Type
26NBPH11T	General Pharmacy(Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

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

CO No.	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 semi-solid dosage forms based on the characteristics of APIs, excipients, and preparation methods.

DETAILED SYLLABUS

Unit No	Topics	No of Lectures
I	Introduction to the Profession of Pharmacy 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.	9 hours
II	Pharmaceutical Calculations 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.	9 hours

III	Solid Dosage Forms 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.	9 hours
IV	Monophasic and Biphasic Liquids 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.	9 hours
V	Semisolid Dosage Forms 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	9 hours

	and general method of preparation.	

TEXTBOOKS:

1. R. M. Mehta, “Dispensing Pharmacy” Vallabh Prakashan, 2017

2. Amit K. Goyal, Gautam Rath, and R. K. Narang, “Textbook of Pharmaceutical Dispensing” CBS Publishers & Distributors Pvt. Ltd., 2016

3. N. K. Jain and G. D. Gupta, “Modern Dispensing Pharmacy” CBS Publishers & Distributors Pvt. Ltd., 2016 (Second Edition)

Reference Books:

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.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	-	-	-	2	2	-	2	-	3
CO2	3	2	3	2	-	-	-	-	-	-	3
CO3	3	2	3	2	2	-	-	-	-	2	3
CO4	3	2	3	2	2	-	-	-	-	2	3
CO5	3	2	3	2	2	2	2	-	2	2	3

Course Code	Course Title			Course Type
26NBPH12T	Human Anatomy, Physiology and Pathophysiology I			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

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.

CO No.	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	**Introduction to human body** **Cellular and tissue level of organization.** Definition and scope of anatomy, physiology and pathophysiology. Levels of structural organization and bodysystems,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	12
II	**Integumentary system and wound healing** Structure and functions of skin. Skin disorders: Psoriasis and dermatitis and pathophysiology of Leprosy. Basic principles of wound healing. **Skeletal system and joints** 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**	12

	Pathophysiology of rheumatoid arthritis, osteoporosis and gout.	
III	**Body fluids, blood and lymphatic system** Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, mechanisms of coagulation, blood grouping, RH factors and transfusion. Lymphatic organs and tissues, lymphatic vessels, lymph formation, circulation and functions of lymphatic system. **Basic mechanism of inflammation and repair** 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.	12
IV	**Peripheral nervous system** 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.	12
V	**Cardiovascular system** 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).	12

TEXT BOOKS:

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.

Reference books:

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, Philadelphia.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Intermersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	-	-	-	1	-	-	-	2	-	-
CO2	1	1	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	3	-	2	-	1	-	-
CO4	-	3	2	-	-	-	-	-	2	-	-
CO5	3	-	-	-	2	-	-	-	1	-	-

Course Code	Course Title			Course Type
26NBPH13T	Introduction to Pharmacognosy			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

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:

CO No.	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	**Fundamentals of Pharmacognosy** (a) Definitions, 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 Pharmacopeia – 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.	10 hours
II	**Cultivation, Collection, Processing and Storage of Drugs of Natural Origin** 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.	8 hours

III	**Quality Control of Drugs of Natural Origin (WHO Guidelines)** 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 bar coding.	8 hours
IV	**Introduction to Metabolites of Plant Origin** 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.	12 hours
V	**Phyto-therapeutic Agents** 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 • Dermatological agents: Aloe • Drugs used in women's health: Chasteberry, Shatavari • Respiratory drugs: Vasaka	7 hours

TEXTBOOKS:

1. Textbook of pharamcognosy,C.K.KOKATE,56 Edition,NIrali prakashan ,Newdelhi,2019
2. Evans, W.C., Trease and Evans Pharmacognosy. 16th ed. London: W.B. Saunders & Co., 2009.

Reference Books:

1. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy. 9th ed. Philadelphia: Lea &Febiger, 1988.
2. Wallis, T.E., Textbook of Pharmacognosy. London: J. & A. Churchill Ltd.
3. World Health Organization (1998) Quality control methods for medicinal plant materials. Geneva: World Health Organization.
4. World Health Organization (2003) WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. Geneva: World Health Organization.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	2	0	1			0		3	
CO2	3	2	3	2	1	1				2	1
CO3	2	2	3	3	2	1	1	0		1	2
CO4	2	3	3	0	3	2	1	1		2	2
CO5	3	3	2	2	3	2	1	2	1	2	2

Course Code	Course Title			Course Type
26NBPH14T	Pharmaceutical Inorganic and Analytical Chemistry(Theory)			Core
Credit	Hours Per Week(L-T-P)			Max.Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

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:

CO No.	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
5	Describe the drugs used in expectorants, emetics, haemintics, poison and antidote and astringents.

DETAILED SYLLABUS

Unit No.	Topics	No. of Lectures
I	**Introduction to pharmaceutical analysis:** 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.	7 hours
II	**Acid-Base Chemistry and Buffer Systems in Pharmac**y 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.	8 hours
III	**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.	14 hours

	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.	
IV	**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.	10 hours
V	**Miscellaneous Compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartrate. **Haematinics:** Ferrous sulphate*, Ferrous gluconate**.** **Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate**	06 hours

TEXTBOOKS:

1. A.A. Nepoleon, Pharmaceutical Titrimetric Analysis.

2. G. R. Chatwal, Textbook of Pharmaceutical Inorganic Chemistry.

Reference Books:

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.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	2	1	2	1	1	0	1	1	2
CO2	3	2	2	1	1	1	1	0	2	1	2
CO3	3	3	3	2	2	1	1	1	1	1	2
CO4	3	2	2	1	1	3	2	1	3	2	2
CO5	3	2	2	0	1	3	2	1	3	1	2

Course Code	Course Title			Course Type
26NBPH15T	Healthcare Psychology and Communication Skills			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	1	--	--	15
Maximum Marks	SE			ESE
50	20			30

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

CO No.	Upon successful completion of this course, the student will be able to
1	Explain the fundamental concepts of psychology and the irrelevance 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	**Introduction to Psychology in Healthcare** 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 behavior change. Emotion and motivation: theories and implications in health contexts.	3 hours
II	**Developmental and Behavioural Psychology** 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
III	**Foundations of Health Communication** 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.	3
IV	**Professional Communication in Healthcare Settings** 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

V	**Health Psychology and Behavioral Interventions** Health belief models and illness behavior. Psychosomatic illnesses and the mind–body connection. Behavior change theories (e.g., CBT, TTM) in treatment adherence. Psychological first aid and crisis communication .Mental health promotion and stigma reduction through communication.	3

TEXTBOOKS:

1. Kumar, A., Communication Skills for Health Professionals. Jaypee Brothers Medical Publishers, New Delhi.

Reference Books:

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. Park, K., Park's Textbook of Preventive and Social Medicine. BanarsidasBhanot Publishers, Jabalpur.

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	2	1	1	--	-	2	2	-	2	-	1
CO2	2	2	2	-	-	2	2		2	-	1
CO3	1	2	2	1	-	2	3	2	2	-	1
CO4	1	2	3	1	-	3	3	2	3	-	2
CO5	2	3	2	-	2	3	2	1	3	-	2

Course Code	Course Title			Course Type
26NBPH16T	Basics of Python Programming for Pharmaceutical Sciences (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
2	2	--	--	30
Maximum Marks	SE			ESE
50	20			30

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 No.	Upon successful completion of this course,the students will be ablet o:
1	Explain the fundamentals of Python programming, including variables, data types.
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	Introduction to Python programming • 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. Introductionto standard libraries and third-party libraries, installing and uninstalling libraries.	6 Hours
II	**Control Structures & Functions** • 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.	6 hours
III	**Data Structures & File Handling** • 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	6 hours

	data access and manipulation tasks.	
IV	**Data Handling with Pandas** • Introduction to Pandas library • Pandas Series and Data Frame 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.	6 Hours
V	**Data Visualization with Matplotlib** • 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.	6 Hours

TEXTBOOKS:

1. Perkovic, L., 2015. Introduction to Computing Using Python: An Application Development Focus. 2nd ed. Hoboken: Wiley.

Reference Books:

1. Weiss, C.J., 2017. Scientific Computing for Chemists with Python. Available at: https://weisscharlesj.github.io/SciComp for Chemists/notebooks/introduction/intro.ht ml
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/Datasets for Education and Research:
5. 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.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	1	-	2	-	-	-	-	-	-	2
CO2	3	3	2	2	-	-	-	-	-	-	2
CO3	3	2	2	3	1	-	-	-	-	-	2
CO4	3	3	2	3	2	-	1	-	1	-	2
CO5	3	3	2	3	2	-	2	-	1	-	3

Course Code	Course Title			Course Type
26NBPH11L	General Pharmacy			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

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:

CO No.	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	Prepare semisolid and specialized dosage forms such as ointments, liniments, and and suppositories using appropriate bases and techniques.

LIST OF PRACTICALS

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

d. potassium permanganate solution

e. boric acid solution

f. Normal saline nasal drops

3. Syrups

a) Simple Syrup – IP

b) paracetamol syrup

c) Iron tonic syrup

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

d) glycerinated gelatin pessaries

6. Semisolids

a) Sulphur ointment – IP

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

c) cream preparation

d) gel preparation

e) paste formulation

7. Gargles & Mouthwashes

*** Bolded are the newly added topics**

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.*

*** Bolded are the newly added topics**

TEXTBOOKS:

1. S. Narmatha B. S., Joseph K. Matta, and Anitha Gandi, "Dispensing Pharmacy: A Practical Manual" Third Edition, Amazon/Academic Publishers, 2021.
2. Nilimanka Das, "Practical Manual of Dispensing Pharmacy" Nirali Prakashan, 2020 (Second Edition)

Reference Books:

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

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development

CO1	3	2	3	2	–	–	–	–	–	–	3
CO2	3	2	3	2	2	–	–	–	–	2	3
CO3	3	2	3	2	2	–	–	–	–	2	3
CO4	3	2	3	2	2	2	–	–	2	2	3
CO5	3	2	2	2	2	2	2	–	2	2	3

Course Code	Course Title			Course Type
26NBPH12L	Human Anatomy,Physiology and Pathophysiology I (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max .Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

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:

CO No.	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..

List of Experiments

(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.

Reference Books:

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.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	1		3	-	2	-	-	-	3	-	-
CO2	2	2	3	-	1	-	-	-	-	-	-
CO3	-	--	2	-	3	-	-	-	1	-	-
CO4	-	3	-	-	-	-	2	-	2	-	-
CO5	-	-	-	-	3	2	2	-	2	-	-

Course Code	Course Title			Course Type
26NBPH14L	Introduction to Pharmacognosy (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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.

List of Experiments (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.
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 dimensions of starch grains by eyepiece micrometer.
14. Experiential learning-based experiments involving collection, identification of medicinal plant material, preparation of voucher specimens and excursion visits to medicinal plant garden.

TEXTBOOKS:

1. Practical Pharmacognosy Dr.K.R.Khandelwal, 13th Edition, Nirali Prakashan, 2019.
2. Practical Pharmacognosy C.K.Kokate, 5th edition, Vallabh Prakashan, Delhi, 2014.

Reference Books:

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.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	3		2	1	1		2	1	1
CO2	2	3	3	1	1	1	2			1	2
CO3	3	2	3	1	3	2	1	1	1	2	2
CO4	2	2	3	2	2	1	1				2
CO5	3	1	3	3	2	2	1	2			2

Course Code	Course Title			Course Type
26NBPH14L	**Pharmaceutical Inorganic and Analytical Chemistry (Practical)**			**Core**
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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.

LIST OF PRACTICALS

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 ofSodium Chloride by precipitation titration (Modified Volhard's method)

h Estimation of Barium Sulphate by Gravimetry

*** Bolded are the newly added topics**

TEXTBOOKS:

1. Vogel, A.I., *Vogel's Textbook of Quantitative Chemical Analysis*. Essex: Pearson Education Limited.

2. Beckett, A.H. and Stenlake, J.B., *Practical Pharmaceutical Chemistry*. Part I & II. London: The Athlone Press, University of London.

Reference Books:

1. Bentley, R. and Driver, J., *Bentley and Driver's Textbook of Pharmaceutical Chemistry*. Oxford: Oxford University Press.
2. Kennedy, J.H., *Analytical Chemistry: Principles*. New York: Saunders College Publishing.
3. Schroff, M.L., *Inorganic Pharmaceutical Chemistry*. New Delhi: Oxford Book Company.
4. Indian Pharmacopoeia Commission, *Indian Pharmacopoeia*. Ghaziabad, India.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	3	1	2	2	1	0	2	2	2
CO2	3	2	3	1	2	2	1	1	2	2	2
CO3	3	3	2	1	2	3	2	1	3	2	2
CO4	3	3	3	2	1	2	1	1	2	1	2
CO5	3	3	3	2	1	2	2	1	2	1	3

Course Code	Course Title			Course Type
26NBPH15L	Healthcare Psychology and Communication Skills(Practical)			Core
Credit	Hours Per Week(L-T-P)			Max.Hours
	L	T	P	
1	--	--	2	30
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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

LIST OF PRACTICALS

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

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

Reference Books:

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.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	2	1	1	-	-	2	2	-	2	-	1
CO2	2	2	2	-	-	2	2		2	-	1
CO3	1	2	2	1	-	2	3	2	2	-	1
CO4	1	2	3	1	-	3	3	2	3	-	2
CO5	2	3	2	-	2	3	2	1	3	-	2

Course structure for B.Pharmacy
I YEAR IISEMESTER

S. No.	Course Code	Course Title		Hours per week			Credits
				L	T	P	C
1	**26NBPH21T**	Biochemistry		3	0	0	3
2	**26NBPH22T**	Human Anatomy, Physiology and Pathophysiology II		4	0	0	4
3	**26NBPH23T**	Pharmaceutical Organic Chemistry		4	0	0	4
4	**26NBPH24T**	Pharmacognosy and Phytochemistry		4	0	0	4
5	**26NBPH25T**	Physical Pharmaceutics		3	0	0	3
6	**26NBPH26T**	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences		2	0	0	2
7	**26NBPH21L**	Biochemistry		0	0	3	1
8	**26NBPH22L**	Human Anatomy, Physiology and Pathophysiology II		0	0	3	1
9	**26NBPH23L**	Pharmaceutical Organic Chemistry		0	0	3	1
10	**26NBPH24L**	Pharmacognosy and Phytochemistry		0	0	3	1
11	**26NBPH25L**	Physical Pharmaceutics		0	0	3	1
	26NBPH27S (LABORATORY)	**26NBPH27AS**	Communication Skills	2			1
		26NBPH27BS	Mental Well Being, Stress & Conflict Management				
		26NBPH27CS	Fundamentals of Computer Operations				
Total credits				**37**			**26**

Course Code	Course Title			CourseT ype
26NBPH21T	Biochemistry(Theory)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

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:

CO No.	Upon successful completion of this course, the students will be able to:
CO1	Explain the principles of enzymology and various tests in clinical chemistry.
CO2	Describe the classification, structure, and functions of major biomolecules such as carbohydrates, lipids, proteins, nucleic acids, enzymes, and vitamins.
CO3	Explain the principles of bioenergetics, biological oxidation, and the overview of metabolic pathways of biomolecules, along with their clinical significance.
CO4	Understand metabolism of lipid and its significance.
CO5	Understand metabolism of proteins & its significance and monitoring of metabolic and organ-specific disorders.

DETAILED SYLLABUS

Unit No.	Topics	No. of Lectures
I	**Enzymology** 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. 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
II	• Introduction about biomolecules – Introduction of carbohydrate, lipids, nucleic acids, amino acids and proteins. • Bioenergetics: Concept of free energy; relationship between free energy, enthalpy, and entropy; redox potential; energy-rich compounds (ATP, GTP, etc.) and their biological significance. • Carbohydrate Metabolism and their role in diabetis 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	10

	during fed state, fasting, and prolonged starvation; metabolic derangements in diabetes mellitus and related disorders. • Biological Oxidation: Electron Transport Chain (ETC), oxidative phosphorylation, and mechanisms of ATP synthesis; regulation and clinical implications of mitochondrial dysfunction and oxidative stress.	
III	**Lipid metabolism** a. Classification, functions, and properties of lipids and lipoproteins (HDL, LDL, VLDL, chylomicrons) b. β-oxidation and de-novo synthesis of fatty acids: Ketone bodies: synthesis, utilization, and clinical significance c. Biological significance of cholesterol, lipid profile, and its clinical significance d. Disorders associated with lipid metabolism: Hyperlipidaemias and hypercholesterolemia, lipid storage diseases, atherosclerosis, fatty liver disease, and obesity	7
IV	**Amino acids and protein metabolism** a. Classification and Biological Functions: Classification and physiological roles of amino acids. Structure and functions of proteins and plasma proteins 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). c. Catabolism of Specific Amino Acids and Related Disorders: Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria,	10

	Albinism, Alkaptonuria, Tyrosinemia) and Inborn errors of branched chain and aromatic amino acids d. Biochemical significance of neurotransmitters and hormones derived from amino acids: 5-HT (serotonin), melatonin, dopamine, noradrenaline, adrenaline e. Catabolism of heme and related disorders (jaundice).	
V	**Nucleic acid metabolism and genetic information transfer** 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. b. Genome Structure and Central Dogma: Organization of the mammalian genome. Introduction to DNA replication, Transcription, and Translation. c. Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins) d. DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Overview of clinical disorders associated with faulty DNA repair.	8

TEXT BOOKS:

1. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations. New York: WileyLiss.
2. Satyanarayana, U. and Chakrapani, U., Biochemistry. Kolkata: Books and Allied (P) Ltd.

Reference Books:

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. Stryer, L., Biochemistry. New York: W.H. Freeman.
6. Devlin, T.M., Textbook of Biochemistry with Clinical Correlations. New York: WileyLiss.
7. Satyanarayana, U. and Chakrapani, U., Biochemistry. Kolkata: Books and Allied (P) Ltd.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	-	-	-	2	2	-	2	-	3
CO2	3	2	3	2	-	-	-	-	-	-	3
CO3	3	2	3	2	2	-	-	-	-	2	3
CO4	3	2	3	2	2	-	-	-	-	2	3
CO5	3	2	3	2	2	2	2	-	2	2	3

Course Code	Course Title			Course Type
26NBPH22T	Human Anatomy, Physiology and Pathophysiology II (Theory)			Core
Credit	Hours Per Week(L-T-P)			Max .Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

Course Objectives:

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:

CO No.	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 patho physiological 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	**Nervous system** a)Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse and neurotransmitters. **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). b)Pathophysiology of epilepsy, Parkinson's disease, stroke, migraine, depression, schizophrenia, Alzheimer's disease and meningitis.	14
II	**Gastrointestinal System** 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. b) Pathophysiology of inflammatory bowel diseases, peptic ulcer, jaundice, hepatitis, typhoid and alcoholic and non alcoholic fatty liver disease	12
III	**Respiratory System** a) 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 methods.	12

	b) Pathophysiology of asthma, chronic obstructive pulmonary diseases and tuberculosis. c) Urinary System 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.Role of Renin Angitensin Aldosterone System in kidney. d) Pathophysiology of acute and chronic renal failure and urinary tract infections	
IV	**Endocrine System** 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. b) Pathophysiology of diabetes, hypothyroidism, hyperthyroidism, goiter and polycystic ovary syndrome.	10
V	**Reproductive System and Cancer** 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. b) Pathophysiology of sexually transmitted diseases: AIDS, syphilis and gonorrhea. c) Etiology and pathogenesis of cancer.	12

TEXTBOOKS:

1. Wilson, K.J.W. – Ross and Wilson Anatomy and Physiology in Health and Illness, Churchill Livingstone. A student-
friendly text with clear diagrams and clinical correlations.

2. Tortora, G.J. & Grabowski, S.R. – Principles of Anatomy and Physiology, Wiley. Comprehensive coverage of anatomy and physiology with integrated pathophysiology.

Reference Books:

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

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CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	2	1	-	-	-	-	-	-	1
CO2	3	2	2	1	-	-	-	-	-	-	1
CO3	3	2	2	1	2	-	-	-	1	-	1
CO4	3	3	2	1	2	-	-	-	1	-	1
CO5	3	3	2	1	2	2	2	-	1	-	2

Course Code	Course Title			CourseType
26NBPH24T	Pharmaceutical Organic Chemistry (Theory)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
4	4	--	--	60
Maximum Marks	SE			ESE
100	40			60

Course Objectives:

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:

CO No.	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
I	**Aliphatic Saturated Hydrocarbons – Alkanes** • Methods of preparation: Wurtz reaction, Kolbe's reaction, Clemmensen reduction, Wolff–Kishner reduction • Chemical reactions of alkanes • Mechanism of free radical substitution (halogenation) • Pharmaceutical applications of alkanes: Liquid paraffin, soft paraffin, hard paraffin **Cycloalkanes** • Baeyer's strain theory and its limitations • Coulson–Moffitt modification • Sachse–Mohr theory	12
II	**Aliphatic Unsaturated Hydrocarbons – - Alkenes** • Methods of preparation: o Dehydration of alcohols o Dehydrohalogenation of alkyl halides o Dehalogenation of vicinal dihalides o Wittig reaction • Chemical reactions of alkenes • Mechanism of electrophilic addition reactions • Markovnikov's and anti-Markovnikov's rule • Ozonolysis **Conjugated Dienes** • Stability of conjugated dienes • Mechanism of Diels–Alder reaction Electrophilic and free radical addition reactions • 1,2- and 1,4-addition reactions	12

III	**Alkyl Halides**
	• Nucleophilic substitution reactions: SN1 and SN2
	  o Mechanism, kinetics, substrate structure, solvent effect, stereochemistry
	• Elimination reactions: E1 and E2
	  o Mechanism, kinetics, substrate structure, solvent effect, stereochemistry
	• Zaitsev's (Saytzeff's) rule with examples
	• Comparison of substitution vs elimination reactions
		12

	Benzene and Its Derivatives–-
	• IUPAC nomenclature of mono- and di-substituted benzene derivatives
	• Structure of benzene
	• Molecular orbital picture and resonance
	• Aromaticity and Hückel's rule
	• Electrophilic aromatic substitution reactions:
	  o Nitration
	  o Halogenation
	  o Friedel–Crafts alkylation and its limitations
	  o Friedel–Crafts acylation
	  o Sulphonation and desulphonation
	• Effect of substituents on reactivity and orientation
		12

	Carbonyl Compounds- **Aldehydes and Ketones** • Preparation and properties of carbonyl compounds • Nucleophilic addition reactions • Aldol condensation and crossed aldol condensation • Cannizzaro and crossed Cannizzaro reactions • Benzoin and Perkin condensation • Oxidation and reduction reactions	12

	• Pharmaceutical applications of carbonyl compounds: Chloral, Paraldehyde, Ketoprofen	

TEXTBOOKS:

1. Morrison,R.T.,Boyd,R.N.andBhattacharjee,S.K.,OrganicChemistry.Pearson Education India.
2. Bahl,B.S. and Bahl, A., Textbook of Organic Chemistry.S. Chand&Company.

Reference Books:

1. Finar, I.L., Organic Chemistry, Vol.I.Pearson Books.
2. Furniss,B.S., Vogel's Textbook of Practical Organic Chemistry.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	3	1	3	-	-	-	2	3	3
CO2	3	2	3	-	3	-	-	-	2	3	3
CO3	3	3	2	-	2	-	-	-	2	3	3
CO4	3	2	2	-	3	-	-	-	3	2	3
CO5	3	3	2	2	3	-	-	-	3	2	2

Course Code	Course Title			Course Type
26NBPH24T	Pharmacognosy and Phytochemistry (Theory)			Core
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
4	4	--	-	60
Maximum Marks	SE			ESE
100	40			60

Course Objectives:

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 No.	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	**Metabolic Pathways and Biogenetic Studies –** Brief study of basic metabolic pathways and biosynthesis of secondary metabolites including: • Shikimic acid pathway • Acetate pathway • Amino acid pathways Utilization of radioactive isotopes in biogenetic studies. Introduction to pathway prediction tools and modern genetic tools such as CRISPR/Cas9.	10
II	**Primary Metabolites –** General classification and identification tests Pharmacognostic study (biological source, distribution, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: **Carbohydrates:** • Acacia, • Agar • Tragacanth • Honey **Proteins and Enzymes:** • Gelatin • Casein • Proteolytic enzymes: Papain, Bromelain, Serratiopeptidase, Urokinase, Streptokinase, Pepsin **Lipids (Waxes, Fats, Fixed Oils):** • Castor oil • Olive oil	12

	• Cocoa butter • Wool fat • Beeswax	
III	**Secondary Metabolites –** General classification and identification tests Pharmacognostic study (biological source, distribution, cultivation of underlined drugs, identifying characters, chemical constituents, specific tests, therapeutic uses, and commercial applications) of: **Alkaloids:** • Vinca • Rauwolfia • Opium **Volatile Oils:** • Lemongrass • Clove • Cinnamon • Fennel **Tannins:** • Myrobalans • Catechu • Pomegranate **Resins:** • Guggul • Asafoetida **Glycosides:** • Senna • Liquorice • Digitalis **Phenylpropanoids and Flavonoids:** • Green Tea	12

	• Ginkgo • Flax seed **Iridoids, Other Terpenoids and Naphthoquinones:** • Gentian • Artemisia	
IV	**Extraction Methods for Medicinal Plants – Conventional Methods of Extraction:** • Infusion • Decoction • Digestion • Maceration • Percolation • Reflux • Distillation • Soxhlet extraction • Successive solvent extraction **Modern Methods of Extraction:** • Supercritical fluid extraction • Microwave-assisted extraction • Ultrasonic-assisted extraction • Enzyme-assisted extraction • Pressurized liquid extraction	12

V	**Overview of Isolation, Identification and Characterization Techniques–** **Separation and Isolation Techniques:** • Planar chromatography • Column chromatography • Preparative TLC • Flash chromatography **Identification Techniques:** • Phytochemical tests • Chromatographic techniques • Spectroscopic techniques **Fingerprinting of medicinal plants using TLC/HPTLC.** **Types and significance of markers (phytochemical reference standards).** **Screening and analysis of major metabolites:** • Alkaloids • Glycosides • Saponins • Tannins • Resins • Flavonoids • Phenolics • Steroids	12

Text Books:

1. Text book of pharmacognosy by C.K.Kokate, A.P..Purohit, S.B.Gokhale, 56th edition, Nirali prakashan, New Delhi, 2019.

2. Herbal Drug Technology, S S Agarawal, First Edition,Universities Press,2007.

Reference Books:

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.

CO-PO Mapping

CourseOutcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	3	2	2	1	1	1			2
CO2	3	2	3		2		1				
CO3	3	2	2	2	2						3
CO4	2	3	3	3	3		1			1	2
CO5	3	2	3	2	2	1		1			2

Course Code	Course Title			Course Type
26NBPH25T	Physical Pharmaceutics (Theory)			Core
Credit	Hours Per Week(L-T-P)			Max Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	SE			ESE
75	30			45

Course Objectives:

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:

CO No.	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	**Solubility distribution phenomenon & buffers** 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. Introduction to buffers, Buffers in pharmaceutical and biological system, pH determination methos (Electrometry and colorimetry). Buffer equation / Factor influencing the pH of buffer solutions, Factor influencing Buffer capacity, General procedure for preparing buffers, Indicators.	9
II	**Interfacial phenomenon** 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**

III	**Colloidal and Coarse Dispersion** 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. 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 stabilizaition (DLVO Theory, Monomolecular adsorption, Multimolecular adsorption, Film formation, Solid particle adsorption). Physical instabilities of emulsions (creaming, coalescence and breaking, and phase inversion).	**12**
	Rheological studies 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	**8**
	Micromeritics 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 powers (Powder flow tester).	**8**

TEXTBOOKS

1.Sinko, P.J., Martin&, Physical Pharmacy and Pharmaceutical Sciences.

2.CVS Subramanyam- A Textbook of Physical Pharmaceutics

Reference Books:

1. Allen, L.V. and McPherson, T.B., Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems.

2. Adejare, A., Remington: The Science and Practice of Pharmacy.

3. Aulton, M.E. and Taylor, K.M.G., Aulton Pharmaceutics: The Design and Manufacture of Medicines. Elsevier.

4. 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

5. Quantitative Chemical Analysis. Myers, D., Surfaces, Interfaces, and Colloids: Principles and Applications. Ladisch, M.R., Rheology of Fluid and Semisolid Foods. Springer.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	1	3	2	1	-	-	-	2	1	2
CO2	3	2	2	3	2	-	-	-	1		2
CO3	3	2	3	2	2	-	-	-	1		2
CO4	3	2	3	2	2	-	-	-	2		2
CO5	3	1	2	3	2	-	-	-	1		2

Course Code	Course Title			Course Type
26NBPH26T	Applied Biostatistics and Data Analytics for Pharmaceutical Sciences (Theory)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
2	2	--	--	30
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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 analyzing 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:

CO No.	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	**Descriptive Statistics** • Types of data in pharmaceutical sciences (nominal, ordinal, interval, ratio) • Sources of data in pharmacy: clinical trials, pharmacovigilance, quality control, PK studies • Measures of central tendency: mean, median, mode, their calculation and interpretation • Measures of dispersion (range, variance, standard deviation) and their interpretation using pharmaceutical data • Skewness and understanding distribution shape in biological measurements Perform descriptive statistical analysis using Python libraries such as NumPy and Pandas, with focus on Interpretation of results	6 hours
II	**Probability & Statistical Distributions in Healthcare** • Basic probability concepts and laws (addition and multiplication rules), conditional probability and its interpretation • Bayes' theorem and its application in clinical decision-making • Concept of random variables (discrete and continuous) • Normal distribution and its importance in biological and pharmaceutical measurements, • Binomial distribution demonstrating applications in clinical trial outcomes • Poisson distribution for modeling rare events such as	6 hours

	adverse drug reactions • Graphical visualization of these probability distributions using Python	
III	**Sampling & Statistical Inference** • Population versus sample, sampling techniques used in clinical research, Sampling error and bias • Conceptual understanding of the Central Limit Theorem • Confidence intervals and their interpretation • Hypothesis testing framework (null and alternative hypotheses) • Type I and Type II errors, p-value and statistical significance • Demonstration, calculation and interpretation of these parameters using python with pharmaceutical data	6 hours
IV	**Basics of Correlation & Regression:** Conceptual understanding of the following concepts with emphasis on their interpretation- • correlation and Pearson correlation coefficients • Interpretation of positive and negative correlations • Scatter plots and trend visualization using pharmaceutical data such as dose-response relationships • Simple linear regression concept, interpretation of regression coefficients • Introduction to odds ratio and its application in clinical risk analysis	6 hours
V	**Statistical Analysis Using Python – Case based learning** • Demonstration of descriptive statistics, correlation analysis and linear regression using Python libraries- SciPy / Statsmodels / Scikit-learn on pharmaceutical datasets • Interpretation of the output summaries and p-values • Preparation of statistical reports	6 hours

TEXTBOOKS:

1.C. R Kothari , text book of Research Methodology 2. Introduction to Bio statistics By K khanum

Reference Books:

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 H Sciences. Hoboken, NJ: Wiley-Blackwell.

3. Rowe, P., Essential Statistics for the Pharmaceutical Sciences. London: Pharmaceutical

4. Bolton, S. and Bon, C., Pharmaceutical Statistics: Practical and Clinical Applications. N York: Informa Healthcare.

5. De Muth, J.E., Basic Statistics and Pharmaceutical Statistical Applications. Boca Raton CRC Press

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	1										1
CO2	1	2			2	1					1
CO3	1	2	1			1	1		1		2
CO4	2	2	1		2		2	1	2		1
CO5	2		1	3	3		2	1			1

Course Code	Course Title			Course Type
26NBPH21L	Biochemistry (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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 ignificance.
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.

LIST OF PRACTICALS(Minimum 12experiments must be performed)

1. Identification tests for proteins (Albumin and Casein).
2. Qualitative analysis of carbohydrates* (Glucose, Fructose, Lactose, Sucrose, and Starch).
3. Qualitative analysis of urine for normal and abnormal constituents.
4. Estimation of blood glucose.
5. Estimation of total cholesterol and HDL cholesterol.
6. Estimation of urea, creatinine, and uric acid in serum.
7. Estimation of serum total protein and albumin.
8. Study of enzymatic hydrolysis of starch.
9. Study of the effect of temperature on salivary amylase activity.
10. Study of the effect of substrate concentration on salivary amylase activity.
11. Estimation of hemoglobin in blood by Sahli's method / Cyanmethemoglobin method.
12. Estimation of serum bilirubin (total and direct bilirubin).
13. Estimation of glycogen content
14. Estimation of SGOT and SGPT

TEXT BOOKS:

1. Varley, H., Gowenlock, A. H., Bell, M., and Bell, J. L. Varley's Practical Clinical Biochemistry. Heinemann Medical Books.
2. Burtis, C. A., Ashwood, E. R., and Bruns, D. E. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Elsevier.

Reference Books:

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.

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	3	-	2	-	-	-	2	1	1
CO2	3	2	2	-	-	-	-	-	1	-	-
CO3	3	3	2	-	-	-	1	-	-	-	2
CO4	2	2	1	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	2

Course Code	Course Title			Course Type
26NBPH22L	Human Anatomy,Physiology and Pathophysiology II (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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**.**

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.
15. Hands-on training in cardiopulmonary resuscitation (CPR).

TEXT BOOKS:

1. Tortora, G. J., and Grabowski, S. R. Principles of Anatomy and Physiology. John Wiley & Sons.
2. Brunton, L., Chabner, B., and Knollmann, B. Goodman & Gilman's The Pharmacological Basis of Therapeutics. McGraw-Hill, New York.

Reference Books:

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. Colledge, N. R., Walker, B. R., and Ralston, S. H. Davidson's Principles and Practice of Medicine. Churchill Livingstone, London

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	3	2	-	2	2	1	3	-	2
CO3	3	2	2	1	2	-	-	-	2	-	1
CO4	3	3	3	2	2	2	2	-	3	-	2
CO5	3	2	3	2	2	-	-	-	2	-	2

Course Code	Course Title			Course Type
26NBPH23L	Pharmaceutical Organic Chemistry (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max.Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives

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

Course Outcomes:

CO No.	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.

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.

TEXTBOOKS:

1. Vogel, A. I. Elementary Practical Organic Chemistry. Longman Group Ltd.
2. Mann, F. G. and Saunders, B. C. Practical Organic Chemistry. Pearson Education.

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. 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.
3. Pavia, D. L., Lampman, G. M., Kriz, G. S. and Engel, R. Introduction to Organic Laboratory Techniques. Cengage Learning.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	-	3	2	2	--	2	-	2	2	2
CO2	3	2	3	2	2	-	-	-	2	2	2
CO3	3	-	2	2	2	-	-	-	2	3	2
CO4	3	2	3	-	2	-	-	2	2	3	2
CO5	3	2	3	-	2	-	-	2	2	3	2

Course Code	Course Title			CourseType
26NBPH24L	Pharmacognosy and Phytochemistry (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

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 sourcesas perPharmacopoeial standards**.**

Course Outcomes:

CO No.	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

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 Glycyrhizin 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**.**

Text Books:

1. Practical Pharmacognosy Dr.K.R.Khandelwal, 13th Edition, Nirali Prakashan, 2019.
2. Practical Pharmacognosy C.K.Kokate, 5th edition, Vallabh Prakashan, Delhi, 2014.
3. Harbone J B. Phytochemical methods-A Guide to Modern Techniques Plant analysis, 3rd Edition Springer,1998.

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
3. Analysis. Springer.
4. Wallis, T. E. Textbook of Pharmacognosy. CBS Publishers & Distributors, New Delhi.
5. Tyler, V. E., Brady, L. R. and Robbers, J. E. Pharmacognosy. Lea & Febiger.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	2	2	3	1	2						1
CO2	2	3	3	1	2		1				2
CO3	2	3	3	1	3			2			1
CO4	3	3	3	3	3	1	1	1			2
CO5	2	3	3	2	2			1			2

Course Code	Course Title			Course Type
26NBPH25L	Physical Pharmaceutics (Practical)			Core
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Objectives:

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:

CO No.	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.

LIST OF EXPERIMENTS(Minimum 12 experiments must be performed)

1. Determination of surface tension of given liquids by drop count method and drop weight method.
2. Determination of critical micellar concentration (CMC) of surfactants.
3. Determination of viscosity of liquids using Ostwald's viscometer and Brookfield viscometer.
4. Determination of HLB value of a surfactant.
5. Calculation of isotonicity by different methods (Sodium Chloride Equivalent Method).
6. Determination of particle size and particle size distribution using sieving method.
7. Determination of particle size and particle size distribution using microscopic method.
8. Determination of densities and derived properties of powders (bulk density, tapped density, Hausner ratio, Carr's compressibility index), true density, and porosity.
9. Determination of angle of repose and influence of glidants on angle of repose.
10. Determination of solubility of a drug at different pH/buffer systems at room temperature.
11. Determination of partition coefficient of a drug in n-octanol and water system.
12. Determination of partition coefficient of a drug in benzene and water system.
13. Determination of critical solution temperature and composition of phenol–water 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.

TEXT BOOKS

1. Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee

2. Experimental pharmaceutics by Eugene, Parrott.

Reference Books:

1. Sinko, P. J. Martin's Physical Pharmacy and Pharmaceutical Sciences. Lippincott Williams & Wilkin

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.

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	3	3	2	3	-	-	-	-	1	2	3
CO2	3	2	-	1	1	-	-	-	2	1	2
CO3	3	2	2	1	1	-	-	-	2	1	3
CO4	3	3	2	1	1	-	-	-	2	2	3
CO5	3	-	2	2	1	-	-	-	2	2	3

Course Code*	Course Title*	Course Type		
26NBPH27AS	Communication Skills	Elective		
26NBPH27BS	Mental Well-Being, Stress & Conflict Management			
26NBPH27CS	Fundamentals of Computer Operations			
Credit	Hours Per Week (L-T-P)	Max. Hours		
	L	T	P	
1	--	--	2	30
Maximum Marks	SE	ESE		
50	20	30		

Course Code	Course Title			Course Type
26NBPH27AS	Communication Skills			Elective
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	2	30
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Enhance verbal and non-verbal communication skills in academic, clinical, and professional pharmacy settings.
2. Develop competence in patient counselling, prescription communication, and interprofessional dialogue.
3. Promote empathetic and ethical communication in diverse cultural and patient contexts.
4. Use digital tools and professional formats (e.g., emails, reports, and posters) for effective communication.
5. Foster confidence, active listening, and clarity in pharmacy-related presentations and conversations.

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course,the students will be able to
1	Demonstrate effective verbal and non-verbal communication in clinical, retail, and academic pharmacy contexts.
2	Perform patient counselling and handle real-world pharmacy interactions using role-play and case scenarios.
3	Draft professional emails, prepare patient information leaflets, and create drug labels with clarity and accuracy.
4	Deliver confident oral presentations and communicate complex medical information in a simplified, patient-friendly manner.
5	Apply principles of ethical and culturally sensitive communication while handling patients and professional peers

List of Practicals

(Perform Any 12 Experiments)

1. Introduction to Communication in Pharmacy

- Types of communication: verbal, non-verbal, and written
- Importance in clinical, academic, and retail pharmacy

2. Listening and Observation Skills Workshop

- Active listening techniques and barriers to listening
- Observation of patient cues: posture, tone, and compliance

3. Role-play: Communicating with a Patient for Dispensing a Prescription

- Explanation of dosage, frequency, side effects, and precautions

4. Role-play: Handling Difficult Conversations

(e.g., angry patient or confused elderly patient)

- Empathy, patience, tone modulation, and de-escalation techniques

5. Written Communication I: Professional Email Writing & Documentation

- Writing emails to doctors, suppliers, and institutions
- Structure, etiquette, and clarity in pharmacy communication

6. Written Communication II: Preparing Patient Information Leaflets and Drug Labels

- Use of simple language, drug facts, precautions, and icons
- Creating flyers for common conditions (e.g., diabetes and asthma)

7. Non-verbal Communication Skills

- Body language, eye contact, gestures, and tone of voice
- Cross-cultural sensitivity in pharmacy communication

8. Presentation Skills I – Basic Techniques

- Voice projection, clarity, and use of visuals
- Individual practice with simple pharmacy topics

9. Presentation Skills II – Group Presentations

- Topics: health awareness campaigns, drug education, and OTC safety
- Peer and faculty feedback

10. Patient Counseling Practice (Case-Based)

- Counseling for chronic illnesses (e.g., hypertension and diabetes)
- Role-playing real-life counseling situations

11. Communicating with Healthcare Professionals

- Case handoff, drug information requests, and referral writing
- Using SBAR (Situation, Background, Assessment, Recommendation) format

12. Mock Interview / Group Discussion Practice

- Industry and clinical job interview scenarios
- GD topics such as "Generic vs. Branded Medicines"

13. Digital Communication Skills for Pharmacists

- Creating a simple health blog or social media awareness post
- Basics of teleconsultation and e-pharmacy chat support

14. Ethics and Professionalism in Communication

- Confidentiality, patient rights, and informed consent
- Role-play on ethical dilemmas in pharmacy practice

15. Assessment & Reflection

- Final presentation or counseling demonstration
- Feedback, self-evaluation, and faculty observation

TEXTBOOKS:

1.Communication Skills in Pharmacy Practice – E. M. Kelly & S. L. Svarstad, Lippincott Williams & Wilkins

Reference Books:

1. Developing Communication Skills for Pharmacy – Catherine Langford, Pharmaceutical Press
2. Patient Counselling Guidelines for Pharmacists – WHO India, World Health Organization

CO-PO Mapping

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	-	2	-	1	1	2	2	3	2	-	2
CO2	-	1	1	1	2	2	2	3	2	-	2
CO3	-	2	-	2	1	1	2	3	1	-	3
CO4	-	1	-	2	2	3	3	3	3	-	3
CO5	-	1	-	1	3	3	3	3	3	-	2

Course Code	Course Title			Course Type
26NBPH27BS	Mental Well-Being ,Stress and Conflict Management			Elective
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	2	30
Maximum Marks	SE			ESE
50	20			30

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce students to the concepts of mental well-being and stress.
2. Equip students with techniques to manage stress, anxiety, and emotional well-being.
3. Develop conflict resolution skills for personal and professional life.
4. Encourage emotional intelligence and interpersonal communication.
5. Promote resilience and positive mindset development

COURSE OUTCOMES (CO):

CO No.	Upon successful completion of this course,the students will be able to
1	Identify sources and effects of stress in personal and professional life.
2	Apply stress management techniques such as mindfulness, journaling, and relaxation exercises.
3	Utilize conflict management strategies to resolve interpersonal and workplace conflicts.
4	Demonstrate improved emotional intelligence and resilience.
5	Develop effective communication skills for personal and professional growth.

List of Practicals

(Perform any 12 Experiments)

1. Self-assessment of stress levels using Perceived Stress Scale (PSS)
2. Journaling activity: Maintain a 7-day emotional diary
3. Mindfulness breathing exercise and reflection
4. Guided meditation session and feedback form
5. Time management activity using Eisenhower Matrix
6. Role-play exercise on workplace conflict resolution
7. SWOT analysis of personal behavior and coping mechanisms
8. Cognitive restructuring worksheet for negative thoughts
9. Group discussion: "How do you respond to stress?"
10. Conflict styles self-test (Thomas-Kilmann Conflict Mode Instrument)
11. Visualization technique to reduce anxiety
12. Progressive muscle relaxation practice
13. Team activity: Building trust through icebreakers and communication
14. Reflection report after practicing gratitude for 5 days
15. Case study analysis: Conflict scenario in a healthcare/pharma setup

TEXTBOOKS:

1. Conflict Management: A Practical Guide to Developing Negotiation Strategies — *Barbara A. Budjac Corvette, Pearson Education*
2. Managing Stress: Principles and Strategies for Health and Well-Being — *Brian Luke Seaward, Jones & Bartlett Learning*

Reference Books:

1. The Relaxation and Stress Reduction Workbook — *Martha Davis, Elizabeth Robbins Eshelman & Matthew McKay, New Harbinger Publications*
2. Emotional Intelligence — *Daniel Goleman, Bantam Books*
3. The 7 Habits of Highly Effective People — *Stephen R. Covey, Simon & Schuster*
4. Conflict Management: A Practical Guide to Developing Negotiation Strategies — *Barbara A. Budjac Corvette, Pearson Education*
5. Mindfulness: An Eight-Week Plan for Finding Peace in a Frantic World — *Mark Williams & Danny Penman, Rodale Books*

6. Stress Management for Life: A Research-Based Experiential Approach — *Michael Olpin & Margie Hesson, Cengage Learning*
7. Crucial Conversations: Tools for Talking When Stakes Are High — *Kerry Patterson, Joseph Grenny, Ron McMillan & Al Switzler, McGraw-Hill Education*

CO-PO Mapping:

Course Outcomes	Pharmacy Knowledge	Problem Analysis, Critical Thinking and Evidence-Based Decision Making	Pharmaceutical Skills & Practice	Modern Tools, AI & Digital Competence	Research & Innovation	Professional Ethics & Human Values	Communication & Interpersonal Skills	Leadership, Management & Entrepreneurship	Pharmacist & Society	Environment and sustainability	Life-Long Learning & Professional Development
CO1	1	2	-	1	1	2	3	3	2	-	2
CO2	2	1	1	1	2	2	3	3	2	-	2
CO3	2	2	-	2	1	1	3	3	1	-	3
CO4	2	1	-	2	2	3	3	3	3	-	3
CO5	3	1	-	1	3	3	3	3	3	-	2

Course Code	Course Title			Course Type
26NBPH27CS	Fundamentals of Computer Operations			Elective
Credit	Hours Per Week(L-T-P)			Max. Hours
	L	T	P	
1	--	--	2	30
Maximum Marks	SE		ESE	
50	20		30	

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide foundational knowledge of computer systems, operating environments, and digital tools used in academic and professional settings.
2. Develop practical skills in digital documentation, data handling, and presentation using commonly available office productivity tools.
3. Familiarize students with file management practices and digital communication methods used in professional environments.
4. Enhance the ability to access, search, and retrieve scientific and academic information from online resources.
5. Prepare students to utilize computer-based tools for managing pharmaceutical data, documentation, and basic professional tasks.

COURSE OUTCOMES (CO):

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

CO No.	Upon successful completion of this course,the students will be ablet o
1	Demonstrate the ability to operate computer systems and perform basic system and file management functions.
2	Prepare and format digital documents and spreadsheets for academic and pharmaceutical applications.
3	Develop presentations and use digital communication tools for effective professional communication.
4	Access and retrieve scientific information using online databases and academic search platforms.
5	Apply basic computer skills for organizing, analyzing, and managing pharmaceutical data and documentation.

List of Practicals

(Perform any 12 Experiments)

General Instruction on Digital Tools

Open-source digital tools are preferred for teaching and learning purposes. However, institutions may choose appropriate software platforms, applications, or online services depending on availability, institutional policy, and infrastructure. The selected tools should enable students to perform the required digital and documentation tasks effectively. The specific software may vary, but the skills and competencies listed below must be achieved using suitable tools.

Practical Components

1. Basic operation and navigation of a computer operating system, including system settings and file explorer functions.
2. Creating, renaming, organizing, moving, and deleting files and folders within a computer system.
3. Preparing a structured academic or pharmacy-related report using a word-processing application with appropriate formatting, tables, headers, and page layout.
4. Inserting equations, images, and formatted elements while preparing documents such as reports, notices, or certificates using document editing tools.
5. Creating spreadsheets for pharmacy-related calculations such as dose calculations, inventory records, or sales data using spreadsheet applications.
6. Applying basic spreadsheet formulas and functions such as summation, averaging, conditional calculations, and counting operations.
7. Generating graphs, charts, and data visualizations from experimental or pharmaceutical data using spreadsheet tools.
8. Preparing a short academic presentation (approximately five slides) using presentation software with text, images, and basic design elements.
9. Performing effective internet browsing and academic search techniques using online scientific literature databases and search platforms.

10. Writing and sending professional emails including file attachments, proper subject lines, and appropriate use of CC and BCC with correct communication etiquette.
11. Introduction to digital systems used in pharmacy practices such as billing, inventory management, or prescription management through demonstration or simulation.
12. Using cloud-based storage platforms for saving, organizing, and sharing academic or pharmacy-related files and data.
13. Exploring digital health technologies such as pharmacy-related mobile applications or electronic health tools used in healthcare practice.
14. Accessing and utilizing online learning platforms for professional education and course materials.
15. Preparing and submitting digital assignments using word-processing, spreadsheet, or presentation tools.

Reference Books:

1. Introduction to Computers — *Peter Norton, McGraw-Hill Education*
2. Computer Basics: Absolute Beginner's Guide — *Michael Miller, Que Publishing*

CO-PO Mapping

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CO3	2	2	-	2	1	1	2	3	1	-	3
CO4	3	1	-	2	2	3	3	3	3	-	3
CO5	3	1	-	1	3	3	3	3	3	-	2