Syllabus for B.Voc. Programme

in

Bachelor of Vocation in Pharmaceutical Chemistry

Choice Based Credit System (CBCS)

CBCS SYLLABUS FOR B. VOC IN PHARMACEUTICAL CHEMISRY

GAUHATI UNIVERSITY

SEMESTER	CORE COURSE (12 PAPERS, 72 CREDITS)	ABILITY ENHANCEMENT CUMPOLSURY COURSE (AECC) 2 PAPERS, 8 CREDITS	SKILL ENHANCEMENT COURSE (SEC) 4 PAPERS, 16 CREDITS	DESCIPLINE SPECIFIC ELECTIVE (DSE) 6 PAPERS, 36 CREDITS
I	PHC-VC-1016 PHC -VC-1026 PHC-VC-1036	ENG-AEC-1014		
II	PHC-VC-2016 PHC-VC-2026 PHC-VC-2036	ENV-AEC-2014		
III	PHC-VC-3016 PHC-VC-3026 PHC-VC-3036		INDIAN DRUG REGULATORY GUIDELINES XXX-SE-3XX4	
IV	PHC-VC-4016 PHC-VC-4026 PHC-VC-4036		**PHARMACEUTICAL UNIT OPERATION** XXX-SE-4XX4	
V			**INTRODUCTION TO DRUG DELIVERY SYSTEM** XXX-SE-5XX4	PHC-VC-5016 PHC-VC-5026 PHC-VC-5036
VI			**ENTREPRENEURSHIP DEVELOPMENT** XXX-SE-6XX4	PHC-VC-6016 PHC-VC-6026 PHC-VC-6036

B. Voc. Pharmaceutical Chemistry
Semester I

PHC-VC-1016: Pharmaceutical Inorganic Chemistry

Total Marks:100; Total Credit: 04

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**a.** Rational nos. Proportional set of nos., Ratios, Fractions, Decimals, Percentage. **b.** Other nos. Exponents and Logarithms, Variables, Constants and Parameters, Graphical presentation of data-Different types of graphs (Line graph, Bar graph, Pie chart, Histogram etc.) Slope and intercept. **c.** Accuracy and measurements Rounding nos. significant figures, correcting nos., Accuracy in arithmetic calculations, Accuracy in weighing, measuring for assays, Limits and uniformity of content.	1 Credits 15 Marks
II	**a.** System and Units Mass and weights, Metric units, Conversions between systems, Temperature conversions and others. **b.** Ratios, Proportions and percentage Percent calculations, Proportions, Concentration systems, Part per million, calculation of amount of ingredients required to make up percentage solutions, Conversion from one to another strength. Alcohol calculations	
III	**a.** Dilutions Simple dilutions, Serial dilutions, concentrated solutions' strengths, multiple dilutions, mixing concentrations. **b.** Density Determination of density, specific gravity Determination of displacement value, displacement volumes-solid-solid, liquid-liquid systems.	1 Credits 15 Marks
IV	**a.** . Molecular Weight Moles, millimoles, milliequivalents, milliosmoles, Molar concentrations **b.** Parenteral solutions and isotonicity Rate of flow of IV solutions, Isotonicity	
V	Diagnostic drugs, pharmaceutical necessities- preservatives, complexation and chelation- application in pharmacy, sources of impurities and their control, limit test for iron, arsenic, lead, heavy metals, chloride and sulphate: Gastrointestinal agents (Acidifying agents: dilute hydrochloric acid; sodium bicarbonate, aluminium hydroxide gel, aluminium phosphate: Saline cathartics: sodium potassium tartarate and magnesium sulphate).	1 Credits 15 Marks
VI	An outline methods of preparation, uses, sources of impurities, tests of purity and identification and special tests, if any, of the following classes of inorganic pharmaceuticals included in IP 96, gases and vapours-inhalants (oxygen), anaesthetics (nitrous oxide), topical agents-protective (calamine, titanium dioxide, talc, kaolin), astringent (zinc oxide, zinc sulphate) and anti- infective (boric acid, H_2O_2, iodine, povidone iodine, potassium permanganate, silver nitrate.).	

VII	A. Acids and bases-acid base theory, specification of acidity and basicity, official inorganic acid (boric acid HCL, HNO_3, H_3PO_4), nonofficial inorganic acids (H_2SO_4), official inorganic bases (strong ammonia solution, calcium hydroxide, KOH, Na_2CO_3, NaOH, soda lime). B. Buffers- theory and mechanism, pharmaceutical buffer selection, pharmaceutical buffer system, preparation of pharmaceutical buffer.	1 Credits 15 Marks
VIII	A. Antioxidant- theory, the selection of antioxidants, official antioxidants (hypophosphorous acid, sodium bisulphite, sodium thiosulphate, sodium nitrite, nitrogen). B. Pharmaceutical accepted glass-chemistry of glass, types of test employed forglass. C. Water: official water (water, purified water, water of injection, bacteriostatic water for injection, sterile water for injection).	

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	Preparation of Boric acid or calcium Lactate.
2	Qualitative analysis of given inorganic mixtures (cation + Anions) (at least 5 mixtures).
3	To perform the limit test for chloride and sulphate.
4	To perform the limit test for iron and lead.
5	To perform the assay of hydrogen peroxide.
6	To perform the assay of zinc oxide.
7	To perform the assay of calcium gluconate.

Internal Assessment Total mark: 20/1 credit

Submission of assignments, midterm examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry

Semester I

PHC-VC-1026: Fundamentals of Organic Chemistry

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIIT	UNIT TITLE	CREDITS & MARKS
I	Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces. Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces, Acids and bases, general nomenclature.	**1 Credits 15 Marks**
II	**Stereochemistry:** Isomerism and nomenclature and associated physiochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations, stereochemistry of specific reactions and intermediates, Stereoselective and stereospecific reactions.	**1 Credits 15 Marks**
III	**Structure, Nomenclature, Preparation and Reactions** Structure, Nomenclature, Preparations and Reactions of: Alkanes, Alkenes, Alkynes; Cycloalkanes, Dienses, Benzene, Polynuclear aromatic compounds, Arenes.	**1 Credits 15 Marks**
IV	Alkyl halides, Alcohol, Ethers, Epoxides, Amines, Phenols, Aldehydes and Ketones, Carboxylic acids, Functional derivatives of carboxylic acids, Reactive intermediates-carbocations, cabanions, carbenes, nitrene and nitrenium ions.	**1 Credits 15 Marks**

Recommended Books for the syllabi are:

1. Morrison & Boyd, Organic Chemistry , Prentice-Hall, 6th Ed. 2001.
2. March J. Advanced Organic Chemistry, MacGraw-Hill, 3rd Ed., 1985.

Reference Books:

1. Solomon & Fryhle, Organic Chemistry, Wily, 8th 2004.
2. Shriner & Morill, The systemic Identification of Organic Compounds, Wily, 8th 2004.
3. Furniss, Vogel's Textbook of Practical Organic Chemistry, Pearson education, 5th 2004.
4. Eliel E, Stereochemistry of Carbon Compounds, McGraw-Hill, 7th 1962
5. Eliel E, Elements of Stereochemistry, Wily, 3rd, 1969.
6. Cahn & Dermer, Introduction to Chemical Nomenclature, Butterworths, 3rd, 1979.
7. Warren S, Organic Synthesis-The disconnection approach, Wily, 4th, 1982
8. Wheland G Advanced Organic Chemistry, Wily, 3rd, 1960
9. Kagan H. Organic Stereochemistry, Wily, 4th, 1965

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	Introduction to laboratory and safetyhazards
2	Introduction to organic compound identification test
3	Introduction to reagent test
4	Introduction to functional group (I) to (V) and to identifies the given unknown (4-9)
5	Preparation of standard solutions
6	Introduction to laboratory glasswares ad analytical balance
7	Preparation and standardization of sodium hydroxide.
8	Preparation and standardization of Hydrochloric acid.
9	To determine Normality, Morality, %w/v and gm/liter of anysolution
10	Standardization of analytical weights and calibration of volumetric apparatus.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, midterm examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester I

PHC-VC-1036: Human Anatomy and Physiology

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	a. Introduction & Scope of Human Anatomy & Physiology Scope of anatomy and physiology and terminology used in these subjects. Sense Organs: Basic anatomy and physiology of the eye (vision), ear (hearing), taste buds, nose (smell) and skin (superficial receptors). b. Elementary tissues of the human body c. Elementary tissues of the human body: Epithelial, connective muscular and nervous tissues, their sub-type and characteristics. Structural & functional organization of cell, its components and functions: Body fluids & its composition, transport mechanisms across the cell membrane, Cell cycle.	**1 Credits** **15 Marks**
II	**a) Support & Movement** Osseous system: structure, composition and functions of skeleton, classification of joints, types of movements at joints, Disorders of joints. Skeletal muscles: Their gross anatomy, physiology of muscle contraction, physiological properties **b) Nervous system** Central Nervous System: Functions of different parts of brain and spinal cord, Neurohumoral transmission in the Central Nervous System, reflex action, electroencephalogram, cranial nerves and their functions. Autonomic Nervous System: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S	**1 Credits** **15 Marks**
III	**Maintenance of Human body – I** **Haemopoietic system**: Composition and function of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets	**1 Credits**

	and coagulation. **Lymph and Lymphatic system**: Composition, formation and circulation of lymph, disorders of lymphand lymphatic system. Basic physiology and functions of spleen. Cardiovascular system: Basic outline of cardiovascular disorders like hypertension, hypo tension, arteriosclerosis angina, myocardial infarction, congestive heart failure and cardiac arrhythmia. **Respiratory system**: Anatomy of respiratory organs, functions of respiration, mechanism and regulation of respiration, respiratory volumes and capacity.	**15 Marks**
IV	Maintenance of Human body-II **Digestive system:** Gross anatomy of the gastrointestinal tract functions of its different-parts Including those of liver, pancreas and gall bladder. Various gastro-intestinal secretions and their role in the absorption and digestion of food, disorders of digestive system. **Urinary system**: Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance. Diseases of the urinary system. **Reproductive system**: Male and Female reproductive system and their hormones. Physiology of menstruation, coitus and fertilization.	**1 Credits** **15 Marks**

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	Introduction to microscope
2	To study the various tissue permanent slide (part I)
3	To study the various tissue permanent slide (part II)
4	Introduction to haemoglobinometer and haemocytometer

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester I

ENG-AEC-1014:English & Communication Skill

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**English grammar** – Parts of speech, articles, preposition, tenses, active and passive speech, direct and indirect speech	**1 Credits** **15 Marks**
II	a. **Presentation techniques** – Tips, Dos and don'ts of presentation, notice and placard presentations. b. **Etiquettes and grooming** Group discussion and extempore communication. Interviews – Tips and model interviews (video shooting and display)	**1 Credits** **15 Marks**
III	**Written skills:** proposal, writing formats, report writing business letters, applications, covering letters, curriculum vitae designing, summary writing.	**1 Credits** **15 Marks**
IV	**Listening-Phonetics and pronunciations** (with the help of phonetics dictionary and with tapes from language laboratory).	**1 Credits** **15 Marks**

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester II

PHC-VC-2016: Pharmaceutics (Basic Principles)

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	Introduction to Different dosage forms, Routes of administration and their comparisons, Environment control in Pharmaceutical industry and its importance, Importance of air, water, Humidity, Temperature in drug manufacturing giving some examples.	**1 Credits 15 Marks**
II	**Introduction to various process in Pharmaceutical manufacturing Units** Principles of heat transfer: Modes of Heat transfer-Conduction, Convection, Radiation, Induction, Sources of heat – Steam and Electricity. Factors affecting: Rate of evaporation, Differentiations between Evaporation, Distillation, Rectification, Precipitation, Crystallization. Brief introduction: Solvent distillation and its application. Different types of heat reactions-Heats of relations and formations, Heat of melting, vaporization and sublimation, Differential and integral heat of hydration and salvation. **Introduction to dispensed products** Classification of dispensed products: Brief description and applications of each product. Difference between extemporaneous preparations and Non extemporaneous preparations. Classification as per physical state – Solids, Liquids, Semisolids, Inhalations. Classification as per route of administration, Classification as Sterile and non-sterile preparations, Classification as Galenicals and non-galenicals. Packaging of dispensed products: Containers and closures, Labeling of dispensed products.	**1 Credits 15 Marks**
II	**States of matter** Different states of matter-solid, liquid, Gas, Crystalline and Amorphous, Hygroscopic-Efflorescent- Deliquescent, Modified states of matter-Glassy state, Class transition temperature, Liquid Crystals, Liquid- solid compact, Solid dispersions. Two component system containing solid-solid liquid phases, Eutectic mixtures **Polymorphism** What is Polymorphism, Pseudo polymorphism, Solvates and	**1 Credits 15 Marks**

	Hydrates, Meta-stable forms? Examples of polymorphic drugs and effect on physicochemical properties **Principles of fluid flow** Reynold's no., and its importance. Types of flow- Laminar flow, Intermediate flow, Turbulent flow. Importance of types of flow in Pharmaceutical processing.	
IV	Solubility and solubilization: Definitions and expressions, Physical properties of different solvents and solutes and their effects on solubility, Major pharmaceutical solvents – brief discussions. Liquid-liquid systems-solubility and Miscibility, Partitioning between immiscible solvents and partition co-efficient, Effect of pH on solubility – Dissociation constant, Solubilization techniques-Brief discussion. Complexation: Classification of complexes and its applications. Concept of Filtration of filtration techniques.	**1 Credits** **15 Marks**

Reference books:

1. C.V.S, S. Pharmaceutical engineering, Principles and Practice, Vallabh Prakashan.
2. K.S. Pharmaceutical Engineering New age International publisher.
3. P., M. Elementary Chemical engineering, Tata MacGrawHill.
4. Physical Pharmacy By Alfred Martin
5. Physical pharmaceutics, E. Shotton, Indian edition, oxford press.
6. Physicochemical principles of pharmacy, 5th edition, Alexander T. Florence and David Attwood., Pharmaceutical press.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	To prepare the list of market products as per physical form
2	To prepare the list of market products as per route of administration
3	To studytwo component system-Preparation of eutectic mixture (2)
4	To study the solubility relationship of 3-component system containing benzene, water and acetic acid
5	To study the mutual solubility of given liquids (phenol, water) and find out upper consolute temperature.
6	To determine Reynold's no. in given system
7	To prepare different pharmaceutical buffers.
8	To study the effect of pH on solubility of given drugs.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester II

PHC-VC-2026: Advanced Pharmaceutical Chemistry

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Gaseous and Solid State Chemistry** Behaviour of Gases: Kinetic theory of gases, deviation from behaviours and explanation. Solid State: Crystalline structures, lattices, physical properties, Bragg's law, Miller indices Adsorption: Freundlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.	**1 Credits** **15 Marks**
II	**The Liquid State** The Liquid State: Physical properties (surface tension, perachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents). Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory.	
III	First, second and third laws, Zeroth law, absolute temperature scale, thermo, chemical equations, phase euquilibria and phase rule.	
IV	**Chemical Kinetics** **Chemical Kinetics**: Zero, first and second order reactions, complex reactions, theories of reaction Kinetics, characteristics of homogeneous and heterogeneous catalysts, acid base and enzyme catalysis. **Photochemistry** Consequences of light absorption, Jablenski diagram, Lambert-Beer Law, Quantum efficiency.	**1 Credits** **15 Marks**
V	**Errors and statistics** Types of error, Precision and accuracy, Mean and Standard deviation, Confidence interval, of results and means of two samples, Paired T-test, Q-test, Correlation and linear regression, comparison of more than two means, Significant figures, Rules for retaining significant digits.	**1 Credits** **15 Marks**

VI	Basis of sampling, sampling procedure and selection of sample, factors affecting sampling: sampling and physical state, crushing, grinding and hazards in sampling.	
VII	**Introduction to titrimetric analysis** Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.	
VIII	**Errors and Statistical Data Treatment of Analytical Results** Introduction to Analytical Chemistry, Classification of Classical and Electro-analytical Techniques, Literature of Analytical Chemistry (Names of Author and Publishers for any Ten Books, Journals and Reviews), Criterion for selection of analytical Techniques, Analytical Data Treatment, Error, Types of errors, Accuracy and Precision, Statistical Terms: Mode, Average, Median, Deviation, Average Deviation, Relative Average Deviation, Standard Deviation & Coefficient of variance, Q-test for the rejection of result and related numerical.	**1 Credits** **15 Marks**

Recommended Books for the syllabi:

1. G. Raj, Advance Physical Chemistry, 20th Edition, Goel Publishing House, Merrut, 1996-97
2. Dr. J.N. Gurtu, Dr. Hemant Snehi, Advance Physical Chemistry, 7th Revised and Enlarged Edition, Pragati Prakashan, Merrut, 2000.
3. P.L. Soni. O.P Dharmartha, U.N. Dash, Textbook of Physical Chemistry, 22nd Edition, Sultan Chand and Sons, New Delhi, 2001.

Reference Books:

1. B.S. Bahl G.D. Tuli, Arun Bahl, Essentials of Physical Chemistry, Reprinted 24th Edition, S. Chand and Company Ltd. New Delhi, 2004.
2. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8th Edition, Oxford University Press, Bombay, 1994.
3. S. Glasstone, Textbook of Physical Chemistry, 2nd Edition, Rajiv Beri for Macmillan India Limited, New Delhi, 1995.
4. J.B. Yadav, Advanced Practical Physical Chemistry, 15th Edition, Goel Publishing House, Meerut, 1997.
5. W.J. Moore, Physical Chemistry, 5th Edition, Orient Longman Pvt. Ltd., New Delhi, 2004.
6. I. Das, A Sharma, N.R. Agrawal, An Introduction to Physical Chemistry, Revised 2nd Edition, New Age International Publishers, New Delhi, 2005.
7. B. Viswanathan, P.S. Raghwan, Practical Physical Chemistry, 1st Edition, Viva Books Pvt. Ltd., 2005.
8. D.P. Shoemaker, C.W. Garland, J.W. Nibler, Experiments in Physical Chemistry, 5th Edition Mcgraw Hill International Edition, New York, 1989.
9. S. Glasstone, D.Levis, Elements of Physical Chemistry, 2nd Edition, Macmillan and Company Limited, 1970.
10. R.M. Verma. A Textbook of Physical Chemistry, Volume – I & II, 1st Edition, CBS Publishers and Distributors, Delhi, 1992.
11. P.W. Atkins, Physical Chemistry, 5th Edition, Oxford University Press, UK, 1994.
12. P.S. Rachavan, M.S. Shethi, Concepts and Problems in Physical Chemistry, 1st Edition, Discovery Publishing House, New Delhi, 1997.
13. A.W, Adamson, Physical Chemistry of Surfaces, 5th Edition, A Wiley Interscience Publication, New

York, 1990.
14. C.K. Vemulapathi, Physical Chemistry, 1st Edition, Prentice-Hall of India Pvt. Ltd. New Delhi, 1997
15. C.R. Metz, Schaum's Solved Problems Series, 2000 solved problems in Physical Chemistry, 2nd Edition, Mcgraw Hill Publishing Company, USA, 1989
16. R. Chang, Physical Chemistry with Applications to Biological Systems, 2nd Edition, Macmillan Publishing Co., New York, 1981.
17. Prof. S.K. Dutta, Principles of Physical Chemistry and Biophysical Chemistry, 1st Edition, Books and Allied (P) Ltd. Kolkata, 2007.

Recommended Books for the syllabi are:

1. Vogel's Text book of Quantitative Chemical Analysis. J. Mandham, R.C. Denney, J.D. Bernes, M.J.K. Thomas, 5th Edition, ELBS, UK, 1996.
2. G.D. Christian, analytical Chemistry, 5th Edition, John Wiley & Sons, New York, 1994.
3. D.A. Skoog, D.M. West. F.J. Holler, Analytical Chemistry: An Introduction. 6th Edition, Saunders, College Publishing, New York, 1994.
4. J.A. Dean, Analytical Chemistry Handbook, 1st Edition, McGraw Hill Inc., New York, 1995.

Reference Books:

1. Dr. A.V. Kasture, Dr. K.R. Mahadik, Dr. S.G. Wadodkar, Dr. H.N. More, A Textbook of Pharmaceutical Analysis, Volume – 1, 8th Edition, Nirali Prakashan, Pune, 2002.
2. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th Edition, Prentice-Hall of India Pvt. Ltd. New Delhi, 1993.
3. K.A., Connors, A Textbook of Pharmaceutical Analysis, 3rd Edition. John Wiley & Sons. New York 1982.
4. J.H. Kennedy, Analytical Chemsitry [principles, 2nd Edition, Saunders College Publishing, New York 1990.
5. D.A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry, 7th Edition Saunders College Publishing, New York1996.
6. The India Pharmacopoeia 2007, Volume – I, II & III, Conteoller of Publication, 2007.
7. R.M. Verma, Analytical Chemistry, 2nd Edition, CBS Publishers, New Delhi, 1991.
8. S.M. Khopkar, Basic Concepts of Analytical Chemistry, 2nd Edition, New Age International Publishers, New Delhi, 1998.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	To check the validation of Freundlich and Langmuir adsorption isotherm using charcoal and acetic acid.
2	Preparation and standardization of sodium hydroxide.
3	Preparation and standardization of hydrochloride acid.
4	To determine Normality, Molarity, %w/v, and gm/litre of any solution.
5	Standardization of analytical weights and calibration of volumetric apparatus.
6	Non-aqueous titrations: preparation and standardization of perchloric acid and

Internal Assessment Total mark: 20/1 credit

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester II

PHC-VC-2036: Fundamentals of Biochemistry

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Biological macromolecules: carbohydrates** Introduction to carbohydrates, Nomenclature, definition and classification of carbohydrates. Monosaccharides, classification, structural aspect and biological significance. Disaccharides, Oligosaccharides, Polysaccharides.	**1 Credits 15 Marks**
II	**Introduction to lipids** Structure and function diversity of lipids, Definition and classification, Fatty acids, Triacyl glycerols, glycerophospholipids, Sphingolipids, steroids and other biologically important lipids (Terpenes, Steroids, cholesterol etc.)	**1 Credits 15 Marks**
II	**Proteins and Nucleic acids** Proteins, structure and function, General structure of Amino Acids, Classification of Amino acids, Peptide bond link amino acids in proteins, Composition of amino acid in protein and determining sequence of amino acid residue. Structure of protein, Types of protein structure, Primary structure, Secondary structure, Tertiary structure. Quaternary structure, Various other biologically important protein. Basic studies of nucleic acids.	**1 Credits 15 Marks**
IV	**Enzymes and co-enzymes** Structure and function of enzyme, Classification of enzyme, Enzyme kinetics and its mechanism of action Enzyme inhibition. Types of enzyme inhibition, Reversible enzyme inhibition, Irreversible enzyme inhibition, Regulation of enzyme activity, Enzymes and iso enzymes in clinical diagnosis. Coenzyme classification, Role of vitamin as	**1 Credits 15 Marks**

	coenzyme, Biological significance, Metal as coenzyme and its biological significance.	

Recommended books for the syllabi:

1. Dr. U Satyanarayana, Biochemistry, 2nd edition, Books and allied (P)., 2004.
2. A. White Philip Handler, E.L. Smith, R.L. Hill Lehman, Principles of Biochemistry, 6th Edition, Tata McGraw Hill Publishing Company Ltd., 2004.
3. D.L. Nelson, M.M. Cox, Lehninger Principles of Biochemistry, 4th edition, W.H, Freeman & Company, 2005.

Reference Books:

1. P.C. Champe, R.A. Harvey, Biochemistry, 2nd edition, Lippincott-Raven Publishers, 1994
2. R.K. Murray, D.K. Granner, P.A. Mayes. V.W. Rodwell, Harper's Illustrated Biochemistry, 26th edition, McGraw Hill Publhisher, 2003.
3. W.H. Elliott, C.C. Elliott, Biochemistry & Molecular Biology, 1st edition, Oxford University Press, 1997.
4. G.L. Zubay, W.W. Parson, D.E Vance, Principles of Biochemisty, 1st edition, WCB publishers, 1995.
5. E.E. Conn and P.K. Stumpf, G. Vruening. R.H. Doi, outlines of Biochemistry, 5th edition, John Wiley& Sons, New York 1999.
6. D.B. Marks, Board Reviw series, Biochemistry, 2nd edition, Harwal Publishing, 1994.

PRACTICALS: 40 Marks (2 Credits)

SL. NO	TOPIC
1	To determine the viscosity and specific gravity of the given liquids.
2	To determine the surface tension of the given liquids.
3	To study the effect of temperature on viscosity and surface tension of the given liquids.
4	Qualitative and quantitative tests of carbohydrates.
5	Qualitative and quantitative tests of proteins.
6	Qualitative and quantitative tests of fats
7	Blood sugar tests

Internal Assessment Total mark: 20/1 credit

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester II

ENV-AEC-2014 : Environmental Studies

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

Unit – 1:

The multidisciplinary nature of environmental studies

Definition, scope and importance. Need for Public awareness**.**

Unit – 2

Natural Resources:

Renewable and non renewable resources. Natural resources and associated problems Forest Resources : use and over- exploitation , deforestation, case studies. Timber extraction ,mining, dams and their effects on forest and tribal people.

Water Resources : use and over- exploitation of surface and ground water, floods, droughts, dams - benefits and problems.

Mineral Resources: use and exploitation, environmental effects of extracting and using mineral resources, case studies- with reference to Karnataka

Food Resources: World food problems, changes caused by agricultural and overgrazing. Effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.

Energy Resources: growing energy needs, Renewable and non renewable energy resources, use of alternate energy sources, case studies.

Land Resources: Land as a resource, land degradation, (man induced landslides), soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit - 3

Ecosystem: Concept of an ecosystem. Structure and function of an ecosystem, Producers , consumers and decomposers. Energy flow in an ecosystem. Food chains, food web and ecological pyramids. Introduction , types , characteristic feature, structure and function of the following ecosystem

Forest ecosystem

Grassland ecosystem

Desert ecosystem

Aquatic ecosystem (ponds)

Unit – 4

Biodiversity and its Conservation:

Introduction - Definition, genetic, species, ecosystem diversity. Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option value. India as a mega - diversity nation.

Hot - spots of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In - situ and Ex - situ conservation

Important National Parks of India

1. Nagarahole National Park 2. Bandipur National Park
3. Gir National Park 4. Kaziranga National Park

Unit – 5

Environmental Pollution:

Definition-causes, effects and control measures of :

a. Air Pollution b. Water Pollution
c. Soil Pollution d. Marine Pollution
e. Noise Pollution f. Thermal Pollution
g. Nuclear hazards

Solid Waste management : causes , effects and control measures of urban and industrial wastes
Role of an individual in prevention of pollution

Pollution case studies with respect to India. Examples

Bhopal Gas Tragedy
Photochemical smog of Mumbai
River Ganga pollution

Disaster Management : floods , earthquakes, cyclones and landslides
Disaster Management information systems and efforts of Indian government to tackle the problem

Unit – 6 :

Social issues and the Environment:

From unsustainable to sustainable development. Urban problems related to energy Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people, its problems and concerns, case studies. Environmental ethics: issues and possible solutions
Climate changes: global warming. acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation. Consumerism and waste products Environmental Protection Act. Air (Prevention and Control of Pollution) Act
Water (Prevention and Control of Pollution) Act. Wildlife Protection Act
Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit – 7

Human Population and the Environment:

Population growth, variation among nations. Population explosion, Family welfare Programme. Environment and human health, Human Rights, Value Education.HIV/AIDS
Women and child welfare. Role of information technology in environment and human health
Case studies

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester III

PHC-VC-3016: Advanced Organic Chemistry

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

1.

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Structure of molecule:** Atomic orbital, Hybridization, Sigma and pi bonds, Intermolecular forces and related properties, conjugation, Bond length and bond energies, polarity of Bonds and molecules.	**1 Credits 15 Marks**
II	**Electro availability effects** Inductive effects, Resonance effects, hyper conjugation, steric effects, application of these factors on the strength of acids and bases bond length, tautomerism.	**1 Credits 15 Marks**
III	Conservation of orbital symmetry and rules, electrocyclic, cycloaddition and sigmatropic reaction; neighbouring group effect, transition metal complexes as catalyst for organic reactions.	**1 Credits 15 Marks**
IV	**a. Nucleophilic and electrophilic aromatic reactions** Relation between Kinetics and mechanism of SN_1 and SN_2 reactions, stereochemical implications Factors affecting nucleophilic substitution reactions:- a. Effects of solvent. b. Effect of structure. c. Effect of nucleophile. d. Effect of leaving group. e. Application of these in preparation and reactions of alkyl halides, alcohols f. Nucleophilic substitutions at aryl carbon atom. **b. Elimination reactions** a. Elimination reaction & factors effecting it b. E_1, E_2 and E_1 (cb) mechanism. c. Orientation in E_1 and E_2 (Saytzaff and Hoffmann elimination).	**1 Credits 15 Marks**

Reference Books:

1. Miller J, Aromatic nucleophilic Substitution, Elsevier, 7th ,1968.
2. Furniss, Vogel's textbook of practical Organic chemistry, Pearson education, 5th, 2004
3. Norman R, Principals of Organic synthesis, Wily, 4th, 1981.
4. Sykes P,A guide to mechanism in organic Chemistry, longman, 3rd, 1981.

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	To perform the assay of aspirin.
2	To demonstrate Karl Fischer apparatus.
3	To find out the concentration of give acid solution bypotentiometer.
4	To determine the content of sulfamethizole (from table) by potentiometer.
5	To find out the concentration of given acid solution by pHmeter.
6	To determine the dissociation constant of given acetic acid solution pH metry.
7	To find out the concentration of given acid solution byusing conductometer.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester III

PHC-VC-3026: Advanced Analytical Chemistry-I

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Extraction techniques** Simple extraction, multiple extractions, separation of drugs in multicomponent system. Effect of pH on extractability of drugs, continuous extractions.	**1 Credits** **15 Marks**
II	Classification, theories, retention mechanism, separation efficiency, methodology and pharmacopoeial applications of column, paper and thin layer chromatography	**1 Credits** **15 Marks**
III	**Electroanalytical methods: Basics of electro analytical methods.** **A. Potentiometric and pH metric methods** Standard reduction potentials, various electrodes and cell potential, applications of potentiometry and pH metry. **B. Conductometry:** Conductance, factors affecting conductance, kohlrausch law, conductivity cells, application.	**1 Credits** **15 Marks**
IV	**Miscellaneous Methods:** Kjehldahl's method, Karl Fischer Titration.	**1 Credits** **15 Marks**

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	To determine the dissociation constant of given acetic acid solution pH metry.
2	To find out the concentration of given acid solution byusing conductometer.
3	Introduction and detailed demonstration to various synthetic techniques and apparatus used in that technique.
4	Heating and cooling methods, distillation, reaction work-up, filtration, extraction, purification, identification.
5	Introduction to the use of stereo models.
6	Introduction to instrumental technique (3-4).

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester III

PHC-VC-3036: **Phytochemistry**

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	Study of drugs containing resins combinations: Introduction, classification, general properties, chemical tests of resins. Pharmacognostic Studies of the following resin containing drugs: Colophony, Podophyllum, Jalap, Cannabis, Capsicus, myrrh, Asafoetida, balsam of Tolu, balsam of Peru, Benzoin, turmeric and Ginger.	**1 Credits 15 Marks**
II	Study of tannins and tannin containing drugs: Introduction, classification, general properties, chemical tests. Drugs: Black catechu, pale catechu and Myrobalans.	**1 Credits 15 Marks**
III	Study of Volatile oil containing drugs: Introduction, classification, general properties, chemical tests and general methods of obtaining volatile oils from plants. Pharmacognostic studies of the following drugs, containing volatile oils: Mentha, coriander, carway, dill, fennel, cinnamon, lemon peel, lemon grass, clove, nutmeg, eucalyptus, chenopodium, cardamom, valerian, sandalwood.	**1 Credits 15 Marks**
IV	Basic idea of extraction, isolation and separation of active constituents from medicinal plants and Phytochemical Screning: Basic principle of extraction. The factors which may affect the extraction process. Different type of extracts and their preparations. The comparative studies of different methods employed for extraction of phytoconstituents. Phyto chemical screening of alkaloids, saponins,cardenolides, bufadienolides, flavonoids, tannins, anthraquinones, cyanogenetic glycosides and amino acids in different extracts.	**1 Credits 15 Marks**

Reference Books:

1. Pharmacognosy and phytochemistry, part I and II, Vinod D. Rangari, Carrier Publications, 1 st edition, Reprint, 2007.
2. Pharmacognosy V.E. Tylar, L.R. Brady, J.E. Habbers, Lea and Febgir Philadelphia, 8th edition, 1981.
3. Cultivation and utilization of Aromatic Plants,handa S.S and Kaul ,M.K, regional Research Laboratory, Jammu, 1st edition,1997.
4. Mukherji P.K, Quality control of Herbal Drugs, Busines Horizon Pharma, Publishers,1st edition,2002.
5. Herbal drug technology,S.S. Agrawal and M.Paridhavi, Universities Press, 1st edition,2007.
6. Essentials of Pharmacognosy, S.H Ansari, Birla Publications Pvt. Ltd, 1st edition,2005-2006.
7. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G.Chauhan and Pillai APG, volume I, left drugs, 2005, Gujarat Ayurved University, Jamnagar.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	To study and demonstration of paper chromatography.
2	To study and demonstration of TLC.
3	To perform the paper chromatography of given sample.
4	To study and demonstration of TLC.
5	To perform the paper chromatography of given sample.
6	To perform the TLC of given sample.
7	To estimate nitrogen content by kjeldahl's method.

Internal Assessment Total mark: 20/1 credit

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester III

XXX-SE-3XX4 Indian Drug Regulatory Guidelines

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	Good laboratory Practice, Standard operating procedure, Standard Testing procedure, Certificate of Analysis, Method of Analysis, good receipt note.	**1 Credits** **15 Marks**
II	**Approval of new drugs** Investigational New Drugs (IND) submission, format & content of IND, content of investigator Brochure, general consideration of new drug Approval (NDA), specific requirements, content & format of NDA, manufacturing control requirement of NDA.	**1 Credits** **15 Marks**
III	GMP, ISO 9000, TQM, ICH	**1 Credits** **15 Marks**
IV	Occupational Health and Hazards, Safety at workplace, Accident prevention techniques, Safety Management system, list of hazardous chemicals and handling of toxic and hazardous chemicals, acids, ether & etc.	**1 Credits** **15 Marks**

Reference Books:

1. J.A Dean, analytical chemistry handbook, McGrew hill Inc., 1st Ed,. 1995.
2. Ethical Guidelines for Biomedical research on human subjects 2000. Indian Council of Medical Research, New Delhi.
3. Goodman & Gilman: JG Hardman, LE Limbard, 10th Edn. McGraw Hill Publications, 2001.
4. Central Drugs Standard Control Organization. Good Clinical Practices- Guidelines for Clinical Trials on pharmaceutical Products in India. New Delhi: Ministry of Health; 2001.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester IV

PHC-VC-4016: Microbiology

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	Scope of microbiology, type of microorganism, classification of microbes, Actinomycetes, bacteria, rickettsiae, spirochetes and viruses. Identification of microbes: stain and types of staining techniques, electron microscopy, nutrition, cultivation, isolation and identification of bacteria, actinomycetes, fungi, viruses.	**1 Credits** **15 Marks**
II	**Control of microbes by physical and chemical methods:** A. Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants, antiseptics and their evaluation. B. Sterilization: different methods, validation of sterilization methods and equipments, sterility testing of pharmaceutical products. C. Clean area classification. Validation of aseptic room	**1 Credits** **15 Marks**
III	Preservative efficacy, Microbial assay of antibiotics and vitamin B12	**1 Credits** **15 Marks**
IV	Immunology and immunological preparations: principles, antigens and haptens, immune system, cellular and humoral immunity, immunological tolerance, antigen- antibody reactions and their applications, Hypersenstivity, active and passive immunization products, their preparation, standardization and storage.	**1 Credits** **15 Marks**

Reference Books:

1. Remington's Pharmaceutical sciences" Gennaro A.R ed.. 18th Ed, Mack Publishing Co, Easton, pa, USA,1990.
2. L.M. Prescott, G.P. Jarly, D.A Klein," Microbiology" 2nd, Ed Wm. C. Brown publishers, Oxford, 1993.
3. S.P Vyas, V.K.dixit," pharmaceutical Biotechnology"1st ed. CBS Publishers & distributors, New Delhi,1998.
4. N.K Jain" Pharmaceutical Microbiology" Vallabh prakashan, Delhi.
5. K. Kieslich.ed 'Biotechnology" vol. Via, Verlag Chamie, Switzerland, 1984.

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
I	Date collection: Ideal slides of micro organisms (bacteria, virus, spirochaets, Ricketssia, Fungi ect.).
II	Preparation of various growth media.
III	Identification of microbes by staining techniques.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester IV

PHC-VC-4026:Advanced Analytical Chemistry-II

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

1.

UNIT	UNIT TITLE	CREDITS & MARKS
I	High Performance Liquid chromatography (HPLC): introduction, theory- migration equation, theoretical plate, columns and stationary phases, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, classification and principle of HPLC, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, Instrumentation (including significance of guard column), scope and applications.	**1 Credits 15 Marks**
II	Introduction, HPTLC, Quantitation-scraping and elution, visual comparison, area management, desitometry and thermal method, applications and recent advancement.	**1 Credits 15 Marks**
III	Introduction, principles of Gas- Chromatography, instrumentation, columns and stationary phases, qualitative and quantitative applications in pharmaceuticals	**1 Credits 15 Marks**
IV	**Analytical method development & Validation protocol preparation** Method Optimization, Accuracy, precision, linearity, specificity, system suitability, robustness.	**1 Credits 15 Marks**

Reference books:

1. Instrumental Methods of Analysis, Willard Merritt, Dean and Settle, CBS publishers and Distributers, Delhi.
2. Introduction to high Performance liquid chromatography, RJ Hamilton, Chapman hall, London
3. Instrumental Methods of Chemical analysis, BK Sharma, Goel publication House. Meerut, 2nd edition-2001 India.
4. Instrumental Methods of chemical Analysis,3rd Ed, GW Ewing, McGrew Hill book Co, NY-1969.
5. Introduction of Instrumental Analysis, Robert Braun, McGrew Hill; New York.

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
I	To demonstrate GC as analytical tool.
II	To demonstrate HPLC as analytical tool.
III	To demonstrate HPTLC as analytical technique.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester IV

PHC-VC-4036: Medicinal Chemistry-I

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Steroids:** Introduction, Nomenclature, Stereochemistry, simple reactions of cholesterol, classification of sterols, sex hormones, cardiac glycosides. Bile acids, sapogenins.	**1 Credits** **15 Marks**
II	Chemical naming, structure activity relationship, physicochemical and steric, aspects, mode of action and use of..... a. **General anaesthetic agents:** Introduction, medicinal aspects of anaesthetics, mode of action, gases and volatile liquid anaesthetics, intravenous anaesthetics of fixed anaesthetics, toxicity of general anaesthetics (divinely ether, ethyi chloride, cyclopropane, thiopentone sodium, ketamine. b. **Local anaesthetic agents:** introduction, SAR, benzoic acid derivatives, aminobenzoic acid derivatives. Lidocaine derivatives, miscellaneous, toxicity, mode of action (benzocaine, procaine hydrochloride, mepivacaine, lidocaine, cinchocaine hydrochloride). c. **Sedatives hypnotics:** introduction, classification, SAR, barbiturates, amides and imides,alcohols and their carbamate derivatives, aldehydes and their derivatives, mode of action, pharmacologitone sodium, thiopentone sodium) non barbiturates (official drugs), d. **Anticonvulsants:** Introduction , classification of epilepsy, SAR, barbiturates (official drugs) hydantoins, oxazolidinediones, succinamides, miscellaneous dregs, phenytoin siodium, troxidne.	**1 Credits** **15 Marks**
III	Chemical naming, structure activity relationship, physicochemical and steric aspects, mode of action and uses of..... **a. CNS stimulants:** CNS stimulants of natural origin, synthetic CNS stimulants (nikethamide, methylxanthines and modified methylxanthines (theophylline) **b. Psychopharmacological agents:** antipsychotics, phenothiazines (chlorpromazine, trifluperazine, butyrophenones, miscellaneous), antidepressants-TCA (amitriptyline), MAO inhibitors, atypical antideresants, antianxiety drugs-meprobamate and	**1 Credits** **15 Marks**

	related drugs, benzodianepines (diazepam) **c. Hallucinogens:** hallucinogenic agents related to indoles, phenethylamines, cannabinoids. **d. Diuretics:** Carbonic anhydrase inhibitors (acetazolamide and dichlorphenamide), Thiazides and related drugs (bendrofluazide), High ceiling diuretics, aldosterone antagonists, other potassium sparing diuretics, osmotic diuretics.	
IV	**CVS agents:** introduction, cardiac glycosides, SAR, mechanism of action , toxic effects, antihypertensive agents-introduction, etiology, ganglion blocking agents, antiadrenergic agents, drugs acting directly on smooth muscles, drugs acting in CNS (propranolol) antianginals and vasodilators- introduction, mechanism of smooth muscle vasodilatation, esters of nitrous and nitric acid, side effects (nitroglycetine), antiarryhthmic and antifibrillytic drugs classification of antiarrhythmic drugs, mechanism of action, side effects antilipemic drugs, promethazine).	**1 Credits** **15 Marks**

Reference Books:

1. Strategies for Organic drugs Synthesis & design by Daniel Lednicer, Joha wiley & sons., USA
2. Organic Chemistry by L. Finar, vol. I & II, ELBS Longman, London.
3. Kar, A medicinal chemistry, New Age international Publication, New Delhi, 2007.
4. Ladu, B.N.,Mandel H.G & E.L Way, Fundamentals of drug metabolism & disposition, William & Wilkins Co. Baltimore.
5. Taylor, J.B and Triggle,D.J comprehensive Medicinal Chemistry II, vol. 1-8, Quantitative Drug design, Elsevier Ltd. 2007.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
I	To synthesize sulphanilamide from acetanilide. (step-I).
II	To synthesize phthalimide from phthalic anhydride.
III	To synhesize anthranilic acid from phthalimide.
IV	To synthesize N-phenyi anthranilic acid from o-chlorobenzoic acid.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester IV

XXX-SE-4XX4: Pharmaceutical Unit Operation

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	TITLE	CREDITS & MARKS
I	**Size Reduction:** Objectives, theory of size reduction, energy requirement in size reduction, factors influencing size reduction, limit of size reduction, wet and dry milling, application. • Selection of size reduction equipment. • Study of various mills including ball mill, hammer mill, fluid energy mill, colloid mill, cutter mill. • Introduction to methods of generating nanoparticles.	**1 Credits** **15 Marks**
II	**Size Separation:** • Principles of size separation, screens- types, Pharmacopoeial standards, screening methods. • Screening equipments including shaking and vibrating screens, gyratory screens, sedimentation tank, elutriation and cyclone type separators. • Application of size separation in pharmacy.	**1 Credits** **15 Marks**
III	• Theory of mixing, mixing mechanisms, types of mixtures. • Solid-solid, solid- liquid and liquid- liquid mixing equipment. • Semisolid mixing. • Importance of content uniformity in solid dosage forms	**1 Credits** **15 Marks**
IV	• Objectives, crystal lattice lattice, types of crystal form, size and habit, formation of crystals, supersaturation theory, factors affecting crystallization process, crystal growth. • Study various type of crystallizers: Swenson walker, tanks, circulating magma, vacuum and crystal cooling crystallizer. • Spherical crystallization and its application in pharmacy. • Brief introduction of co-crystals	**1 Credits** **15 Marks**

Reference books:

1. The theory & practical of industrial pharmacy-Lachman L, Lieberman H.A & Kanjig J.L, Varghese publishing house, Bombay.
2. Alfonso G Remington: The science & practice of pharmacy. Vol I & II. Lippincott, Williams & Wilkins Philadelphia.
3. Introduction to chemical engineering, W.L. Badger and J.T Banchero, Tata McGrew- Hill publishing Company Ltd, New Delhi.
4. Encyclopedia of pharmaceutical technology, James Swarbrick, Informa healthcare, USA.
5. Principles and practice of Automatic process control, C.A smith and A Corripio, John Willey & Sons, Inc, USA.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester V

PHC-VE-5016: Advanced Analytical Chemistry-III

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Ultraviolet/Visible molecular Absorption Spectroscopy:** Electromagnetic radiation- its properties and absorption by molecules, factors affecting absorption of radiation by molecules, Beer's Law and its deviations, Beer's & Lambert's Law, instrumentation, sample handling techniques and pharmaceutical application and recent advancement.	**1 Credits 15 Marks**
II	**Infrared spectroscopy:** Introduction, instrumentation (components and their general working principles) sample handing, a brief Introduction, to Fourier Transform Infrared Spectroscopy (FTIR) and ATR, applications and recent advancement, analytical shortcomings. • Introduction to Raman spectroscopy.	**1 Credits 15 Marks**
III	**Molecular Luminescence spectroscopy:** Theory of fluorescence and phosphorescence, factors affecting the intensity of chemiluminescence's, instrumentation and analytical applications and recent advancement.	**1 Credits 15 Marks**
IV	**Molecular Absorption spectroscopy:** Theory, aspects basic instrumentation, elements interpretation of spectra, and applications of Absorption spectroscopy.	**1 Credits 15 Marks**

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	To determine dissociation constant (pKa) of indicator by using UV-visible spectrophotometer.
2	To interpret the given IR spectra(chelical + drug).
3	Detection and identification of proteins & aminoacids.
4	Detection and identification of carbohydrates.
5	Detection and identification of Lipids.
6	Analysis of normal and abnormal constituents of urine.
7	Physical examination of hormonal solutions, steroids and flavons.
8	To perform assay of Mefenemic acid as per IP'2007. 13
9	To perform assay of Calcium gluconate injection as per IP 2007.
10	To perform the assay of Isoniazide table as per IP'96
11	To find out content of active ingredient of Metformine tablet as per IP'2007.13
12	To perform the assay of active ingredient for Riboflavin as per IP'2007.13
13	To perform content uniformity test for paracetamol as per IP'2007.13
14	To perform uniformity test for Co-trimoxzole as per IP'2007.13.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester V

PHC-VE-5026: Pharmacology-I

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	TITLE	CREDITS & MARKS
I	• **General pharmacology:** Introduction to pharmacology, sources of drugs, dosage forms and routes of administration. • **Pharmacodynamics:** General principles of drug action. Molecular basis of drug Targets. • **Pharmacokinetics:** Absorption, distribution, Metabolism and excretion of drugs. Principles of pharmacokinetics, Bioavailability and Bioequivalence, pharmacogenetics, Adverse drug reaction, drug interactions, Bioassays & Preclinical studies. Clinical trials.	**1 Credits 15 Marks**
II	**Pharmacology of Peripheral Nervous system:** Neurohumoral transmission (autonomic and somatic), Parasympathomimetics, parasympatholytics, sympathomimetics, adrenergic receptor and neuron, blocking agents, ganglionic stimulants and blocking agents, neuromuscular blocking agents, basics of ANS disorders.	**1 Credits 15 Marks**
III	**Pharmacology of Respiratory System:** Drugs used in treatment of Bronchial asthma, Dry cough, COPD 9also Mucolytics, Expectorants, Antitussives).	**1 Credits 15 Marks**
IV	Pharmacology of Nitric oxide, endothelins, ANP, purines.	**1 Credits 15 Marks**

Reference Books:

1. Fundamentals of Experimental Pharmacology by M.N. Ghosh.
2. Handbook of Experimental Pharmacology by S.K. Kulkarni
3. Pharmacology by V.J. Sharma
4. Lippincot's Pharmacology by Heavy & Champ.
5. General P'cology: Basis concept by H.L. Sharma
6. Practicals in Pharmacology by Dr. Goyal.
7. Medical Pharmacology by Goth.
8. Pharmacology by Gaddum
9. Principles of Drug Action by Goldstein Aronow & Kalaman.
10. Lewis Pharmacology by Crossland.
11. Elements of Pharmacology by Dr. Derasari & Dr. Gandhi.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	Introduction to Experimental Pharmacology.
2	To study basic instruments used for isolated tissue experiments
3	To study different laboratory animals.
4	Introduction to CPCSEA its construction and its function (CPCSEA guidelines)
5	To study various methods of euthanasia.
6	To study various methods of anesthesia & method of disposal of animals.
7	Demonstration of mounting of isolated rat ileum.
8	To study PD_2 value of Ach/Histamine using rat/G.pig ileum using simulation software.
9	To study dose ratio of Carbachol/ Ach & Physostigmine/ Ach using rat ileum using simulation software.
10	To study PA_2 value of Atropin/Mepyramine using rat/G.pig ileum using simulation software.
11	To find out nature of unknown drug using rat ileum using simulation software.
12	To study the effect of various drugs acting on neuromuscular junction using simulation software (Computer Assisted Experiment).
13	To study the effect of various drugs on cat nictating membrane (Computer Assisted Experiment).

Internal Assessment Total mark: 20/1 credit

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester V

PHC-VE-5036: Medicinal Chemistry-II

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**The following classes of drugs will be discussed in relation to:** Introduction, Chemical classification (if any). Chemical nomenclature, Mechanism of action, Synthesis of the agent mention in the bracket, Structure activity relationship & therapeutic uses. a. Sulphonamides and fluoroquinnolones (sulphanilamide, sulphaguanidine, sulphathiazole, sulphafurazole sulphamerizine, sulphamethoxazole). b. Antimalarials (chloroquin, prinaquin, mepacrin hydrochloride, pyrimethamine). c. Antimycobacterials (Antileprotic & Antitubercle agents) (isoneazid, para amino salicylic acid). d. Antifungal agents (metronidazole, fluconazole).	1 Credits 15 Marks
II	**The following classes of drugs will be discussed in relation to:** Introduction, Chemical classification (if any), Chemical nomenclature, Mechanism of action,Synthesis of the agent mention in the bracket, Structure activity relationship & Therapeutic uses. a. Antiviral drugs including Anti- HIV drugs (amantadine). b. Antineplastic agents (methotrezate, chlorambucil, mustine, thio TEPA, cyclophospomide, 6- merceptopurine hydroxyl urea). Antiseptics and Disinfectants	1 Credits 15 Marks
III	Introduction, Chemical classification (if any), Chemical nomenclature, Mechanism of action,Synthesis of the agent mention in the bracket, Structure activity relationship & Therapeutic uses of Antibiotics.: Beta –lactams, aminoglycosides, tetracyclines, macrolides, polyene & polypeptide antibiotics, chloramphenicol, (ampicillin, carbenicillin, cephalexin, penicillin-=V, chloramphenicol).	1 Credits 15 Marks
IV	Combinatorial chemistry: Introduction, principle, importance of new drug discovery, various synthetic approaches and library purification, HTS.	1 Credits 15 Marks

Reference Books:

1. Smith & William's: Introduction to the principle of drug design and action,4th edition, H. John Smith, Eds, CRS Press- Taylor & Francis Group , USA.
2. Text book of Drug Design & discovery,3rd edition, Povl Krogsgaard- Larsan, Tommy Liljefors & ULF , Madsen, Eds, Taylor & francis Group, USA.
3. Walter Sneader's drug Discovery-A history, John Willy & Sons, Ltd.UK.
4. Vogel's Text book of principal Organic Chemistry, ELBS/ Longman, London.
5. Practical Organic chemistry by Mann & Saunder, Orient Longman, London.
6. Spectrometric identification of Organic compounds by R.M. Sliverstein, G. Claytron Bassel's and T.C. Movvill, John Wiley & sons, USA.

PRACTICALS: 20 Marks (1 Credits)

SL. NO	TOPIC
1	Organic spotting of binarymixtures of Liquid + Liquid 9all type) Min 4-5.
2	Synthesis of aspirin from salicylic acid.
3	Synthesis of N-acetyl glycine from glycine.
4	Synthesis of benzillic acid from benzyl.
5	Synthesis of benzyl from benzoin.
6	Synthesis of benzaldehyde phenyl hydroxime from benzaldehyde.

Internal Assessment Total mark: 20/1 credit

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester V

XXX-SE-5XX4: Introduction to Drug Delivery System

Total Marks:100 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Immediate Release Novel Dosage Forms:** Fast dissolving tablets including effervescent tables, mouth dissolving table, oral films.	**1 Credits 15 Marks**
II	**Oral Controlled Drug Delivery Systems:** Physicochemical and Biological factors influencing design, dissolution controlled system. Diffusion controlled system. Bioerodible system, Release rate kinetics, General methods of design and evaluations of controlled release products such as Osmotically controlled system, lon Exchange systems. Pulsatile drug Delivery Systems, Gastroretentive drug delivery systems.	**1 Credits 15 Marks**
III	**Mucoadhesive Drug Delivery System:** Physiology of mucosa, mechanism of transmucosal permeation. Delivery through Gastro intestinal, buccal rectal and vaginal routes. **Colon Specific Drug Delivery System:** Matrix table, coated table, Encapsulated tablet.	**1 Credits 15 Marks**
IV	**Transdermal Drug Delivery System.** The structure & function of skin fundamental of skin permeation, kinetic evaluation, formulation design & optimization, permeation enhancements recent advancements in skin delivery system, Evaluation, Merits & Demerits.	**1 Credits 15 Marks**

Reference Books:

1. Progress in Controlled and Novel Delivery System, edited by N.K. Jain, CBS Publishers & Distributors, New York.
2. Targeted & Controlled Drug Delivery, S.p Vayas and R.K. Khar, CBS Publishers & Distributors, New Delhi.
3. Pharmaceutical Dosage Form: Disperse system, Vol.I,II,7 III, Lierbermen H.A and Leon Lachman, Marcel Dekker, New York.
4. Protein Formulation & Delivery, edited by E.J. Manally and J.E Hastedt, Informa Healthcare, New York.
5. Encyclopedia of Pharmaceutical Technology, Jasmes Swarbrick and James C. Boylan, Marcel Dekker Inc., New York.
6. Handbook of Pharmaceutical controlled Release Technology, Donald L.Wise, Marcel Dekker, USA.

PRACTICALS: **20 Marks (1 Credits)**

SL. NO	TOPIC
1	To determine surface tension of prepared herbal cosmetics.
2	To study the effect of various drugs on cat nictating membrane (Computer Assisted Experiment).
3	Surface tension of cosmetics.
4	Skin analysis.
5	To study the effect of quenching on quinine sulphate by KI.
6	To find out content of active ingredient of Metformine tablet as per IP'2007.13
7	To perform the assay of Isoniazide table as per IP'96
8	To perform assay of Calcium gluconate injection as per IP 2007.
9	To perform assay of Mefenemic acid as per IP'2007. 13

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester VI

PHC-VE-6016: Advanced Analytical Chemistry-IV

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Fundamental of NMR & CMR Spectroscopy:** Principal, basic of NMR (peak height, peak signal, chemical shift) instrumentation and applications of NMR, criteria for a compound to be NMR active. Basic components of instrumentation of PMR and CMR. Shielding- deshielding, splitting, TMS, Resolution and multiplicity	**1 Credits 15 Marks**
II	**Mass Spectroscopy** Theory, introduction and modifications: unit mass and molecular ions, important terms-singly and doubly charged ions, meta stable peak, base peak, is otropic mass peaks, relative intensity, etc, recognition molecules, including compounds containing oxygen, sulphur, nitrogen and halogens; α-,β-, allylic and benzylic cleavage.	**1 Credits 15 Marks**
III	**Gravimetric analysis:** Precipitation techniques, solubility products: The colloidal state. Supersaturation co-precipitation, post-precipitation. Digestional washing of the precipitate, Filtration, Filter papers and crucibles,ignition. Thermogravimetric curves, specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, organic precipitants.	**1 Credits 15 Marks**
IV	Introduction to GCMS, LCMS, ICPMS. Structure determination using IR, NMR, Mass spectroscopy	**1 Credits 15 Marks**

Reference Books:

1. Practical NMR Spectroscopy. M.L Martin, J.J. Delpeuch and G.J Marin, Heyden.
2. Kemp. W.Organic spectroscopy 3rd ed. W.H. Freeman &Co 1991.
3. Introduction to NRM spectroscopy. R.J. Abraham, J. Fisher and P. Loftus, Wiley.
4. Application of Spectroscopy of Organic Compounds, J. R. Dyer, prentice Hall.
5. Spectroscopy Methods in organic Chemistry. D.H. Williams, I. Fleming,Tata.
6. S.M. khopkar, New Age international Pvt. Ltd. Basic Concepts of analytical Chemistry, 2nd ed. 1998.
7. J.H. Kemedy, Analytical chemistry: Principles, W.B Saunder publishing, 2nd ed, 1990.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester VI

PHC-VE-6026: Pharmacology-II

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Pathophysiology and Drugs used in:** Congestive Cardiac Failure, Angina, Myocardial Infarction, Cardiac Arrhythmias, hypertension, Hyperlipidemia and Atherosclerosis, Anemia, Coagulation disordes, Shock.	**1 Credits 15 Marks**
II	**Drugs Acting on Urinary System.** Fluid and electrolyte balance, Diuretics, Anti diuretics, Urine acidifying and alkalinizing agents.	**1 Credits 15 Marks**
III	**Pharmacology of Gastro Intestinal Tract:** Antacid, antiemetics, antidiarroheal, laxatives, appetizer, demulcents, mucolytics, Adsorbants, Astringents, Digestants Pathophysiology and drugs used in peptic ulcer & inflammatory Bowel Disease.	**1 Credits 15 Marks**
IV	Concepts of RIA, Radioligand Studies, ELISA.	**1 Credits 15 Marks**

Recommended Books for the syllabi are:

1. Pharmacological basis of Therapeutics by Goodman & Gillman.
2. Pharmacology and Pharmacotherapeutics by Satoskar & Bhandarkar.
3. Essentials of Pharmacotherapeutics by F.S.K. Barar.
4. Essentials: of Medical Pharmacology by K.D, Tripathi.
5. Pharmacology by Rang & Dale.

Reference Books:

1. Fundamentals of Experimental Pharmacology by M.N. Ghosh.
2. Handbook of Experimental pharmacology by S.K. Kulkarni.
3. Exp. P'cology by R.V. Goyal
4. Pharmacological Experiments on Isolated Preparations by Perry.
5. Medical Pharmacology by Goth.
6. Pharmacology by Gaddum.
7. Lewis Phaemacology by Crossland.
8. Textbook of Pharmacology by Bowman & Eand.
9. Elements of Pharmacology by Dr. Derasari & Dr.Gandhi.
10. Drug Interactions by Hansten.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester VI

PHC-VE-6036: Medicinal Chemistry-III

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	**Drug design** Analogues and prodrug concept, Concept of lead, Rational approach to drug design, Overview of drug design and development, Tailoring of drug.	1 Credits 15 Marks
II	**Physiochemical properties of drug molecules influencing biological activity** Physical properties, Meyer-overton and meyer-hemmi theory ,Fergusion theory, vanderwaal's constant, steric factors, Factors governing ability of drugs to reach active site. Stereochemistry and drug action, bioisosterism.	1 Credits 15 Marks
III	**Molecular modeling and drug design:** De novo Drug Design, Molecular modeling (MM), Computer Aided Drug Design (CADD), methods of lead discovery, identification and Optimization of Lead, Docking study introduction.	1 Credits 15 Marks
IV	Lipophilic, electronic and stearic parameters, Hansch Linear Free Energy Relationship (LFER) model of QSAR. Free Wilson Mathematical Model of QSAR.	1 Credits 15 Marks

Reference Books:

1. Strategies for Organic Drug Synthesis & Desigh by Daniel Lednier, John Wiley & Sons, USA.
2. Organic Chemistry by L. Finar, vol. I & II, ELBS/Longman, London.
3. Kar,A. Medicinal Chemistry, New Age International Publishers, New Delhi,2007.
4. Ladu. B.N Mandel H.G & E.L. Way, Fundamentals of drug Metabolism & Disposition, William & Wilkins Co. Baltimore.
5. Taylor, J.B and Triggle, D.J. Comprehensive Medicinal Chemistry II, vol. 1-8. Quantitative drug Design, Elsevier Ltd.2007.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B. Voc. Pharmaceutical Chemistry
Semester VI

XXX-SE-6XX4: Entrepreneurship Development

Total Marks:80 **Total Credit: 04**

Theory (Total marks: 60)

UNIT	UNIT TITLE	CREDITS & MARKS
I	Entrepreneurship: Introduction to Entrepreneur, Entrepreneurship and Enterprise, Importance and Relevance of the Entrepreneur, Factors Influencing Entrepreneurship, Pros and Cons of being an Entrepreneur, Women Entrepreneurs, Problems and Promotion, Types of Entrepreneurs, Characteristics of a Successful Entrepreneur, Competency Requirement for Entrepreneurs.	**1 Credits 15 Marks**
II	**Entrepreneurial traits, motivation and development** Types of startups; Entrepreneurial class Theories; Entrepreneurial leadership; International Entrepreneurship- Opportunities and challenges; Source of innovative ideas; Entrepreneurship and creativity; Techniques for generating ideas, Impediments to creativity	**1 Credits 15 Marks**
III	**Entrepreneurial Development Institutions and Policy initiatives** Implementation of the Project: Financial Assistance through SFC's, SIDBI, Commercial Banks, KVIC, NABARD. Financial incentives and Tax Concessions for MS&MEs, Policies for North Eastern Region; Role of government in entrepreneurship development; recent trends, Vision 2020 of Sikkim.	**1 Credits 15 Marks**
IV	**Business Plan Development, Lunching, Feedback and Follow-up** Preparing the Business Plan (BP): Typical BP format, Financial Aspects of the BP, Marketing Aspects of the BP, Human Resource Aspects of the BP, Technical Aspects of the BP, Social Aspects of the BP, Preparation of BP, and Common Pitfalls to be avoided in Preparation of a BP. An Overview of the Steps involved in Starting a Business Venture, Location, Clearances and Permits Required, Formalities, Licensing and Registration Procedures. Launching the Enterprise**:** Trade license**,** Approvals and Clearance, Registration Project Control; Feed Back and Follow-up. **Activity**: Course will involve development of feasible Business Plan by students in Groups. Case studies may be developed and discussed for better understanding of the prevalent scenario**.**	**1 Credits 15 Marks**

SUGGESTED READINGS:

1. Ramachandran, K., Entrepreneurship Development, Tata McGraw Hill, India
2. Kumar, Arya, (2010) Entrepreneurship: Creating and Leading an Entrepreneurial Organization, Pearson, India.
3. Hishrich., Peters,(2008) Entrepreneurship: Starting, Developing and Managing a New Enterprise, Irwin.
4. Roy, Rajeev, Entrepreneurship, Oxford University Press.
5. Kuratko, D.F., and T. V. Rao,(2010) Entrepreneurship: A South-Asian Perspective, Cengage Learning.
6. Government of India, Reports of the committee on Development of small and medium entrepreneurs.

Internal Assessment **Total mark: 20/1 credit**

Submission of assignments, mid term examination, seminar/ presentation, attendance & group discussion

B.Voc. Pharmaceutical Chemistry Semester VI
PHC-VC-P605: Practical

Total Marks:20 **Total Credit: 01**

Practical

SL. NO	TOPIC
1	To study the standards of tablets as per IP 6 sums related to standards of tablets.
2	To perform weight variation tests as well as content of active ingredient test of given sample of the mefanamic acid tablet.
3	To perform content of active ingredient test and weight variation for tablet of Metformin HCL
4	To perform weight variation test and content of active ingredient test for given chloramphenicol capsule as per IP 96
5	To determine energy utilized byball mill for size reduction process
6	To determine particle size distribution of given sample of granules by sieving method.
7	To determine % yield of crystals in crystallization experiment under different conditions.
8	To produce crystals using different conditions of crystallization and to stay the crystal habit.
9	To study the effect of speed and time on solid liquid mixing.
10	To determine the mixing efficiency of two immiscible liquid using variable speed propeller mixer.
11	To determine mixing index of a given powder mixture using double cone blender.
12	To determine the rate of mixing of solid in liquid using a magnetic stirrer at different speeds.
13	To study the effect of filter aid on sedimentation rate and to determine optimum concentration of filter aid.
14	To determine humidity and % humidity of air wet bulb-dry bulb method.
15	To determine humidity and % humidity of air using dew point method.
16	To isolate volatile oil of given plant drug using distillation method.
17	To determine % of volatile oil in given plant drug using clavenger's apparatus.
18	To determine mixing index for blending given power using laboratory mixer.
19	To determine the average particle size & to study particle size distribution using standard sieve method for given powder substance. Demonstration of following instruments: Hammer mill Jaw crusher. Demonstration of following instruments: Vibrating (oscillating) sifter. Double cone mixer. Demonstration of pyrogen test

B.Voc. Pharmaceutical Chemistry Semester VI
PHC-VC-P606: Industrial Training/Project/Internship

Total Marks:60 **Total Credit: 03**
Project Report Marks: 40
Viva-voce marks: 20

Short-term working experience in pharmaceutical companies will help students better understand the pharmaceutical industry, learn the process of drug discovery and development, and build a strong network with experts and fellows in the pharmaceutical field, which can positively contribute to future career development. In addition, it will help students to identify if they really enjoy working in industry and help them in choosing a future career after graduation.

(Note: Students shall proceed for Industrial Training/Project/Internship of twelve weeks duration immediately after the completion of 5th Semester examination (winter vacation). The External Examiner appointed by the University shall assess the Industrial Training/Project/Internship Report during vivavoca to be conducted in 6th Semester.