BACHELOR OF VOCATION

Pharmaceutical Chemistry (to be implemented from July 2017)

Semester	Course Code	Course Title	Credit		Marks
			General Component	Skill Component	Total
Semester-I	PHA-BV-T101	Basic Pharmaceutical Calculations	2	2	100
	PHA-BV-T102	Fundamentals of Organic Chemistry	3	1	100
	PHA-BV-T103	Pharmaceutical Inorganic Chemistry	2	2	100
	PHA-BV-T104	English & Communication Skill	2	2	100
	PHA-BV-T105	Human Anatomy and Physiology	3	1	100
	PHA-BV-P106	Practical	-	10	200
	Total		**12**	**18**	**700**
Semester-II	PHA-BV-T201	Pharmaceutics (Basic Principles)	3	1	100
	PHA-BV-T202	Physical Chemistry	2	2	100
	PHA-BV-T203	Fundamental Biochemistry	2	2	100
	PHA-BV-T204	Analytical chemistry	3	1	100
	PHA-BV-T205	Fundamentals of Pharmacognosy	2	2	100
	PHA-BV-P206	Practical	-	10	200
	Total		**12**	**18**	**700**
Semester-III	PHA-BV-T301	Advanced Organic Chemistry	3	1	100
	PHA-BV-T302	Advanced Analytical Chemistry-I	3	1	100
	PHA-BV-T303	Phytochemistry	2	2	100
	PHA-BV-T304	Indian Drug Regulatory Guidelines	2	2	100
	PHA-BV-T305	Basic Computer Applications	2	2	100
	PHA-BV-P306	Practical	-	10	200
	Total		**12**	**18**	**700**
Semester-IV	PHA-BV-E401	Foundation Course (English)	4	-	100
	PHA-BV-T402	Microbiology	2	2	100
	PHA-BV-T403	Advanced Analytical Chemistry - II	2	2	100
	PHA-BV-T404	Medicinal Chemistry-I	2	2	100
	PHA-BV-T405	Pharmaceutical Practice	2	2	100
	PHA-BV-P406	Practical	-	10	200
	Total		**12**	**18**	**700**
Semester-V	PHA-BV-E401	Foundation Course (Environmental Studies)	4	-	100
	PHA-BV-T402	Advanced analytical Chemistry – III	2	2	100
	PHA-BV-T403	Pharmacology – I	2	2	100
	PHA-BV-T404	Introduction to Drug Delivery System	2	2	100
	PHA-BV-T405	Medicinal Chemistry – II	2	2	100
	PHA-BV-P406	Practical	-	10	200
	Total		**12**	**18**	**700**
Semester-VI	PHA-BV-E501	Foundation Course (Eastern Himalayan Studies)	4	-	100
	PHA-BV-T502	Medicinal Chemistry – III	2	2	100
	PHA-BV-T503	Advanced Analytical Chemistry - IV	2	2	100

	PHA-BV-T504	Pharmacology II	2	2	100
	PHA-BV-T505	Entrepreneurship Development	2	2	100
	PHA-BV-P506	Industrial Training/ Project / Internship	-	10	200
	Total		**12**	**18**	**700**

COMPOSITION

Name of the Program(s) (Diploma, Adv. Diploma, Degree)	**Semesters**	**No. of Credits 30 Credit /Semester**	**Job Roles and NSQF-Levels**
Diploma in Pharmaceutical Chemistry	I	60 credits	**NSQF-Level 5** Supervisor
	II		
Advance Diploma in Pharmaceutical Chemistry	III	60 credits	**NSQF-Level 6** Technician / Trainer
	IV		
B.Voc. in Pharmaceutical Chemistry	V	60 credits	**NSQF-Level 7** B.Voc. Graduate
	VI		

B. Voc. Pharmaceutical Chemistry
Semester I

BVPC 111: Basic Pharmaceutical Calculations

COURSE OBJECTIVES:
To make student learn the basic calculations, a pharmaceutical chemistry professional is expected to do in his/her professional life.

Unit – 1

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.

Unit – 2

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.
c. **Alcohol calculations**

Unit – 3

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.

Units – 4

a. **Molecular Weight**
   Moles, millimoles, milliewquivalents, milliosmoles, Molar concentrations
b. **Parenteral solutions and isotonicity**
   Rate of flow of IV solutions, Isotonicity

Reference books:

1. A.J. Winfield, J. A Rees, I. Smith, Pharmaceutical Practice, 4th editions, Elsevier publication.
2. Christopher A.L. and D.B. Pharmaceutical compounding and Dispensing, Pharmaceutical press.
3. D.P., G. Dosage Calculations, Delmar Publishers.
4. Don A.B. and T.W G. Pharmacy Calculations, CBS Publisher.
5. Cooper and Gunn's, Dispensing for Pharmaceutical students, ed. S.J. Carter, 12th edition. CBS Publisher.
6. Judith A. R Ians et al. Introduction of Pharmaceutical Calculations, Pharmaceutical Press.

B. Voc. Pharmaceutical Chemistry
Semester I

BVPC 112 : Fundamentals of Organic Chemistry

COURSE OBJECTIVES:

1. To learn fundamentals of chemical bonds, stereochemistry.
2. To learn basic chemical functional groups of compounds with respect to their physical and chemical properties.
3. To learn the simple organic chemical reactions.
4. To identify organic compounds by testing their physical and chemical properties.

Unit – 1

Basics

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.

Unit – 2

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.

Unit – 3

Structure, Nomenclature, Preparation and Reactions

Structure, Nomenclature, Preparations and Reactions of: Alkanes, Alkenes, Alkynes; Cycloalkanes, Dienses, Benzene, Polynuclear aromatic compounds, Arenes.

Unit – 4

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.

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

BVPC 113: **Pharmaceutical Inorganic Chemistry**

COURSE OBJECTIVES:

1. To learn the structure, preparation, properties and medicinal uses of various inorganic compounds.
2. To learn the methods used to determine purity of inorganic medicinal compounds.

Unit-1

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).

Unit-2

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.).

Unit-3

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.

Unit-4

C. Antioxidant- theory, the selection of antioxidants, official antioxidants (hypophosphorous acid, sodium bisulphite, sodium thiosulphate, sodium nitrite, nitrogen).
D. Pharmaceutical accepted glass-chemistry of glass, types of test employed for glass.
E. Water: official water (water, purified water, water of injection, bacteriostatic water for injection, sterile water for injection).

Recommended Books for the syllabi are:

1. GR Chatwal, Pharmaceutical Chemistry-Inorganic, volume-1, 2nd edition, Himalaya Publishing House, Mumbai, 2005.
2. G. Svehal,Vogel's Qualitative Analysis, 6th edition, Orient Longman Pvt. Ltd, New Delhi,1994.
3. Dr.A.V Kasture, De. S.G. Wadodkar, pharmaceutical chemistry-I, 1st edition, Nirali Prakashan, Pune, 1993.
4. A.H. Backett, J.b. Stenlake, Practical Pharmaceutical Chemistry, first Indian edition, CBS Publishers, Delhi, 1987, page 13 and 114.

Reference Books:

1. The Indian Pharmacopoeia 2007, Volume-I,II & III, Conteoller of publication,2007.
2. J.H Block, E.R Rocne, T.O Soinr, C.O Wilson, inorganic medicinal and Pharmaceutical Chemistry, First Indian Reprint, Varghese Publishing House,1986.
3. N.M. Shah, practical chemistry, 2nd edition reprint, Eton Press Pvt. Ltd., Bombay, 1967.
4. H.D. Gehani, S.M Parekh, R.V. Bhagwat, inorganic chemistry, 3rd edition, A.R. Sheth and Co., Educational publishers, Bombay, 1965.
5. P. Gundu Rao, Inorganic Pharmaceutical chemistry, 3rd edition, Vallabh Prakashan, Delhi, 1999.
6. Dr. K.G. Bothara, Inorganic Pharmaceutical chemistry,1st edition, Nirali Prakashan, Pune, 1974.
7. N.C. chaudary, N.k. Gurbani, Pharmaceutical Chemistry-I, 1st edition, Vallabh Prakashan, Delhi, 1995.
8. V.V. Nadkarni, A.N. Kothare, P.S. Fernandes, Semimicro Qualitative Analysis, 2nd edition, Poular Prakashan, 1997.
9. T.O Soine, C.O.Wilson, Roger's Inorganic pharmaceutical chemistry, 8th edition, Lean and Febiger, USA, 1967.

10. A.G Sharpe. Inorganic Chemistry, 3rd edition, ELBS with Longman, UK, 1992.
11. M.S Sethi, P.S. Raghawan, Concepts and Problems in Inorganic Chemistry, 1st edition, Discovery Publishing House, New Delhi, 1998.
12. Bertini, Gray, Lipper, Velentine, Bioinorganic Chemistry, 1st edition, viva Books Pvt. Ltd, New Delhi, 1998.

B. Voc. Pharmaceutical Chemistry
Semester I

BVPC 114: English & Communication Skill

COURSE OBJECTIVES:
To learn basic communication skills (oral and written)

Unit – 1
English grammar – Parts of speech, articles, preposition, tenses, active and passive speech, direct and indirect speech

Unit – 2
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)

Unit – 3
Written skills: proposal, writing formats, report writing business letters, applications, covering letters, curriculum vitae designing, summary writing.

Unit – 4
Listening-Phonetics and pronunciations (with the help of phonetics dictionary and with tapes from language laboratory).

Reference Books:
1. Wren and Martin, English Grammar

BVPC 115: Human Anatomy and Physiology

COURSE OBJECTIVES:

1. To understand structure and functions of each body components from cellular level to system level.
2. To understand how functions of each cell is integrated to make the entire body function with complete co-ordination.
3. To understand the various diseases related to disturbances in the body function.
4. To learn fundamentals of health, various dimensions of health, understanding of basic terminologies
5. To learn some simple first aid techniques and management of emergency situations

Unit – 1

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.

Unit – 2

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 of skeletal muscle and their disorders.

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

Units – 3

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 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.

Unit – 4

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.

Endocrine System: Basic anatomy and physiology of pituitary, thyroid, Parathyroid, Andrenals, pancreas, Testes and Ovary, their hormones and functions.

Reference books:

1. Anne M.R. Agur & Ming J. Lee: Grant's Atlas of Anatomy, Lippincott, Williams and Wilkins B.D. Chaurasia's Human Anatomy (3 Volumes) CBS Publishers & Distributors.
2. B. Young, J. W. Heath: Wheater's functional Histology-a Text and Colour Atlas, Churchill Livingstone.
3. Bullock B.L. & Henze R.L. Focus on Pathphysiology, Lippincott Chatterjee, C.C. Human Physiology (Medical Allied Agency, Calcutta)
4. Chummy S. Sinnatamby: Last's Anatomy – Regional and Applied, Churchill Libingstone.
5. Gandhi, T.P. et. al: Human Anatomy, Physiology & Health Education (B.S. Shah Prakashan, Ahmedabad).
6. Garg K et. al: A Text Book of Histology (CBS Publishers, New Delhi).
7. Ghai, C.L.: A Text book of practical physiology (Jaypee Brothers Medical Publisher (P)

B. Voc. Pharmaceutical Chemistry
Semester I

BVPC 116: Practical

(Any ten experiments or group of experiments each of three hours duration from the followings)

Human Anatomy Physiology

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

Chemistry:

1. Introduction to laboratory and safety hazards
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 any solution
10. Standardization of analytical weights and calibration of volumetric apparatus.

Pharmaceutical Inorganic Chemistry

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.

Reference Books:

1. Manuals provided with the licensed version of the Software.
2. Computer Application and Basic Biostatistics: H.B. Bhadka, Dr. N.N. Jani, Dr. G.R. Kulkarni, Akshat Publications.

B. Voc. Pharmaceutical Chemistry
Semester II

BVPC 211: Pharmaceutics (Basic Principles)

COURSE OBJECTIVES:

1. To make student understand the different dosage forms and routes of administration.
2. To understand the important physical properties of compounds and its impact in preparation and stability of drug formulation
3. To understand the common processes used in manufacturing of drug formulations.

Unit – 1

Introduction:

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.

Unit – 2

a. 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.

b. 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.

Units – 3

a. 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

b. Polymorphism

What is Polymorphism, Pseudo polymorphism, Solvates and Hydrates, Meta-stable forms? Examples of polymorphic drugs and effect on physicochemical properties

c. 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.

Units- 4

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.

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.

B. Voc. Pharmaceutical Chemistry
Semester II

BVPC 212: Physical Chemistry

COURSE OBJECTIVE:

1. To learn the important physical properties of drugs and chemicals, that can significantly affect the drug manufacturing.
2. To quantify these physical properties and methods to alter the same so as to avail desired levels.

Unit – 1
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.

Unit – 2
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.

Unit – 3
Thermodynamics
First, second and third laws, Zeroth law, absolute temperature scale, thermo, chemical equations, phase euquilibria and phase rule.

Unit – 4
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.

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.

B. Voc. Pharmaceutical Chemistry
Semester II

BVPC 213: Fundamental Biochemistry

COURSE OBJECTIVE:

1. To learn the structure and function of various biochemical.
2. To learn the basic metabolic process occurs within the human body and factors regulating the same.

Unit – 1

Biological macromolecules: carbohydrates

Introduction to carbohydrates, Nomenclature, definition and classification of carbohydrates. Monosaccharides, classification, structural aspect and biological significance. Disaccharides, Oligosaccharides, Polysaccharides.

Unit – 2

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.)

Unit – 3

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.

Unit – 4

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 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.

BVPC 214: Analytical Chemistry

COURSE OBJECTIVE:

1. To make student learn the basic principles of various assay techniques commonly used in quality control department of any pharmaceutical industry.
2. To provide the hands-on experience by actually conducting these assays in the lab.

Unit – 1

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.

Unit-2

Sampling

Basis of sampling, sampling procedure and selection of sample, factors affecting sampling: sampling and physical state, crushing, grinding and hazards in sampling.

Unit – 3

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.

Unit – 4

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.

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.

9. A.H. Backett, J.B. Stenlake, Practical Pharmaceutical Chemistry, 4th Edition, CBS POublishers, Delhi, 1997.
10. A. Alexeyev, Quantitative Chemical Analysis, 1st Edition, Mir Publishers, Moscow, 1994
11. I.M. Pande, Systemic Analytical Chemsitry, 1st Edition, Central Book Depot, Allahabad, 1995
12. R. Kellner, J.M. Mermet, M. Otto, H.M Widmer, Analytical Chemsitry, 1st Edition Wiley-VCH, 1998
13. T.Higuchi, Pharmaceutical Analysis, 1st Edition, CBS Publishers, New Delhi 1997.
14. P.D. Sethi, Quantitative Analysis of Drugs in Pharmaceutical Formulations, 3rd Edition, CBS Publishers, New Delhi 1997.
15. F.W. Fifield, D. Kealey, Principle and Practice of Analytical Chemsitry, 5th Edtion, Blackwell Sciecne Ltd., 2000.
16. Y. Anjaneyulu K. Chandrasekhar, Valli Manickam, A Textbook of Analytical Chemistry, 1st Edition, Pharma Book Syndicate, Hyderabad, 2006.

B. Voc. Pharmaceutical Chemistry
Semester II

BVPC 215: Fundamentals of Pharmacognosy

COURSE OBJECTIVES:
1. To learn general morphological and microscopically characters crude drugs.
2. To understand general methods of checking purity of herbal drugs.

Unit – 1
Introduction to Pharmacognosy
Definition, scope, history and development of Pharmacognosy, Introduction to secondary metabolites Definition & Classification.

Unit – 2
Plant tissue & Morphology
Plan tissue of simple and complex and tissue system, morphology of root, stem, bark, wood, leaf, flower, fruit and seed, modification of root, stem and leaf, histology of root, stem and leaf.

Unit – 3
Plant taxonomy
Study of the following families with special reference to medicinally important plants – Malvaccae, Apocynaceac, solanaceae, Leguminosae, Rubiaceae.

Unit – 4
a. Classification and cultivation of crude
Sources of crude drugs & classification of crude drugs, cultivation, collection, processing and storage of crude drugs, importance and factors, influencing cultivation of medicinal plant, quality control of crude drugs, Adulteration and evaluation.

b. Carbohydrate and derived products
Definition, classification & chemical tests of carbohydrates, Agar, Gaur gum, Acacia, Honey, Isabgol, pectin, starch and Tragacanth.

Recommended Books for the syllabi are:
1. Atal C.K. and Kapur B.M., Cultivation and Utilization of Medicinal Plants, Rrl Jammu.
2. Quadry JS, Shah and Qadry Pharmacognosy, B.S. Shah Publication.
3. MG Chauhan, Microscopy of Leaf Drug, JamnanagarAyurved University.
4. Iyengar, Text Book of Pharmacognosy, Manipal Power Press.

Reference Books:

1. Rangari & Rangari, Text Book of Pharmacognosy.
2. Datta A.C., A Class Books of Botany, Oxford University.
3. Bendre A.M. Ashokkumar, A Textbook of Practical Botany Li Rastogi Publication, Meerut, India.
4. Wallis T.E., Textbook of Pharmacognosy, 5th Edition, Cbs Publishers and Di8stributors.
5. Kokate C.K. Practical Pharmacognosy, Vallabh Prakashan, Delhi.
6. Kokate C.K. Purohit A.P. and Gokhale S.B. Pharmagognosy (Degree) Nirali Prakashan, Pune.
7. Khandelwal K.R. Practical Pharmacognosy, Nirali Prakashan.
8. Trease E and Evans W.C. Pharmacognosy, Balliere Tindall, Eastbourne, UK
9. Tyler V.C. Brady L.R. and Rogers W.E. Pharmacognosy, Lea and Febiger, Ph.

B. Voc. Pharmaceutical Chemistry
Semester II

BVPC-216: Practical

(Any ten experiments or group of experiments each of three hours duration from the followings)

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. To check the validation of Freundlich and Langmuir adsorption isotherm using charcoal and acetic acid.
5. Preparation and standardization of sodium hydroxide.
6. Preparation and standardization of hydrochloride acid.
7. To determine Normality, Molarity, %w/v, and gm/litre of any solution.
8. Standardization of analytical weights and calibration of volumetric apparatus.
9. Non-aqueous titrations: preparation and standardization of perchloric acid and sodium/ potassium/ lithium methoxides solutions; Estimations of some Pharmacopoeial products.
10. Care, use and types of microscopes and preparation of different types of slides and study of different cell and tissue system.
11. Microscopical examination of cell contents: starch grains, calcium oxalate & carbonate crystals and phloem fibres & stomatas.
12. Morphology of plant parts indicated in theory.
13. Microscopic examination of stem monocot and dicot plants.
14. Microscopic examination of root monocot and dicot plants.
15. Microscopic examination of leaf monocot and dicot plants.
16. Morphological characteristic of plant family solanaceae.
17. Quantitative microscopy leaf constants.
18. Quantitative microscopy dimension measurement.
19. To study morphology and chemical tests of carbohydrate containing drug.
20. Preparation of herbarium sheets.

Pharmaceutics (Basic Principles) Practical

21. To prepare the list of market products as per physical form
22. To prepare the list of market products as per route of administration
23. To study two component system-Preparation of eutectic mixture (2)
24. To study the solubility relationship of 3-component system containing benzene, water and acetic acid
25. To study the mutual solubility of given liquids (phenol, water) and find out upper consolute temperature.
26. To determine Reynold's no. in given system
27. To prepare different pharmaceutical buffers.
28. To study the effect of pH on solubility of given drugs.

B. Voc. Pharmaceutical Chemistry
Semester III

BVPC 311: Advanced Organic Chemistry

COURSE OBJECTIVES:

1. To learn the simple organic chemical reactions.
2. To learn fundamentals of symmetry and catalysis in organic reactions.
3. To identify organic compounds by testing their physical and chemical properties.

Unit-1

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.

Unit-2

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.

Unit-3

Symmetry

Conservation of orbital symmetry and rules, electrocyclic, cycloaddition and sigmatropic reaction; neighbouring group effect, transition metal complexes as catalyst for organic reactions.

Unit-4

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).
d. Elimination versus substitution.

Recommended books for the syllabi are:

1. Morrison & boyd, organic Chemistry, prentice- hall, 6th Ed ,2001.
2. Advanced organic chemistry; Reaction, Mechanism and Structure by jerry March 4th edition, A Wiley-Interscience publication.
3. Organic Chemistry by I.A. Finar.

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.

BVPC 312: Advanced Analytical Chemistry-I

COURSES OBJECTIVES:

1. To make students familiar with the principles of analytical chemistry (Instrumental methods0and its application in pharmaceutical chemistry.
2. To provide the hands-on experience by actually conducting these assays in the lab.

Unit-1

Extraction techniques

Simple extraction, multiple extractions, separation of drugs in multicomponent system. Effect of pH on extractability of drugs, continuous extractions.

Unit-2

Chromatography

Classification, theories, retention mechanism, separation efficiency, methodology and pharmacopoeial applications of column, paper and thin layer chromatography.

Unit-3

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.

Unit-4

Miscellaneous Methods:

Kjehldahl's method, Karl Fischer Titration.

Recommended Books for the syllabi are:

1. Gary D. Christian, Analytical chemistry, John Wikley & Sons N.Y,5th Ed.. 1994.
2. J.A dean, Analytical chemistry handbook, Me grew hill Inc.. 1st Ed., 1995.
3. Principles of instrumental Analysis, Skoog, holler and Niemen, Harcourt College Publishers, Philadelphia, 1998.
4. P.L soin, O.P Dharmarha, U.N. Dash, Textbook of physical Chemistry, 22nd edition, Sultan Chand and Sons, New delhi,2001.

Reference Books:

1. J.H Kemedy, analytical chemistry: principles, W.B. Saunder publishing, 2nd Ed. 1990.
2. Indian Pharmacopoeia 2007, volume-I, II and III.
3. Practical pharm. Chemistry, Vol. B- Backett, The Athlone Press of University of London.
4. Quantitative chemical analysis- Vogel A.I, Pearson Education..5th edition, 1996.
5. Instrumental method of chemical analysis by Gurdeep Chatwal, Himamaya publishing house, 2005.
6. Quantitative analysis of drugs in pharmaceutical formulations by P.D. sethi CBS Publishers N.D. 3rd edition, 1997.
7. A textbook of pharmaceutical analysis by Kenneth A Connors. Jon Wiley and sons, 3rd edition, 1982.
8. Textbook of pharmaceutical Analysis-J.W Munson, Marcel Dekker Inc., New York.
9. Stahl e., thin layer chromatography, A laboratory handbook, 2nd Edn, springer- Verlag new York, LLC: 1969.

B. Voc. Pharmaceutical Chemistry
Semester III
BVPC 313: Phytochemistry

COURSE OBJECTIVES:
To make students familiar with Pharmacognostic study of tannin, resin and volatile oil containing crude drugs, utilized as medicine.

Unit-1
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.

Unit-2
Study of tannins and tannin containing drugs:
Introduction, classification, general properties, chemical tests. Drugs: Black catechu, pale catechu and Myrobalans.

Unit-3
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.

Unit-4
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.

Recommended books for the syllabi are:

1. Pharmacognosy: C.k. kokate, A.p. purohit, S.b. gokhale, Nirali prakashan, Pune, 39th edition, 2007.
2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International Pvt. Ltd. Publishers, 2nd edition,2007.
3. A Text Book of Pharmacognosy: C.S Shah, J.S Quadry, B.S Shah Prakashan, Ahemedabad,8th edition, 1990.
4. Trease and Evan's Pharmacognosy: W.C Evans, W.B. Saunders Co, Singapore, 15th edition 2008.

Reference Books:

1. Pharmacognosy and phytochemistry, part I and II, Vinod D. Rangari, Carrier Publications, 1st 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.

Semester III
BVPC 314: Indian drugs Regulatory Guidelines

COURSE OBJECTIVES:
To make the students familiar with base principle of Laboratory & research practical as well as new drug development in human.

Unit-1
Good laboratory Practice, Standard operating procedure, Standard Testing procedure, Certificate of Analysis, Method of Analysis, good receipt note.

Unit-2
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.

Unit-3
GMP, ISO 9000, TQM, ICH

Unit-4
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.

Recommended Books for the syllabi are:

1. Gary D. Christian, Analytical chemistry, John Wiley & sons N.Y., 5th Ed., 1994.
2. Indian Pharmacopoeia 2007, Volume- I, II and III.
3. International conference on harmonisation of Technical requirements for registration of pharmaceuticals for human use. ICH Harmonised tripartite guideline. Guideline for Good laboratory Practical.

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.

B. Voc. Pharmaceutical Chemistry
Semester III
BVPC 315: **Basic Computer Applications**

COURSE OBJECTIVES:
To make student learn proper usage of computers for preparing documents, conduct simple calculations and provide pictorial representation of data.

Unit – 1
Computer Fundamentals: MS-Office, Networking and Internet

Unit – 2
MS-Word

Preparation of documents that include text, tables, figures, calculation steps and formatting of such documents

Unit – 3
MS-Excel
To perform calculations for Chemical Kinetics (Zero and first order), Area under curve, solubility, buffers, Filtration, acid-base titration, oxidation-reduction (Preparation graphs)

Unit – 4
Power point presentations

Reference books:

1. "Computers Today" by Senders D.H., Tata Mc. Graw Hill.
2. "Computer fundamentals" by P.K. Sinha, Third edition, BPB Publication.
3. "Information technology", Jaiswal, S., Galgotia Pub.
4. Manuals for MS DOS, MS Office, MS Windows, UNIX.
5. "Office 2000/2003 Complete", BPB Publication.
6. "Internet basic reference A to Z", by Falk B., BPB, Delhi
7. "Operating System" by Stallings, PHI.
8. "Computers in Pharmacy" by Thakur P.S., Manchamda R.Nand P; Birla Pub. Pvt. Ltd.
9. "Programing in ANSI-C by E. Balaguruswamy – Tata Mc. Graw Hill.
10. "Computer Networks" by Tenenbaum A.S., Prentice Hall of India.
11. "Programing with C" by Byron Gottfield.

B. Voc. Pharmaceutical Chemistry
Semester III
BVPC 316: Practical

(Any ten experiments or group of experiments each of three hours duration from the followings)

8. To perform the assay of aspirin.
9. To demonstrate Karl Fischer apparatus.
10. To find out the concentration of give acid solution by potentiometer.
11. To determine the content of sulfamethizole (from table) by potentiometer.
12. To find out the concentration of given acid solution by pH meter.
13. To determine the dissociation constant of given acetic acid solution pH metry.
14. To find out the concentration of given acid solution by using conductometer.
15. Introduction and detailed demonstration to various synthetic techniques and apparatus used in that technique.
16. Heating and cooling methods, distillation, reaction work-up, filtration, extraction, purification, identification.
17. Introduction to the use of stereo models.
18. Introduction to instrumental technique (3-4).
19. To study and demonstration of paper chromatography.
20. To study and demonstration of TLC.
21. To perform the paper chromatography of given sample.
22. To perform the TLC of given sample.
23. To estimate nitrogen content by kjeldahl's method.
24. To validate the different apparatus and instrument.
25. To study nitration reaction by synthesis of drug.
26. To study bromination reaction by synthesis of drug.
27. To study friedel craft alkylation reaction by synthesis of drug.

28. To study friedel craft acylation reaction by synthesis of drug.
29. Determination of bulk density, tapped density, Carr's index and Hausner's ratio of given powder samples.
30. Determination of angle of repose of given powder sample.
31. Determination of concentration of given samples using colorimetry.
32. To synthesize acetanilide from aniline.
33. To synthesize p-bromo acetanilide from acetanilide.
34. To synthesize p-bromo aniline from p-bromo acetanilide.
35. To synthesize benzoic acid from benzamide or phenyl benzoate.
36. To synthesize Benzamide from from benzoyl chloride.

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 411: Foundation Course (English)

(Sikkim University approved syllabi for Foundation Course (English))

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 412: Microbiology

COURSE OBJECTIVES:
1. This course will cover topics in the history of microbial morphology and physiology, bacterial metabolism, genetics, and the classification of microorganisms.
2. This course will increase your awareness and appreciation for microscopic organisms in your environment and their relationships to humans in health and disease.
3. This course will also provide you with tools for a better understanding of microbial pathogenesis, means of control and treatment.

Unit-1
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.

Unit-2
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.
D. Validation of aseptic room.

Unit-3
Preservative efficacy, Microbial assay of antibiotics and vitamin B12
Unit-4
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.

Recommended books for the syllabi are:

1. G.gunnz & S.J. Carter "cooper & gunn's tutorial Pharmacy", 6th ed., pitman medical publishing co. London 1972.
2. W.B. Hugo and A.D Russell "Pharmaceutical Microbiology", Blackwell scientific publication,oxford,1987.
3. "Microbiology"- Davis, Duldecco, Eisen.

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.

B. Voc. Pharmaceutical Chemistry
Semester IV
BVPC 413: Advanced Analytical chemistry-II

COURSE OBJECTIVES:
1. Understand basic principles instrumental analysis of drugs and drug products.
2. Know basic principles of advance chromatographic analysis.
3. Know theoretical interpretation of the analytical results.

Unit-1
HPLC
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.

Unit-2
HPTLC
Introduction, HPTLC, Quantitation-scraping and elution, visual comparison, area management, desitometry and thermal method, applications and recent advancement.

Unit-3
GC
Introduction, principles of Gas- Chromatography, instrumentation, columns and stationary phases, qualitative and quantitative applications in pharmaceuticals.

Unit-4
Analytical method development & Validation protocol preparation

Method Optimization, Accuracy, precision, linearity, specificity, system suitability, robustness.

Recommended Books for the syllabi are

1. Principles of Instrumental analysis, Skoog, Hollar and Nieman, Saunders college Publishers, Philadelphia.
2. Munson JW, High performance liquid chromatography: theory, instrumentation, and pharmaceutical applications in, pharmaceutical analysis modern methods part B, New York, Marcel Dekker.
3. Pharmacopoeia: USP,B.P. IP.

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.

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 414: Medicinal Chemistry-I

COURSE OBJECTIVE:

To learn the structure, structure activity relationship, physicochemical properties and therapeutic uses of drugs belonging to various therapeutic classes.

Unit –1

a) **Steroids:** Introduction, Nomenclature, Stereochemistry, simple reactions of cholesterol, classification of sterols, sex hormones, cardiac glycosides. Bile acids, sapogenins.

Unit-2

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.

Unit –3

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 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.

Unit-4

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).

Recommended Books for the syllabi are:

1. Wilson and Gisworld's textbook of Organic, medicinal and Pharmaceutical Chemistry, J.N Delagado and W.A.R Remers, Eds, J. Lipponcott Co Philadephia.
2. Principles of medicinal chemistry by W.C Foye, Lea & Febiger, Philadelphia.
3. Burger's Medicinal Chemistry, H.E Wolff, Ed, John Wiley & Sons, New York Oxford university press, oxford.
4. Singh and Kapoor "A text book of pharmaceutical and medicinal chemistry" Vallabh Prakashan, New Delhi.

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.

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 414: Pharmaceutics- unit operation

COURSE OBJECTIVES:

1. To study unit operations like size separation, mixing and crystallization. These unit operations have applications in manufacturing and compounding of dosage forms. Some unit operations also have applications in manufacturing of bulk drugs.
2. It is also intended to make students familiar with process control systems, industrial hazards and safety precautions.

Unit-1

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.

Unit-2

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.

Unit-3

Mixing:

- 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.

Unit-4

Crystallization:

- 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.

Recommended books for the syllabi are:

1. Perry's chemical engineer's handbook- Robert H Perry, green DW, Maloney JO McGrew- Hill Inc, New York.
2. Tutorial pharmacy by cooper & Gunn, ed SJ Carter, CBS publishers & Distributors, Delhi.
3. Pharmaceutics The science of Dosage from Design, Aulton ME Churchill Livingstone, London.

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.

6. Industrial Hazards and plant safety, Sanjoy Banerjee, Taylor and Francis, New York.

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 415: pharmaceutical Practice

COURSE OBJECTIVES:
1. To learn the structure, preparation, properties and medicinal uses of various inorganic compounds.
2. To learn the methods used to determine purity and quality of inorganic medicinal compounds.

Unit-1
- **Prescription:** definition, parts, handling, sources of errors in prescriptions, knowledge of latin terms commonly used in prescription writing and their translation into English. Modern concepts of dispensing pharmacy.
- **Compounding of medication:** Powders, tablets, Capsules, Tablet triturates, Pills, Lozenges, Ointments, Creams, Pastes, Jellies, suppositories, Suspensions, Emulsions, mixtures, sprays, Inhalations, paints, labeling of dispensed products.
- **Incompatibility:** physical, chemical and therapeutic incompatibilities and their corrections.

Unit-2
- **Community Pharmacy:** Introduction and management community pharmacy organization and structure of retail and wholesale drug store-types of drug stores and design- Legal requirements for establishment, maintenance of drug store. Dispensing of proprietary products, maintenance of records of retail and whole sale.
- **Inventory control in community pharmacy:** definition, various methods of inventory control, ABC, VED, EOQ, lead time, safety, stock.

Unit-3
- **Pharmaceutical care:** Definition and practical of pharmaceutical care. Emergency – treatment in stock, snake-bite, burns, poisoning, heart diseases, fractures, resuscitation methods. Elements of minor surgery and dressings.
- **Health education:** WHO definition, health promotion care of child, pregnant & breast feeding woman and geriatric patient, role of pharmacist in family planning, prevention of communicable diseases i.e tuberculosis, hepatitis, leprosy, AIDS, syphilis, gonorrhea.

Unit – 4
Public Health, diseases & Awareness:
Classification of food requirement, balanced diet, nutritional deficiency disorders, their treatment and prevention, specification for drinking water.
Demography and family planning: Demography cycle, family planning, various contraceptive methods, First Aid: Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

Recommended Books for the syllabi are:
1. Hoover's dispensing of medication, Mack publishing.
2. Pharmaceutical practice, By Diana M Collett and Michale E. Aulton, Elbs publishers.
3. Dispensing for pharmaceutical students, by cooper and Gunn by S.J Carter, Cbs publishers.

Reference books:
1. Joseph Barnett Sprowls, prescription Pharmacy.

2. S.J Carter, cooper and Gunn's dispensing for pharmaceutical students, Carter, 11th edition CBS Publishers.
3. N.K.jain and S.N. Sharma. The concise Pharmaceutical Dispensing. Vallabh Prakashan, Delhi.
4. N.K. Jain, Health education and Community pharmacy, CBS publishers.
5. Pharmaceutical Dosage forms and drug Delivery systems By Howard C, Ansel by Lippincott Williams & Wilkins.
6. Remington: the science and practice of pharmacy, Mac publishers.
7. Drug and Cosmetics Act and Rules by Vijay Malik.
8. A practical guide to pharmaceutical care, Roverts John p ed9et.al), American pharmaceutical Association.
9. Current dispensing practices, Nanda Arun, Vallabh Prakashan.
10. Pharmacy Practice for technicians, Ballington Don A, New Age international publication.

B. Voc. Pharmaceutical Chemistry
Semester IV

BVPC 416: Practical

(Any ten experiments or group of experiments each of three hours duration from the followings)

1. To separate and identify the given organic binary mixture (solid-solid) (Atleast 5-6 samples).
2. To study reaction monitoring by Thin Layer Chromatography (TLC).
3. To synthesize sulphanilamide from acetanilide. (step-I).
4. To synthesize phthalimide from phthalic anhydride.
5. To synthesize anthranilic acid from phthalimide.
6. To synthesize N-phenyi anthranilic acid from o-chlorobenzoic acid.
7. Date collection: Ideal slides of micro organisms (bacteria, virus, spirochaets, Ricketssia, Fungi ect.).
8. Preparation of various growth media.
9. Identification of microbes by staining techniques.
10. To study the standards of tablets as per IP 6 sums related to standards of tablets.
11. To perform weight variation tests as well as content of active ingredient test of given sample of the mefanamic acid tablet.
12. To perform assay of calcium gluconate in given sample of calcium glucanate injection as per IP.
13. To perform content of active ingredient test and weight variation for tablet of Metformin HCL.
14. To perform weight variation test and content of active ingredient test for given chloramphenicol capsule as per IP 96.
15. To demonstrate GC as analytical tool.
16. To demonstrate HPLC as analytical tool.
17. To demonstrate HPTLC as analytical technique.
18. To determine energy utilized by ball mill for size reduction process.
19. To determine particle size distribution of given sample of granules by sieving method.
20. To determine % yield of crystals in crystallization experiment under different conditions.
21. To produce crystals using different conditions of crystallization and to stay the crystal habit.
22. To study the effect of speed and time on solid liquid mixing.
23. To determine the mixing efficiency of two immiscible liquid using variable speed propeller mixer.
24. To determine mixing index of a given powder mixture using double cone blender.
25. To determine the rate of mixing of solid in liquid using a magnetic stirrer at different speeds.
26. Demonstration of following instruments:

a. Hammer mill
b. Jaw crusher.

27. Demonstration of following instruments:

a. Vibrating (oscillating) sifter.
b. Double cone mixer.
28. Demonstration of pyrogen test.
29. To study the effect of filter aid on sedimentation rate and to determine optimum concentration of filter aid.
30. To determine humidity and % humidity of air wet bulb-dry bulb method.
31. To determine humidity and % humidity of air using dew point method.
32. To isolate volatile oil of given plant drug using distillation method.
33. To determine % of volatile oil in given plant drug using clavenger's apparatus.
34. To determine mixing index for blending given power using laboratory mixer.
35. To determine the % of acetic recovered from mixture of Benzene and Acetic acid using water as an extracting agent.
36. To determine the average particle size & to study particle size distribution using standard sieve method for given powder substance.
37. To study the efficiency of single and multiple extraction

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 511: Foundation Course (Environmental Studies)

(Sikkim University approved syllabi for Foundation Course (Environmental Studies))

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 512: Advanced Analytical chemistry-III

COURSES OBJECTIVES:
1. To understand basic principles of instrumental analysis of drug and drug products.
2. To know basic principle of spectrophotometry and chromatographic analysis.
3. To know theoretical interpretation of the analytical results

Unit-1
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.

Unit-2
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.

Unit-3
Molecular Luminescence spectroscopy:
Theory of fluorescence and phosphorescence, factors affecting the intensity of chemiluminescence's, instrumentation and analytical applications and recent advancement.

Unit-4
Molecular Absorption spectroscopy:

Theory, aspects basic instrumentation, elements interpretation of spectra, and applications of Absorption spectroscopy.

Recommended Books for the syllabi are:

1. Applications of Absorption spectroscopy of Organic compounds J.R Dyer, Prentice hall, London.
2. Organic spectroscopy, W. Kemp, 3rd Ed, ELBS publication, NY,1991.
3. Spectroscopic identification of organic compounds. R.M Silverstein, G.C. Bassler ,TC. Morrill pub. John Wiley and Sons, NY.

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 513: pharmacology-I

COURSE OBJECTIVES:

1. To learn general concepts how the drug produces effect and what factors can contribute in producing the drug effects.
2. To learn the mechanism of action, pharmacological effect, pharmacokinetics, adverse effects, therapeutic application of various classes of drugs.

Unit-1

- **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.

Unit-2

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.

Unit-3

Pharmacology of Respiratory System:

Drugs used in treatment of Bronchial asthma, Dry cough, COPD 9also Mucolytics, Expectorants, Antitussives).

Unit-4

Pharmacology of Nitric oxide, endothelins, ANP, purines.

Recommended Books for the syllabi are:

1. Pharmacognosy Basis of Therapeutics by Goodman & Gillman
2. Pharmacology and pharmacotherapeutics by Satoshkar& 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. 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.

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 514: Introduction to Drug Delivery System

COURSE OBJECTIVE:
To get acquaint knowledge of newly formed drug molecules of various types.

Unit1
Immediate Release Novel Dosage Forms:
Fast dissolving tablets including effervescent tables, mouth dissolving table, oral films.

Unit-2
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.

Unit-3
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.

Unit- 4
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.

Recommended Books for the syllabi are:
1. Modern pharmaceutics, G.S Banker and C.T Rhodes, Marcel Dekker, inc, New York.
2. Controlled Drug Delivery: J.R. Robinson and V.H. Lee. Marcel Dekker, New York.
3. Novel Drug Delivery System, Y.W Chien, Marcel Dekker, Inc New York.

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.

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 515: Medicinal Chemistry-II

COURSES OBJECTIVES:
The course is designed to make students familiar with the principles of medicinal chemistry as applied to pharmaceuticals and to study the synthetic approaches and structure activity relationship of different therapeutic class of drugs.

Unit-1
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).

Unit-2
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).
c. Antiseptics and Disinfectants.

Unit-3
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).

Unit-4
Combinatorial chemistry: Introduction, principle, importance of new drug discovery, various synthetic approaches and library purification, HTS.

Recommended Books for the syllabi are:
1. Wilson and Gisworld's textbook of organic, Medicinal and pharmaceutical Chemistry, J.N. Delagado and W.A.R.Rembers, eds, J. Lipponcott Co. Philadephia.
2. Principles of Medicinal Chemistry by W.C. Foye, Lea & Febiger, Philadelhia.
3. Burger's Medicinal Chemistry, H.E. Wolff, ed. John Wiley & Sons. New York Oxford University Press, Oxford.
4. Strategies for Organic Drug Synthesis & design by Danial Lednicer, john Wiley & sons, USA.

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.

B. Voc. Pharmaceutical Chemistry
Semester V

BVPC 516: Practical

(Any ten experiments or group of experiments each of three hours duration from the followings)

1. Organic spotting of binary mixtures 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.
7. To interpret the given IR spectra(chelical + drug).
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.
15. To study the effect of quenching on quinine sulphate by KI.
16. To determine dissociation constant (pKa) of indicator by using UV-visible spectrophotometer.
17. Disinfection, sanitation and work practices.
18. Skin analysis.
19. Physical examination of hormonal solutions, steroids and flavons.
20. Vitamin assay.
21. Surface tension of cosmetics.
22. Introduction to Experimental Pharmacology.
23. To study basic instruments used for isolated tissue experiments.
24.

A. To study different laboratory animals.
B. Introduction to CPCSEA its construction and its function (CPCSEA guidelines)

25. To study various methods of euthanasia.
26. To study various methods of anesthesia & method of disposal of animals.
27. Demonstration of mounting of isolated rat ileum.
28. To study PD_2 value of Ach/Histamine using rat/G.pig ileum using simulation software.
29. To study dose ratio of Carbachol/ Ach & Physostigmine/ Ach using rat ileum using simulation software.
30. To study PA_2 value of Atropin/Mepyramine using rat/G.pig ileum using simulation software.
31. To find out nature of unknown drug using rat ileum using simulation software.
32. To study the effect of various drugs acting on neuromuscular junction using simulation software (Computer Assisted Experiment).
33. To study the effect of various drugs on cat nictating membrane (Computer Assisted Experiment).
34. Physical examination of hormonal solutions, steroids and flavons.

35. To determine surface tension of prepared herbal cosmetics.
36. Detection and identification of proteins & amino acids.
37. Detection and identification of carbohydrates.
38. Detection and identification of Lipids.
39. Analysis of normal and abnormal constituents of urine.

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC 611: Foundation Course (Eastern Himalayan Studies)

(Sikkim University approved syllabi for Foundation Course (Environmental Studies))

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC 612: Medical chemistry-III

COURSRS OBJECTIVES:
To learn the structure, Structure activity relationship, Physiochemical properties and drug design and docking of drug.

Unit-1
Drug design
Analogues and prodrug concept, Concept of lead, Rational approach to drug design, Overview of drug design and development, Tailoring of drug.

Unit-2
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.

Unit-3
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.

Unit-4
QSAR
Lipophilic, electronic and stearic parameters, Hansch Linear Free Energy Relationship (LFER) model of QSAR. Free Wilson Mathematical Model of QSAR.

Recommended Books for the syllabi are:

1. Wilson and Giswold's Textbook of Organic, Medicinal and Pharmaceutical Chemistry, J.N Delagado and W.A.R Remers Eds.J. Lipponcott Co. Philadephia.
2. Principles of Medicinal Chemistry by W.C Foye, Lea & Febiger, Philadelphia.
3. Burger's Medicinal Chemistry, H.E Wolff, Ed. John Wiley & Sons, New York Oxford University Press, Oxford.

4. Singh and Kapoor " A Text Book of Pharmaceutical and Medicinal Chemistry" Vallabh Prakashan, New Delhi.

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.

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC 613: Advanced Analytical Chemistry-IV

COURSE OBJECTIVES:

1. To make student learn the basic principles of various assay techniques commonly used in quality control department of any pharmaceutical industry.
2. To provide the hands on experience by actually conducting these assays in the lab.

Unit-1

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.

Unit-2

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.

Unit-3

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.

Unit-4

Introduction to GCMS, LCMS, ICPMS. Structure determination using IR, NMR, Mass spectroscopy

Recommended books for the syllabi are:

1. Spectroscopic identification of Organic Compounds, Sliverstein, R.M, Bassler, G.C & Morrill, T.C.
2. Spectroscopy of Organic Compounds, P.S Lalsi, New Age International Lyd.

3. D.A Skoog, F.J Holler, S.R Crouch, Principles of instrumental A nalysis, Thomson coporation, 6th Ed, 2007.
4. Gary D. Christen, Analytical Chemistry handbook, McGrew hill inc,1st ed,1995.

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.

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC 614: Pharmacology –II

COURSES OBECTIVES:

To learn the mechanism of action, pharmacological effects, pharmacokinetics, adverse effects, therapeutic application of various classes of drugs with special attention to drugs acting on cardiovascular, urinary, gastrointestinal system.

Unit –1

Pathophysiology and Drugs used in:

Congestive Cardiac Failure, Angina, Myocardial Infarction, Cardiac Arrhythmias, hypertension, Hyperlipidemia and Atherosclerosis, Anemia, Coagulation disordes, Shock.

Unit- 2

Drugs Acting on Urinary System.

Fluid and electrolyte balance, Diuretics, Anti diuretics, Urine acidifying and alkalinizing agents.

Unit-3

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.

Unit-4

Concepts of RIA, Radioligand Studies, ELISA.

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.

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC 615: Entrepreneurship Development

COURSE OBJECTIVE:
The objective of the course is to equip the students with knowledge on entrepreneurial development, creativity and skills essential for business plan development.

Unit-1
Introduction
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.

Unit-2
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.

Unit-3
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.

Unit-4
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**.**

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.

B. Voc. Pharmaceutical Chemistry
Semester VI

BVPC-616: Industrial Training/Project/Internship

COURSE OBJECTIVE:
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 viva-voce to be conducted in 6th Semester. Internship Report: 150 marks, Viva-voce: 50 marks).*