

COURSE STRUCTURE
B. PHARM. FIRST YEAR

S. No.	Code	Theory Course	Hrs/Week	Exam Hrs.	E.A.	I.A.	Total Marks
1	BPM-101	Pharmaceutical Chemistry - I [Inorganic Chemistry]	2	3	70	30	100
2	BPM-102	Pharmaceutical Chemistry–II [Analytical Chemistry]	2	3	70	30	100
3	BPM-103	Pharmaceutical Chemistry–III [Organic Chemistry-I]	2	3	70	30	100
4	BPM-104	Pharmaceutics - I [General Pharmacy]	2	3	70	30	100
5	BPM-105	Mathematics	2	3	70	30	100
	OR						
	BPM-106	Biology	1	3	40	10	50
6	BPM-107	Pharmacology - I [Human Anatomy & Physiology]	2	3	70	30	100
8	BPM-108	Pharmaceutics - II [Computer Applications]	2	3	70	30	100
9	BPM-109	Environmental Studies	1	3	50	25	75

S. No.	Code	Practical Course	Hrs/Week	Exam Hrs.	E.A.	I.A.	Total Marks
10	BPM-110	Pharmaceutical Chemistry - I [Inorganic Chemistry]	3	4	70	30	100
11	BPM-111	Pharmaceutical Chemistry–II [Analytical Chemistry]	3	4	70	30	100
12	BPM-112	Pharmaceutical Chemistry–III [Organic Chemistry-I]	3	4	70	30	100
13	BPM-113	Pharmaceutics - I [General Pharmacy]	3	4	70	30	100
14	BPM-114	Biology	2	4	40	10	50
15	BPM-115	Pharmacology - I [Human Anatomy & Physiology]	3	4	70	30	100
16	BPM-116	Pharmaceutics - II [Computer Applications]	3	4	70	30	100
17	BPM-117	Environmental Studies	1	2	20	05	25
18	BPM-118	Professional Communication	2	4	70	30	100

E.A. --- Marks for External Assessment

I.A. --- Marks for Internal Assessment

Note:- 105 is for students with PCB at class XII level.

106 and BPM-114 are for the students with PCM at class XII level.

B. PHARM. SECOND YEAR

S. No.	Code	Theory Course	Hrs/Week	Exam Hrs.	E.A.	I.A.	Total Marks
1.	BPM-201	Pharmaceutical Chemistry – IV [Physical Chemistry – I]	2	3	70	30	100
2.	BPM-202	Pharmaceutical Chemistry – V [Physical Chemistry - II]	2	3	70	30	100
3.	BPM-203	Pharmaceutical Chemistry–VI [Pharmaceutical Analysis-I]	2	3	70	30	100
4.	BPM-204	Pharmaceutical Chemistry – VII [Organic Chemistry - II]	2	3	70	30	100

5.	BPM-205	Pharmaceutics - III [Pharmaceutical Microbiology]	2	3	70	30	100
6.	BPM-206	Pharmaceutics - IV [Pharmaceutical Engineering Operations]	2	3	70	30	100
7.	BPM-207	Pharmacognosy - I	2	3	70	30	100
8.	BPM-208	Pharmacology - II	2	3	70	30	100

S. No.	Code	Practical Course	Hrs/ Week	Exam Hrs.	E.A.	I.A.	Total marks
9.	BPM-209	Pharmaceutical Chemistry – IV [Physical Chemistry - I]	3	4	70	30	100
10.	BPM-210	Pharmaceutical Chemistry – V [Physical Chemistry - II]	3	4	70	30	100
11.	BPM-211	Pharmaceutical Chemistry–VI [Pharmaceutical Analysis-I]	3	4	70	30	100
12.	BPM-212	Pharmaceutical Chemistry – VII [Organic Chemistry - II]	3	4	70	30	100
13.	BPM-213	Pharmaceutics - III [Pharmaceutical Microbiology]	3	4	70	30	100
14.	BPM-214	Pharmaceutics - IV(A) [Pharmaceutical Engineering Operations]	3	4	70	30	100
15.	BPM-215	Pharmaceutics - IV (B) [Pharmaceutical Engineering Drawing]	3	4	70	30	100
16.	BPM-216	Pharmacognosy - I	3	4	70	30	100
17.	BPM-217	Pharmacology - II	3	4	70	30	100

B.Pharm Third Year

S. No.	Code	Theory Course	Hrs/ Week	Exam Hrs.	E.A.	I.A.	Total marks
1	BPM-301	Pharmaceutical Chemistry–VIII [Pharmaceutical Analysis-II]	2	3	70	30	100
2	BPM-302	Pharmaceutical Chemistry–IX [Medicinal Chemistry - I]	2	3	70	30	100
3	BPM-303	Pharmaceutical Chemistry –X [Heterocycles, Carbohydrates, Proteins & Nucleic Acid]	2	3	70	30	100
4	BPM-304	Pharmaceutical Chemistry - XI [Biochemistry]	2	3	70	30	100
5	BPM-305	Pharmaceutics - V [Physical Pharmacy]	2	3	70	30	100
6	BPM-306	Pharmaceutics - VI [Formulation Techniques and Cosmeticology]	2	3	70	30	100
7	BPM-307	Pharmacognosy - II [Natural Products]	2	3	70	30	100
8	BPM-308	Pharmacology - III [Pathophysiology and Toxicology]	2	3	70	30	100
9	BPM-309	Pharmacology - IV	2	3	70	30	100

S. No.	Code	Practical Course	Hrs/ Week	Exam Hrs.	E.A.	I.A.	Total marks
10	BPM-310	Pharmaceutical Chemistry–VIII [Pharmaceutical Analysis - II]	3	4	70	30	100

11	BPM-311	Pharmaceutical Chemistry- IX	3	4	70	30	100
12	BPM-312	Pharmaceutical Chemistry – X [Heterocycles,Carbohydrates, Proteins & Nucleic Acid]	3	5	70	30	100
13	BPM-313	Pharmaceutical Chemistry - XI [Biochemistry]	3	5	70	30	100
14	BPM-314	Pharmaceutics - V [Physical Pharmacy]	3	5	70	30	100
15	BPM-315	Pharmaceutics - VI [Formulation Techniques and Cosmeticology]	3	5	70	30	100
16	BPM-316	Pharmacognosy - II [Natural Products]	3	5	70	30	100
17	BPM-317	Pharmacognosy - III [Plant Collection Tour]	-	3	-	-	50
18	BPM-318	Pharmacology - IV	3	5	70	30	100
E.A.		---	Marks for External Assessment				

B.PHARM. FOURTH YEAR

S. No.	Code	Theory Course	Hrs/Week	Exam Hrs.	E.A.	I.A.	Total marks
1	BPM-401	Pharmaceutical Chemistry – XII [Medicinal Chemistry - II]	2	3	70	30	100
2	BPM-402	Pharmaceutical Chemistry – XIII [Medicinal Chemistry - III]	2	3	70	30	100
3	BPM-403	Pharmaceutics - VII [Pharmaceutical Management]	2	3	70	30	100
4	BPM-404	Pharmaceutics - VIII [Pharmaceutical Technology]	2	3	70	30	100
5	BPM-405	Pharmaceutics – IX [Pharmacokinetics & Biopharmaceutics]	2	3	70	30	100
6	BPM-406	Pharmaceutics - X [Pharmaceutical Jurisprudance]	2	3	70	30	100
7	BPM-407	Pharmacology – V [Clinical Pharmacology]	2	3	70	30	100
8	BPM-408	Pharmacognosy - IV [Pharmaceutical Biotechnology]	2	3	70	30	100

S. No.	Code	Practical Course	Hrs/Week	Exam Hrs.	E.A.	I.A.	Total marks
9	BPM-409	Pharmaceutical Chemistry –IX, XII & XIII [Medicinal Chemistry-I, II & III]	3	5	70	30	100
10	BPM-410	Pharmaceutics - VIII [Pharmaceutical Technology]	3	5	70	30	100
11	BPM-411	Pharmaceutics - IX [Pharmacokinetics & Biopharmaceutics]	3	5	70	30	100
12	BPM-412	Pharmacology - V [Clinical Pharmacology]	3	5	70	30	100
13	BPM-413	Pharmacognosy - IV [Pharmaceutical Biotechnology]	3	5	70	30	100
14	BPM-414	Pharmaceutics - X [Industrial Tour]	0	3	-	-	50

BPharm Ist Year

THEORY

BPM – 101

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

PHARMACEUTICAL CHEMISTRY – I [INORGANIC CHEMISTRY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

NOTE: Topics 3-11 will be treated covering **ONLY** an outline of methods of preparation, test for identity and purity including limit test, chemical properties, assay procedures and Pharmaceutical uses.

UNIT – I

1. Review of electronic structure of atom, periodic classification and group properties of elements.
2. Impurities in Pharmaceutical substances and their control.
3. **Pharmaceutical aids and necessities:** Acids and bases (Sodium hydroxide, Phosphoric acid), buffers, antioxidants (Sodium metabisulphite), water (Purified water, water for injection and sterile water for injection) and pharmaceutically acceptable glass.

UNIT – II

4. **Major intra and extra cellular electrolytes:** Major physiological ions, electrolytes used in replacement therapy, Physiological acid-base balance, electrolytes used in acid base therapy, electrolyte combination therapy (calcium chloride, Calcium gluconate, calcium lactate, Calcium levulinate, sodium dihydrogen phosphate, Sodium acetate, sodium bicarbonate, sodium chloride, Potassium chloride, Magnesium chloride).
5. **Essential and trace elements:** Copper, Zinc, Chromium, Manganese, Molybdenum, Selenium, Sulphur and Iodine. Iron and haematinics (Ferrous fumarate, Ferrous gluconate, Ferrous sulphate, Ferric ammonium citrate).

UNIT – III

6. **Gastrointestinal agents:** Acidifying agent (Dilute hydrochloric acid), antacids (Bismuth subcarbonate, Aluminium hydroxide, Calcium carbonate, Magnesium hydroxide, Magnesium {Light and Heavy}, Magnesium carbonate {Light and Heavy}, Magnesium trisilicate), protective and absorbents (Activated Charcol, Light Kaolin, Aluminum sulphate), cathartics (Disodium hydrogen phosphate, magnesium sulphate and other magnesium compounds).
7. **Topical agents:** Protectives (Calamine, Titanium dioxide, Talc, Kaolin), antimicrobials and astringents (Zinc oxide, Zinc sulphate, Boric acid, Hydrogen peroxide, Iodine, Povidone iodine, potassium permanganate, silver nitrate).

UNIT – IV

8. **Dental Products:** Anticaries agent and dentifrices (Sodium fluoride).
9. **Nuclear Chemistry:** Nuclear composition, forces and stability, isotopes, measurement of radioactivity, modes of decay, half life period, artificial radioactivity, application in Pharmacy, Radiopharmaceuticals, Radiopharmaceutical preparations and radio-opaque contrast media.

UNIT – V

10. **Co-ordination compounds and complexations:** study of such compounds used in poison therapy (antidotes).
11. **Miscellaneous Inorganic Pharmaceutical Agents:** inhalants (oxygen), respiratory stimulants, expectorants (Ammonium chloride, Potassium iodide), emetics, anesthetics (nitrous oxide).

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. J. H. Block, E. Roche, T. O. Soine and C.O. Wilson. “Inorganic Medicinal and Pharmaceutical Chemistry”. Lea & Febiger, Philadelphia, PA, USA.
2. L. M. Athorton, Bantley and Drivas. “Text Book of Pharmaceutical Chemistry”. Oxford University Press, Delhi.
3. “Indian Pharmacopoeia”. Vol. I & II, Ministry of Health, Government of India (Latest Edition).

4. A. H. Beckett and J. B. Stenlake. "Preactical Pharmaceutical Chemistry". Part – I, The Athlons Press, University of London, London.
5. C A Discher et. al. "Modern Inorganic Chemistry". Waveland Press.

THEORY

BPM – 102

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.** 3 hrs

PHARMACEUTICAL CHEMISTRY – II [ANALYTICAL CHEMISTRY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Accuracy and Precision. Expressing the accuracy and precision- error, relative error, deviation, mean deviation, relative mean deviation, standard deviation, relative standard deviation, variance, coefficient of variation.
2. **Classification of errors:** Systematic errors, Random errors and Mistakes, Additive and proportionate errors. Minimization of errors.
3. Significant figures, Rejection Quotient test, method of least squares.
4. Numerical problems related to the above topics.

UNIT – II

5. Concept of Mol, g-atom, g-ion, g-formula weight and g-equivalent. Concept of Oxidation-reduction, Oxidation number, balancing equation and reactions of commonly used oxidizing-reducing agents, equivalent weight of acids and bases, equivalent weight of oxidizing and reducing agents. Law of equivalence as the basis of acid-base titrations and redox titrations.
6. **Standard solutions:** Expressing the concentration or strength of solutions in Percentage, g/ L, Normality, m.eq./ml, molarity, formality, molality, mole fraction and in ppm. Expressing the concentration of H₂O₂ solutions. Concentrations of gases in liquids. Expressing the percentage of SO₃ in Oleum.
7. Numerical problems related to the above topics.

UNIT – III

8. Arrhenius theory for electrolytic dissociation in solutions. Concepts of Acids and Bases, Role of Solvent in deciding the acid-base nature, Common ion effect, Ionic

product of water, pH, Buffers, Henderson-Hasselbalsch equation, Hydrolysis of salts.

9. Different types of Acid – Base titrations (Strong acid – Strong base, Strong acid – Weak base, Weak acid – strong base, and Weak acid–weak base). Neutralization curves for these titrations.
10. Acid – Base indicators, choice and theory of these indicators.
11. Multi-step equilibrium, Polyprotic, Polyamine and amino acid systems. Application of acid base titrations in pharmacy particularly assay of NaOH, CaCO₃ and Na₂CO₃.

UNIT – IV

12. **Redox titrations:** Oxidation-reduction curves, Iodometry and Iodimetry. Titrations involving Ceric sulphate, potassium iodate, and potassium bromate, Potassium permanganate, Potassium dichromate. Redox indicators (Internal, External and self indicators).
13. **Solubility:** Factors influencing the solubility of solids in liquids, effect of temperature, solvent, hydrogen bonding, common ion effect & the reaction of solute with another substance like acids. Solubility product. Ionic product. Relation between solubility and solubility product. Relation between Solubility, Solubility product and common ion effect Conditions for the formation of precipitate.
14. **Precipitation titrations:** Preferential adsorption theory. Functioning of Adsorption indicators. Mohr's method, Fajan's method and Volhard's method.

UNIT – V

15. **Gravimetric Analysis:** Precipitation technique related to solubility product. Elementary idea of Colloidal state. Super saturation, Co-precipitation and Post precipitation. Digestion, washing of precipitate, Filtration, Filter papers and crucibles, Ignition of precipitate. Thermo-gravimetric curves.
16. Specific examples like estimation of barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate, Organic precipitants.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. K.A. Connors. "A Text Book of pharmaceutical Analysis". Willey Intescience.

2. J. Mendham, R.C.Denny, J.D. Barnes, M. Thomas and G.H. Jeffery. "Vogel's Text Book of Quantative Chemical Analysis". Pearson Education Asia.
3. A.H. Beckett and J.B. Stenlake. "Practical Pharmaceutical Chemistry". Vol. I & II. The Atherden Press of the University London.
4. "British Pharmacopoeia", Her majesty's Stationary Office, University Press, Cambridge.
5. V. Alexeyev. "Quantitative Analysis". CBS Publishers & Distributors, New Delhi.

THEORY

BPM – 103

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

PHARMACEUTICAL CHEMISTRY – III [ORGANIC CHEMISTRY – I]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Structure and Properties:** Covalent bonding, Hybridization, Multiple bonds. Electronegativity, dipole moment, inductive and field effects. Bond lengths, bond angle and bond energies. Delocalization, hyperconjugation, tautomerism. Hydrogen bonding. Organic acids and bases.
2. **Stereochemistry (Basic Concepts only):** Optical activity, chirality, enantiomers, diastereomers, D/L and R/S nomenclature. Racemic mixture and resolution. Geometrical isomerism.

UNIT – II

3. **Alkanes:** Nomenclature, physical properties, industrial source and preparation. Halogenation, combustion and pyrolytic reactions.
4. **Cycloalkanes:** Nomenclature, Physical properties, Industrial source and preparation. Bayer's strain theory, Conformations of cyclohexane.
5. **Alkenes, Dienes and Alkynes:** Nomenclature, physical properties, industrial source, preparation and addition reactions. Polymerization of dienes. Acidity of alkynes.

UNIT – III

6. **Alcohols, Alkyl Halides and Ethers:** Nomenclature, General methods of preparation, physical properties, chemical reactions.

7. **Aliphatic nucleophilic substitution:** S_N^1 , S_N^2 mechanisms. Hydrolysis of esters.

UNIT – IV

8. **Addition to carbon/carbon and carbon/hetero multiple bonds:** Electrophilic, nucleophilic and free radical addition to carbon-carbon multiple bonds. Michael, Mannich, Grignard, Reformatsky, Wittig and Perkin reactions. Aldol, Knoevengal and Banzoin condensations.
9. **Elimination Reactions:** E1, E2, mechanisms, Saytzeff and Hoffman rules.

UNIT – V

10. **Aldehyde and Ketones:** Structure, nomenclature, physical properties, industrial source, preparation and reactions. Acidity of hydrogens.
11. **Active methylene compounds:** Ethyl acetoacetate – synthesis and applications in organic synthesis.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. R.T. Morrison and R.N. Boyd. "Organic Chemistry", Allyn and Bacon, Inc., Boston, USA.
2. I.L. Finar. "Organic Chemistry", Vol. I and II, The English Language Book Society.
3. P. Sykes. "A Guidebook to Mechanisms in Organic Chemistry", Orient Longman, New Delhi.
4. J. March. "Advanced Organic Chemistry-Reaction, Mechanisms and Structure". Wiley Eastern, New Delhi.
5. S. Pine. "Organic Chemistry", McGraw Hill, 1987.

THEORY

BPM – 104

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam:** 3 hrs

PHARMACEUTICS – I [GENERAL PHARMACY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Introduction:** Origin and development of pharmacy, scope of Pharmacy, Pharmaceutical literature, official books and their importance with special reference to I.P., B.P., U.S.P. and International Pharmacopoeia, various professional bodies and their impact on Pharmacy.
2. **Major categories of Formulations:** Types of Liquid, solid and semi solid dosage forms. Physical and chemical characteristics of drugs influencing their formulations.
3. **Metrology:** Introduction, units of weight and volume in both imperial and metric system. Simple calculations involved in preparing solutions of solids in liquids based on imperial and metric systems, method of allegation.

UNIT – II

4. **Solutions:** Formulation considerations, dispensing problems including preservation. Stability and quality control testing. Official pharmaceutical solutions, product for oral and topical use including syrups, glycerin, drops and aromatic waters.
5. **Emulsions:** Types, identification, selection of emulgents, preparing (with special reference to Official preparations) and stability.
6. **Suspension and Mixtures:** Practical considerations, preparation of products of different categories, evaluation, stability, official suspensions.

UNIT – III

7. **Extraction:** Various methods of extraction namely maceration, percolation. Various factors affecting selection of extraction process. Various extractives namely infusions, decoctions, tinctures, liquids, soft and dry extract.
8. **Tablets:** Brief introduction to tablet processing, methods of granulation, compression on single punch machine only, elementary knowledge of quality control test excluding details of testing equipment.

UNIT – IV

9. **Capsules:** Advantages and disadvantages of capsule dosage form. Materials for production of hard gelatin capsule. Soft gelatin capsule and methods of their manufacture. Nature of capsule shell and capsule content. Importance of base

adsorption and minimum per gm factors in soft gelatin capsules. Quality control of capsules.

10. **Surgical Dressings:** Brief introduction to surgical dressings, sutures and ligatures, natural sutures, absorbable and non-absorbable sutures, manufacturing and quality control.

UNIT – V

11. **Suppositories:** Suppository bases, selection of ideal base, factors affecting drug absorption from rectal suppositories, preparation of suppositories, testing, problems of stability and packing.
12. **Incompatibility:** Physical, chemical and therapeutical implication, illustrative examples and preventive measures, Intravenous admixtures, conflicting reports on compatibility, compatibility of drugs combined in syringe.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. Remington-“The science and Practice of Pharmacy”, Mack Publishing Company, USA.
2. J.W. Copper & G. Gunn. ‘Tutorial Pharmacy’ Pitman Books Ltd. London.
3. J.R. Carter. “Dispensing for Pharmaceutical Students”, 12th Edition, CBS Publishers & Distributions. New Delhi
4. “Bentley’s Text Book of Pharmaceutics”, ELBS Bailliere Tyndal and Cox, London.
5. L. Lachman, H.A. Liberman and J.L. Kanig. “Theory and Practice of industrial Pharmacy”, Varghese Publishing House, Hind Rajasthan Building, Dadar, Bombay – 400014.
6. M.E. Aulton. “Text Book of Pharmaceutics”, Vol.I &II. Churchill Livingstone.
7. United state Pharmacopoeia (National Formulary).
8. “Indian Pharmacopoeia”. Vol. I & II, Ministry of Health, Government of India (Latest Edition).
9. “British Pharmacopoeia”, Her majesty’s Stationary Office, University Press , Cambridge.

THEORY BPM – 105

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

MATHEMATICS

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Algebra:** Arithmetic, geometric & harmonic progressions, evaluation of Σn , Σn^2 and Σn^3 (Elementary treatment only)
2. **Trigonometry:** Measurement of angle, trigonometrical ratio of sum and difference of angle, transformation formulae, trigonometrical-ratios of multiple and submultiple angles. Logarithms (Elementary treatment only).

UNIT – II

3. **Analytical plane geometry:** Cartesian coordinates system, distance between two points, area of triangle. Section formula, equation of straight line (slope intercept form, point slope form, two point slope form, intercept form).

UNIT – III

4. **Calculus:** Limit and continuity (elementary concept only), definition of differential coefficient, differential coefficient of trigonometric functions (exclusive inverse circular and hyperbolic functions), differential coefficient of – a constant and function, $\log_e x$, e^x , a^x , sum of two or more than two functions, product of two functions, quotient of two functions. Differentiating by method of substitution. Application of derivative as a rate measurer. Maxima and minima of a function of single variable. (elementary treatment only)

UNIT – IV

5. **Integration:** Integration as inverse of differentiation, indefinite integral of standard forms, integration of sum and difference of two functions. Integration by substitution and integration by parts.
6. **Differential Equation:** Formation of a differential equation, order and degree, differential equation of the first order and first degree (equation solvable by separation by the variables, linear equation of the first order), linear differential equation with constant coefficients.

UNIT – V

7. **Statistics:**

- Collection, presentation and diagrammatic representation of data, frequency distribution, measure of central tendency, standard deviation and variance (elementary only).
- Probability: Sample spaces, algebra of events, axiomatic approach to probability, finite sample spaces combinational problem.
- Test of significance: One tailed and two tailed tests, student t-test for single mean, difference between two means tests of correlation coefficient chi-square test of goodness of fit and independence of attributes, chi-square test for population variance.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. Gorakh Prasad “Differential Calculus”.
2. “Elementary Engineering Mathematics”, B. S. Grewal Khanna Publishers, Delhi.
3. Gorakh Prasad “Integral Calculus”.
4. H.C. Sexana. “Examples in Statistics”, Sexana, Atama Ran and Sons, Delhi.
5. Ayres. “Mathematics and Statistics for Pharmacy Students”.

THEORY

BPM – 106

Max. Marks: 40; **Pass percentage:** 40; **Hrs/ wk:** 2A. **Duration of Exam.** 3 hrs

BIOLOGY

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 08 marks each.

UNIT – I

1. Methods of classification of plants.

UNIT – II

2. Plant Cell: Structure and non living inclusions: mitosis and meiosis; different types of plant tissues and their functions.

UNIT – III

3. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed, Modification of root and stem.

UNIT – IV

4. General survey of animal kingdom; Structure and life history of parasites as antamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosoma, oxyuris and ancylostoma.

UNIT – V

5. General structure and life history of insects like mosquito, housefly, mites and silkworm.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. A.C. Dutta. “Botany for Degree Students”. Oxford.
2. Marshall & Williams. “Text Book of Zoology”, CBS Publishers & Distributors, New Delhi.
3. Fahn. “Plant Anatomy”, Aditya Books Private Limited, New Delhi.
4. Weiz, B.Paul . “Laboratory Manual in Science of Biology”. Mc Graw-Hill Book Company

THEORY

BPM – 107

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

PHARMACOLOGY – I [HUMAN ANATOMY & PHYSIOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt

one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

i. ANATOMY

1. Histology & Cytology

1. Cell Components (Structure and Functions)
2. Structural and functional characteristics of tissues
 - (a.) Epithelial
 - (b) Connective
 - (c) Muscle
 - (d) Nervous
3. Lymphoid organs (Structure and Functions)
 - (a) Lymph node
 - (b) Thymus
 - (c) Spleen
4. Integument (Structure and Functions)

2. Skeletal System

1. Structure (gross and microscopic), composition & functions of skeleton
2. Classification of joints
 - (a) Fibrous
 - (b) Cartilagenous
 - (c) Synovial
3. Classification of Synovial Joints
4. Types of Movements of joints
5. Joints of upper & lower limb (basic concepts)

B. PHYSIOLOGY

1. Membrane transport
2. Body compartments
3. Ionic equilibrium and resting membrane potential
4. Neuron action potential.
5. Synaptic transmission.
6. Excitation-contraction coupling (Skeletal muscles)
7. Skeletal muscle mechanics.

C. IMMUNOLOGY

1. Innate immunity
2. Acquired immunity
3. Immunoglobulins and T-Cell receptors.
4. Immunoglobulin and TCR genes.
5. Antigens and immunogens
6. Major Histocompatibility complex (MHC)
7. Lymphoid system.
8. Immune response.
9. T- cell subsets and interleukins
10. Cell mediated immunity.
11. Complement.
12. Hypersensitivity.
13. Immunodeficiency.
14. Autoimmunity
15. Regulation and tolerance.
16. Transplantation immunology.

UNIT – II

A. RENAL SYSTEM

1. Structure (Gross and Microscopic) and function of urinary tract.
2. Physiology of urine formation
3. Acid – Base balance
4. Renal processes
5. Clearance

B. DIGESTIVE SYSTEM

1. Structure (Gross and Microscopic) of GI tract.
2. GI tract secretions ; absorption & digestion of food
3. Structure (Gross and Microscopic) & Functions of Liver, pancreas & gall bladder.

4. Nutritional & Vitamin requirements.
5. Vitamin deficiencies & diseases (Basic Concepts)

UNIT – III

A. RESPIRATORY SYSTEM

1. Structure (Gross and Microscopic) Of GI tract.
2. Respiration (Mechanism & regulation).
3. Respiratory volumes and vital capacity.

B. ENDOCRINE SYSTEM

1. Structure (gross and microscopic) of Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testis & ovary – Their hormones.
2. Mechanism of Hormone Action.
3. Hypothalamic – anterior pituitary system.
4. Adrenal hormones.
5. Antidiuretic hormone & regulation of osmolarity & extracellular fluid.
6. Endocrine pancreas.
7. Growth hormone.
8. Adrenal medulla
9. Hormonal control of calcium & phosphate.
10. Thyroid hormones.

C. REPRODUCTIVE SYSTEM

1. Male reproductive System Structure (Gross and Microscopic) and functions.
2. Female reproductive System Structure (Gross and Microscopic) and functions
3. Family Planning: Contraception, medical termination of pregnancy.

UNIT – IV

A. NEUROSCIENCE

1. Peripheral Nervous System.
2. Central Nervous System(functions of different parts of brain)
3. Neurohumoral transmission in CNS
4. Spinal Cord
5. Autonomic nervous System (arrangement and functions)

6. Neurohumoral transmission in ANS
7. Cerebellum
8. Basal ganglia
9. Cerebral cortex
10. Reticular activating system
11. Limbic system
12. Hypothalamus
13. Cranial nerves and their functions
14. Electroencephalogram

B. SENSE ORGANS

1. Structure (Gross and Microscopic) and function of
 - A. Eye (Vision)
 - B. Ear (hearing)
 - C. Nose (smell and equilibrium)
 - D. Skin (Superficial receptors)
 - E. Taste buds

UNIT – V

A. CARDIOVASCULAR SYSTEM

1. Structure (gross) of heart & blood vessels & circulation.
2. Electrical activity of the heart (ECG)
3. Cardiac muscle mechanics (cardiac cycle and heart sounds)
4. Regulation of cardiac output, blood flow & blood pressure.

B. HAEMATOPOIETIC SYSTEM

1. Composition and functions of blood and its cellular components.
2. Blood groups and their significance.
3. Mechanism of coagulation.
4. Parameters for blood donors; procedure of blood collection and storage.

C. FIRST AID

Emergency treatment of

1. Shock
2. Burns

3. Poisoning
4. Fractures
5. Snake bites
6. Resuscitation methods

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. Ross & Wilson. "Anatomy and Physiology in health and Illness", Churchill Livingstone.
2. C.C. Chatterjee, Human Physiology", Medical Allied Agency, Calcutta.
3. B.D. Chaurasia. "Human Anatomy, Regional &Applied", Part I, II &III. CBS Publishers & Distributors, New Delhi.
4. C.A. Keele, E. Niel and N. Joels. "Samson Wright's Applied Physiology", Oxford University Press.
5. N.S. Parmar. "Health Education & community pharmacy", CBS Publishers, Delhi.
6. A.C. Guyton and J.E. Hall. "Text Book of Medical Physiology", WB Saunders Company.
7. G.J. Titora and N.P. Anagnodokos. "Principles of Anatomy & Physiology", Harper & Row Publishers. New Delhi.

THEORY

BPM- 108

Max. Marks: 70; Pass Percentage: 40; Hrs/ Wk: 2; Duration of Exam: 3 Hrs

PHARMACEUTICS – II [COMPUTER APPLICATIONS]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

A Simple Model of Computer, Characteristics of Computer, Problem Solving Using Computers. Representation of Characters in Computers, Representation of Integers, Representation of Fractions. **Number system:** Decimal, Binary, Octal and Hexadecimal numbers and their arithmetic; **Computer Generation and Classification:** First, Second, Third, Fourth, Fifth Generation of Computers.

UNIT- II

Programming Language: Classification machine code, assembly language, high level language, compiling a HLL Program, fourth generation languages.

Operating Systems: Need of Operating System, Type of Operating systems(single user, multi-user, batch, multiprogrammed, time sharing), Internal & external commands of MS-DOS, Features of Windows based O.S., creating, copying, deleting and renaming files/folders.

UNIT- III

Basic Features of C language: **Data types, Constants, Variables, I/O functions, Arithmetic operators, Unary operators, Relational and Logical Operators, the conditional operators, Control structures of C, Switch Statements.**

UNIT- IV

Arrays : Defining an array, processing an array, Arrays and strings.

Functions: Defining and accessing a simple function.

Pointer: Simple concept, Function using pointer type argument(s)..

UNIT- V

Computers and Communication: Types of Communication, Need For Computer Communication Networks, Internet and WWW, Use of email, search engine, types of sites.

Applications: Role of computers in Pharmaceutical Industries, Use of computers for maintaining issue & dispatch record of stocks in Pharma company inventory maintenance.

BOOKS RECOMMENDED (LATEST EDITIONS UNLESS SPECIFIED)-

1. V. Rajaraman- Fundamental of Computers (PHI), 2000.
2. B. B. Gottfried: Programming with C (TMH), 1997.
3. D. Comer, Internet and its working, Pearson Education.

THEORY

BPM – 109

Max. Marks: 50; Pass percentage: 40; Hrs/ wk: 1; Duration of Exam. 3 hrs

ENVIRONMENTAL STUDIES

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 10 marks each.

UNIT – I

1. The Multidisciplinary nature of environmental studies and eco-system
 - a) Definition, scope and importance of ecology and environment.
 - b) The ecological components
 - i. Abiotic components-soil, water light, humidity and temperature
 - ii. Biotic components and their relationships- symbiosis, mutualism, commensalisms, parasitism, predation and antibiosis.
 - c) Concept of an eco-system
 - d) Structure and function of an eco-system
 - e) Producers, consumers and decomposers.
 - f) Energy flow in the eco-system
 - g) Ecological succession
 - h) Food chain, food webs and ecological pyramids.
 - i) Introduction, types, characteristics, features, structure and function of the following ecosystem:
 - i. Forest Eco-system
 - ii. Aquatic Eco- system (ponds, streams, lakes, river, oceans, estuaries)
 - iii. Grassland Eco-system
 - iv. Desert Eco-system
 - j) Need of public awareness

UNIT – II

2. Natural Resources:
 - a) Renewable and non-renewable resources
 - b) Natural resources and associated problems:
 - i. Forest resources: Use and over-exploitation, deforestation, case studies, timber extraction, raining, dams and their effects on forest and tribal people.
 - ii. Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

- iii. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- iv. Food resources: World food problems, changes caused by agriculture and overgrazing, effect of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- v. Energy resources: Growing energy needs renewable and non-renewable energy sources, use of alternate energy sources, case study.
- vi. Land resources: Land as a resource; land degradation, man induced landslides, soil erosion and desertification.
- vii. Biodiversity and its conservation: Definition, genetic, species and ecosystem diversity, value of biodiversity (consumptive use, productive use, social, ethical, aesthetic and option values)
- viii. Biodiversity at global, national and local levels, 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 of biodiversity.
- ix. Bio-geographical classification of India.
- x. Role of individual in conservation of natural resources.
- xi. Equitable use of resources for sustainable lifestyles.

UNIT – III

3. Environmental Pollution:

- i. 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
- ii. Soil Waste Management: Causes, effects and control measures of urban and industrial wastes.
- iii. Role of an individual in prevention of pollution.
- iv. Pollution case studies.
- v. Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social issues and the environment

- a) From unsustainable to sustainable development
- b) Urban problems related to energy
- c) Water conservation, rain water conservation, rain water harvesting, management.
- d) Resettlement and rehabilitation of people: its problems and concerns. Case studies.
- e) Environmental ethics: Issues and possible solutions.
- f) Wasteland reclamation.
- g) Consumerism and waste products.
- h) Population growth, variation among nations. Family welfare program.
- i) Environment and human health, human rights, value education.
- j) HIV/AIDS.
- k) Role of information Technology in Environment and human health.
- l) Case studies.

UNIT – V

Environmental Policies and laws:

- (i) Salient features of following Acts:
 - a) Environment protection Act. 1986.
 - b) Air (prevention and control of pollution) Act. 1981.
 - c) Water (prevention and control of pollution) Act. 1974.
 - d) Wildlife (protection) Act. 1972.
 - e) Forest conservation Act. 1980.
 - f) Issues involved in enforcement of environmental legislation.
 - g) Public awareness.
- (ii) Issues involved in enforcement of environmental legislation.
- (iii) Public awareness.

PRACTICAL

BPM – 110

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam. 4 hrs

PHARMACEUTICAL CHEMISTRY – I [INORGANIC CHEMISTRY]

Experiments related to the following:

1. The background and systematic qualitative analysis of Inorganic mixtures containing up to 4 radicals.
2. Quantitative analysis of Inorganic compounds.
3. Limit tests for impurities in Pharmaceutical compounds.

4. Preparation and Purification of selected Inorganic Pharmaceutical substances.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 111

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 3; **Duration of Exam.** 4 hrs

PHARMACEUTICAL CHEMISTRY – II [ANALYTICAL CHEMISTRY]

Experiments related to the following:

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Acid–Base Titrations: Preparation and standardization of acids and bases; some exercises related to determination of acids and bases separately or in mixture form some official assay procedures e.g. boric acid shall also be covered.
3. Oxidation-Reduction Titrations: Preparation and standardization of some redox titrants e.g. Potassium permanganate, potassium dichromate, iodine, sodiumthiosulphate etc., Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, Iodine solution, titanous chloride, sodium 2, 6-dichlorophenol, indophenol, & ceric ammonium sulphate be designed.
4. Precipitation Titrations: Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titration according to Mohar's, Volhard's and Fazan's methods.
5. Gravimetric analysis: Preparation of Gooch crucible for filtration and use of sintered glass crucibles. Determination of water of hydration; some exercises related gravimetric analysis shall be covered.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

1. Experiments : 50 marks
2. Record : 10 marks
3. Viva voce : 10 marks

PRACTICAL

BPM – 112

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam. 4 hrs
PHARMACEUTICAL CHEMISTRY – III [ORGANIC CHEMISTRY – I]

Experiments related to the following:

1. Introduction to various laboratory techniques viz. recrystallization, distillation, sublimation, thin layer chromatography etc.
2. Simple organic preparations involving acetylation, benzylation, substitutions, sulphonation, oxidation and reduction reactions.
3. Identification of simple organic compounds and preparation of suitable simple derivatives.

.NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 113

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam. 4 hrs
PHARMACEUTICS – I [GENERAL PHARMACY]

Experiments related to the following:

1. Preparation of at least 30 Pharmaceutical products such as waters, solutions, mixtures, elixirs, infusions, sprits, tinctures and other official preparations specified in official compendia.
2. Filling of hard gelatin. Capsules having different dosages.
3. Formulation of suspensions and emulsions by different methods and preliminary idea about their stability.
4. Introduction to prescription, Latin terms commonly used types of dispensing preparations.

5. Solid Dosages Forms: Bulk powders, incorporation of different ingredients preparation of different varieties of powders such as powders for internal use effervescent powders, dusting powders, snuffs, dentifrices etc.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 114

Max. Marks: 40; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.** 4 hrs

BIOLOGY

Experiments related to the following:

1. Morphology of plant parts indicated in theory.
2. Care, use and type of microscopes.
3. Gross identification of slides of structure and life cycle of lower plants, animals mentioned in theory.
4. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
5. Structure of human parasites and insects mentioned in theory with the help of specimens.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 30 marks |
| 2. Record | : | 05 marks |
| 3. Viva voce | : | 05 marks |

PRACTICAL

BPM – 115

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 3; **Duration of Exam.** 4 hrs

PHARMACOLOGY – I [HUMAN ANATOMY & PHYSIOLOGY]

Experiments related to the following:

1. Study of human skeleton.
2. Study of different systems with help of charts and models.
3. Microscopic study of different tissues.
4. Estimation of haemoglobin in blood. Determination of bleeding time, clotting time, RBC count, TLC, DLC and ESR, Blood group determination.
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of ECG-PQRST waves and their significance.
6. Determination of vital capacity, experiments on spirometry.
7. Analysis of normal and abnormal urine: collection of specimen appearance, determination of pH, sugar, proteins, urea and creatinine.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM- 116

Max. Marks: 70; Pass Percentage: 40; Hrs/ Wk: 3; Duration of Exam: 4 Hrs

PHARMACEUTICS – II [COMPUTER APPLICATIONS]

Experiments related to the following:

- 1). Use of external commands of DOS
- 2). **Use of Ms- Word** : Document creation, saving, printing, formatting, table handling and spell checking, and letter mail and merge.
- 3). **Use of MS- Excel:** Creation, Opening, saving and printing of worksheet, Use of formulas, Creation of graphs & charts, protection.
- 4). Program to find the area of a rectangular.
- 5). Program to find the simple interest for the given values of principle, rate of interest and time period.
- 6). Program to find the compound interest for the given values of principle, rate of interest and time period.
- 7). Program to make a simple calculator which can perform basic arithmetic operations.
- 8). Program to find the average of 5 integer numbers.
- 9). Program to find the maximum of four integer numbers using if- statement.

- 10). Program to find the maximum of four integer numbers using conditional operator.
- 11). Program to find the roots of a quadratic equation.
- 12). Program to display the following triangle using nested for loops:

```

*
***
*****
*****
*****
*****
*****
*****

```

- 13). Program to search an integer item from a list of integer items.
- 14). Program to sort a list of integer numbers.
- 15). Program to count the number of vowels and blank spaces in a given string.
- 16). Program to find the simple and compound interests by defining two functions.
- 17). Program to find the area and perimeter of a square by making a single function for that. (*Don't use the global variable(s)*)
- 18). Program to find the average of n integer numbers.
- 19). Design a menu- driven calculator program for simple arithmetic operations using switch statement.
- 20). Write a program to count the number of words from a string; multiple spaces may be used between two consecutive words.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|----------------|---|----------|
| 1. Experiments | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 117

Max. Marks: 20; Pass percentage: 40; Hrs/ wk: 01; Duration of Exam. 2 hrs

ENVIRONMENTAL STUDIES

Experiments related to the following:

1. Eco-System
 - Forest eco-system
 - Aquatic eco-system
 - Grassland eco-system
 - Desert eco-system
2. Spotting (Material/ Spotting) (any five)
 - Tiger
 - Leopard

- Black buck
- Asian Elephant
- Musk deer
- Birds
 - Magpie robin (*Capsychus saularis*)
 - Chukar (*Alectoris chukor*)
 - Pigeon (*Columba livia*)
- Mammals
 - Bat (Pterous)
- Medicinal plants [Tulsi, Neem, Bargad, Peepal, Harad, Aanwla, Jamun)
- Nest
 - Baya's nest (*Ploceus Philippinus*)
- Instruments
 - Jackson turbidity meter
 - Secchi disc
 - Microscope
 - Plankton collection net

3. Field work/record

Visit various eco-systems/ land use pattern/ national parks/ sanctuaries.

Bird watching

Impact of tourism on River Ganga

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

1. Experiments	:	10 marks
2. Record	:	05 marks
3. Viva voce	:	05 marks

PRACTICAL

BPM- 118

Professional Communication

Max. Marks: 70; Pass Percentage: 40; Hrs/ Wk: 2; Duration of Exam: 4 Hrs

Objectives:

- i) To expose the learners to English sound system and acquire phonetic skill and speech rhythm.
- ii) To help the learners use grammar correctly
- iii) To train the learners to speak English, clearly, intelligibly and effectively.
- iv) To equip the learners to compete for a career, and enable them to function effectively in careers which demand good communicative skills.

Contents:

i) Non-verbal communication

- Use of hands
- Posture of shoulders
- Eye contact
- Weight of the body
- Movement of the body
- Platform position

ii) Applied Phonetics

- Sounds of English-Consonants and Vowels
- Phonemic Transcription
- Stress, Rhythm and Intonation

Remedial Grammar

- Some useful expressions (introduction, greetings etc.) that are used frequently
- Common mistakes in the use of nouns, pronouns, adjectives, adverbs, prepositions and Conjunctions
- Use of who and whom, much and many, still and yet, so as and so that, make and do
- Tense and their use
- Confusion of Participles
- Tag questions

Reading and Speaking skills, Listening and Speaking skills

- Presentations and addresses
- Group discussions
- Interviews
- Role playing

Reading and Writing skills, Listening and Writing skills

- Letter Writing – formal and informal
- Real life social situations
- Curriculum Vitae
- Agenda, notice and minutes

Distribution of Marks:

Total	: 70 Marks
Exercise	: 30 Marks
Viva Voce	: 30 Marks
Record	: 10 Marks

RECOMMENDED BOOKS:

- 1) T. Balasubramaniam. “Phonetics for Indian Students”, Macmillan India Ltd.
- 2) Jones, Daniel. “English Pronouncing Dictionary”, Cambridge Univ. Press.
- 3) Oxford Advanced Learners Dictionary.
- 4) Taylor, Grant. “Conversation Practice”, Tata Mc graw Hills, New Delhi.
- 5) F. T. A. Wood. “Remedial English Grammar”, Macmillan India Ltd.
- 6) Berry, Thomas Elliot. “The Most Common Errors in English Usage”, Tata Mc graw Hills, New Delhi.
- 7) N. Krishnaswamy. “Modern English”, Macmillan India Ltd.
- 8) Desmond. “People Watching”.

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THEORY

BPM – 201

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACEUTICAL CHEMISTRY – IV [PHYSICAL CHEMISTRY -I]

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Gaseous State:** Kinetic molecular theory, Ideal gas laws and equation, deviation of gases from ideal behavior. Van-der Waal equation, Explanation of deviation from ideal behavior. Critical phenomenon, Critical constants, experimental determination of critical constants, law of corresponding state. Continuity of states.
2. **Liquid State:** Classification of physical properties, (Surface tension, Parachor, Viscosity, Molar viscosity, Rheochor, Refractive index, Molar refractivity, Refractor, Optical rotation, Dipole moment only) and their use in determination of chemical constitution.

UNIT – II

3. **Solids:** Comparison of amorphous and crystalline solids, crystalline substance, Crystal, Unit cell and space lattice. External features of crystals, Elements of crystal symmetry. Laws of crystallography (Steno's Law, law of symmetry and Hauy's Law), Classification of crystals (Bravais and Modern). Calculation of number of particles per unit cell. Weiss and Miller indices for representing different crystal planes Bragg's equation.
4. **Solutions of Gases in Liquids,** Factors influencing the solubility of gases in liquids, Henry's Law.
5. **Ideal and Non-Ideal Solutions of two Miscible Liquids,** Raoult's Law.

UNIT – III

6. **Colligative Properties:** Osmotic pressure (definitions, experimental determination by Berkley and Hartley method and Townsend's method, Vant Hoff theory, Hypertonic, Hypotonic and Isotonic solutions). Lowering of vapour pressure (Raoult's law of relative lowering of vapour pressure, Experimental determination by using Barometer, Manometer, Isoteniscope and Ostwald-Walker method). Ebullioscopy (Elevation of boiling point, Experimental determination by Landsberger's and Cottrell's method). Cryoscopy (depression of freezing point, Experimental determination by Beckman and Rast's methods). **Derivation of**

formulas to be excluded for each colligative property mentioned; Abnormal colligative properties and molecular weights, Vant Hoff factor.

7. **Partition Law:** Distribution of solute between two immiscible liquids. Distribution Law. Modification when solute undergoes dissociation or association in one of the liquids. Applications.

UNIT – IV

8. **Conductance Cells:** Resistance, Conductance, Specific Conductance, Equivalent Conductivity, Molar conductivity, their units, factors influencing the conductances of various types. Anamoly of strong electrolytes, difference between dissociation and ionization, Debye-Huckel theory (Elementary theoretical idea excluding the derivation of equations). Experimental determination of different type of conductance of electrolyte solutions.

UNIT - V

9. **Adsorption:** Basic terms, Physical and Chemical adsorption, Their comparison and factors influencing them, Types of adsorption curves, Types of adsorption isotherms, Freundlich's and Langmuir's adsorption isotherm equations including derivation. Applications of adsorption in industries and analytical chemistry (In chromatography and adsorption indicators only).
10. **Photochemistry:** Laws of Photochemistry (Beer-Lambert law, Beer law and Law of photochemical equivalence), quantum yield and its determination, basic idea of Fluorescence, Phosphorescence and Chemiluminiscence, Jabolinski diagram.

BOOKS RECOMMENDED (LATEST EDITIONS):

1. S. H. Maron and C. F. Prutton. "Principles of Physical Chemistry" Oxford and IEH publishing Co.
2. A. Martin. "Physical Pharmacy", (IV Edn 1994) B. I. Waverly Pvt. LTD, N. Delhi.
3. S.C. Wall work. "Physical Chemistry for students of Pharmacy and Biology", Longman
4. P. W. Atkins. "Physical Chemistry", Oxford University Press (IV Edn), Oxford
5. I. Das, A. Sharma and N. R. Agarwal. "An Introduction to Physical Chemistry" New Age International Publishers, New Delhi.
6. S. Glasston. "Textbook of Physical Chemistry".
7. Bahl and Tuli. "Essentials of Physical Chemistry".
8. Puri, Sharma and Pathania. "Principles of Physical Chemistry".

9. D.N.Bajpai. "Advanced Physical Chemistry."
10. S. Glasston. "Electrochemistry."

THEORY

BPM – 202

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

PHARMACEUTICAL CHEMISTRY – V [PHYSICAL CHEMISTRY -II]

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Galvanic Cells:** Nernst's theory of single electrode potential, Nernst's equation for single electrode potential (Excluding the derivation). Representing the Redox potential and galvanic cells, Writing the cell reactions, Calculation of Cell potential and spontaneity of cell reaction. Writing the Nernst's equation for galvanic cells involving metal and gas electrodes. Reference electrodes, pH electrodes. Determination of cell potential. Determination of pH using Galvanic cells. Concentration cells [Excluding the concentration cells with transport] and their applications in determination of valency of metal ions, Solubility and transition temperature only].

UNIT – II

2. **Chemical Kinetics – I:** Rate of reaction, Rate constant, Molecularity, Order and pseudo order. Derivation of elementary zero order and 1st order kinetic equations, Examples and Characteristics of zero order and 1st order reactions, Methods for determination of order. Experimental methods for studying the kinetics of 1st order reactions (Conversion of N-chloroacetanilide into p-chloroacetanilide, hydrolysis of ester catalyzed by H⁺, Inversion of Cane sugar, Decomposition of N₂O₅ in CCl₄ medium and decomposition of H₂O₂ only)
3. **Chemical Kinetics–II:** Derivation of second order kinetic equation only when initial concentration of reactants is same, examples and characteristics of 2nd order reactions.

UNIT – III

4. **Chemical Kinetics–III:** Factors influencing the reaction rate, rate constant and order of reactions (Elementary idea). Effect of temperature, temperature

coefficient, Maxwell-Boltzmann distribution curves for distribution of energy and velocity amongst the particles in gases and solutions and the effect of temperature on this distribution. Basic idea of collision theory and transition state, theory of reaction rates. Activation energy and transition state (Excluding the detailed treatment of these theories). Arrhenius equation.

5. **Catalysis:** Characteristics of catalyst and catalysis, intermediate compound formation theory, Adsorption theory and Michaelis – Menten theory (excluding the formula derivation). Acid-Base catalysis, special characteristics of enzyme catalysis.

UNIT – IV

6. **Thermodynamics–I:** Basic terms–System, Surrounding, Universe, types of systems, types of processes state and non-state functions, thermodynamics equilibrium. Concept of work done, old and new sign conventions for heat change and work done. Intrinsic energy, enthalpy, free energy and work function. Calculation of work done in isothermal and adiabatic processes, Zeroth law of thermodynamics, definition of temperature. 1st law thermodynamics- different statements, derivation of state functions like ΔE and ΔH from 1st law equation, application of 1st law including its applications to biological systems, Failure of 1st law.
7. **Thermodynamics–II:** Different statements of 2nd Law of thermodynamics, Concept of Entropy, physical significance of entropy, calculation of entropy in thermodynamically reversible and irreversible processes. Criteria for thermodynamically spontaneous processes. Basic idea of 3rd law of thermodynamics and its application in calculation of entropy (Only elementary idea).

UNIT – V

8. **Chemical Energetics:** Methods to write the Thermochemical equations, different ways to express the heat changes–heat of reaction, Heat of Formation, Heat of combustion, heat of neutralization, Heat of fusion, heat of vaporization, heat of sublimation, heat of transition, bond dissociation energy, Heat of atomization, integral Heat of solution, lattice energy, heat of hydration, differential Heat of solution, heat of dilution, heat of precipitation, heat of polymerization. Hess's

Law of constant heat summation and its applications. Specific and Molar heat capacities. Factors influencing the heat changes, Kirchoff's Equation.

9. **Phase Equilibria:** Phase, component, degree of freedom, Gibb's Phase Rule, application of phase rule to one component and two component systems (ONLY Water system, Sulphur system, Ag – Pb system, and KI–Water system), Explaining the terms–condensed systems, eutectic point, cooling curve, cryohydric point, quadruple point and freezing mixtures.

BOOKS RECOMMENDED (LATEST EDITIONS):

1. S.H.Maron and C.F.Prutton. "Principles of Physical Chemistry", Oxford and IEH publishing Co.
2. A. Martin. "Physical Pharmacy". (IV Edn 1994) B. I. Waverly Pvt. LTD, N. Delhi
3. S.C. Wall work. "Physical Chemistry for students of Pharmacy and Biology", Longman
4. P.W.Atkins. "Physical chemistry", Oxford University Press (IV Edn), Oxford
5. I. Das, A. Sharma and N. R. Agarwal. "An Introduction to Physical Chemistry". New Age International Publishers, New Delhi.
6. C. Kalidas. "Chemical Kinetics Methods", New Age International Publishers, New Delhi.
7. J. Jayaram and J.C. Kuriacose. "Kinetics and Mechanism of Chemical Transformations", McMillan India LTD, New Delhi
8. S. Glasston. "Textbook of physical Chemistry",
9. Bahl and Tuli. "Essentials of Physical Chemistry".
10. Puri, Sharma and Pathania. "Principles of Physical Chemistry."
11. D.N.Bajpai. "Advanced Physical Chemistry".
12. S. Glasston. "Electrochemistry".
13. S. Glasston. "Chemical Thermodynamics".
14. R. C. Rastogi. "Chemical Thermodynamics."
15. K.J. Laidler. "Chemical kinetics."

THEORY

BPM – 203

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICAL CHEMISTRY – VI [PHARMACEUTICAL ANALYSIS-I]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Non-aqueous Titrations:** Theoretical consideration, Acid base equilibria in non-aqueous media, Acid-base titrations, Indicators, Applications.
2. **Complexometric Titrations:** Complexation and chelation, Werner theory and electronic structure of complex ions, Stability constants. Types of complexometric titrations, Indicators for complexometric titrations, Factors influencing the stability of complexes, EDTA-metal ion complexes, Determination of hardness of water.
3. **Miscellaneous Methods of Analysis:** Diazotization titrations, Kjeldahl's method for estimation of nitrogen in inorganic compounds, Organic compounds, Soil and fertilizers, Karl-Fischer titration for estimation of water.

UNIT – II

4. **Polarimetry and Refractometry:** Basic idea of Optical activity, Angle of rotation, specific rotation, refractive index. Effect of concentration, experimental determination of angle of rotation by Polarimeter and refractive index by Abbe's refractometer. Estimation of concentration of sucrose solutions by using polarimeter and refractometer.
5. **Solvent Extraction:** Concept of solvent extraction based on Distribution law, Single and multistep extraction, Continuous counter –current extraction, factors influencing the extraction.

UNIT - III

6. **Chromatography:** Different types of chromatographic techniques. Basic Principles, methodology and general applications (including some applications to pharmaceutical Science) ONLY of the following: Column Chromatography, Paper Chromatography, Thin Layer Chromatography, Gas-Solid and Gas-Liquid Chromatography, HPLC [specific applications not expected].

UNIT- IV

7. **Eudiometry (Gasometry or Volumetric analysis of gases):** Analysis of mixture of gases by Eudiometer, writing the basic combustion equation, Basic calculations based on Eudiometry for calculation of general empirical/molecular formula of gaseous substances and for determination of composition of gaseous mixtures.

8. **Electroanalytical Techniques - I:**

- **Potentiometric titrations:** Principle, techniques and applications. [Note: potential measurement, Nernst's equation etc has already been included in the paper BPM-202. Therefore these are not to be discussed here.]
- **Conductometric titrations:** Principle, Technique and applications to the acid-base titrations (different types) and precipitation titrations. [Note: Conductance measurement, etc has already been included in the paper BPM-201. Therefore these are not to be discussed here.]
- **pH – metric titrations:** Principle, technique's and applications including the determination of pKa value of a weak acid. [Note: Basic concept of pH and buffers has already been included in the paper PBM-102. Therefore these are not to be discussed here.]

UNIT – V

9. **Electroanalytical Techniques – II:**

- **Polarography:** Polarisation, overvoltage, theories of hydrogen overvoltage, Ilkovic equation, Dropping Mercury Electrode, half wave potential, diffusion current, Basic Principle, Techniques and applications.
- **Coulometry:** Principle, Controlled potential coulometry. Instrumentation and applications.
- **Amperometry:** Introduction, principle, technique and applications.

Books recommended (Latest editions):

1. J. Bassett, R.C. Denney, G. H. Jeffrey and J. Mendham. "Vogel's textbook of Quantitative Inorganic analysis, Including Instrumental analysis", Longman.
2. K. A. Konner, "A Textbook of Pharmaceutical analysis" , Wiley Interscience publication.
3. Willard, Merit, Dean and Seatle. "Instrumental Methods of Chemical analysis" Dean and Seatle, Von Nostrand Reinhold, N.Y.
4. Skoog and West. "Principles of Instrumental analysis".

THEORY

BPM – 204

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACEUTICAL CHEMISTRY – VII [ORGANIC CHEMISTRY – II]

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Aromatic Electrophilic Substitution:** Orientation and reactivity in monosubstituted benzene rings. Nitration, Sulphonation, Halogenations, Friedel Craft alkylation and acylation, Gatterman, Reimer- Tieman reactions, Fries rearrangement.
2. **Aromatic Nucleophilic Substitution:** SN_1 and Benzyne mechanisms. Effect of structure, Leaving group and nucleophile on reactivity. Nucleophilic displacement in arene diazonium salts. Von Richter rearrangement.

UNIT – II

3. **Benzene, Arene and Polynuclear Aromatic Hydrocarbons:** Structure, Stability and reactions of benzene. The Huckle 4+2 rule. Structure nomenclature, physical properties, industrial source and preparation of arenes, ‘Halogenation’ of alkyl benzenes. Structure and reactions of naphthalene, phenanthrene and anthracene. Carcinogenic hydrocarbons.
4. **Aryl Halides:** Structure, Nomenclature, Physical properties, Industrial source, Preparation and Reactions.

UNIT - III

5. **Phenols:** Structure, nomenclature, physical properties, industrial source, preparation and Reactions. Acidity of phenols.
6. **Carboxylic Acid:** Structure, nomenclature, physical properties, Industrial source and preparation. Acidity of carboxylic acids. Conversion to acid chlorides, esters, amides and alcohols. Hell Volhard-Zelinsky reaction.
7. **Amines:** Structure, Classification, nomenclature, physical properties. Industrial source and preparation. Basicity of amines. Hoffman elimination, Conversion of amines to amides. Halogenation, Nitration and Sulphonation of aromatic amines. Hinesburg test.

UNIT- IV

8. **Oxidations:** Aromatization, Dehydrogenations, yielding C-C double bonds, aldehydes, Ketones. Cleavage of C-C bond in glycols, aldehydes and ketones. Ozonolysis and decarboxylations.

9. **Reductions:** Reduction of nitro and nitroso compounds. Acylation condensation and Cannizaro's reaction.

UNIT – V

10. **Molecular Rearrangements:** Wagner-Meerwin, Pinnacle-Pinacolone, Favorskii, Wolf, Hoffman, Curtius, Schmidt, Beckmann and Baeyer-Villager rearrangements.

Books recommended (Latest editions):

1. P. Sykes, "A Guidebook to Mechanisms in Organic Chemistry", Orient Long man, New Delhi.
 2. R. T. Morison and R. N. Boyd, "Organic Chemistry", Allyn and Bacon, Inc, Boston, USA.
 3. I. L. Finar, "Organic Chemistry", Vol. I and Vol. II. The English Language Book Society.
 4. J. March, "Advanced Organic Chemistry Reaction, Mechanisms and Structure", Wiley Eastern, New Delhi.
 5. S. Pine, "Organic Chemistry", Mc Grew Hill.
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THEORY

BPM – 205

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACEUTICS – III [PHARMACEUTICAL MICROBIOLOGY]

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **General Microbiology:** Importance of pharmaceutical microbiology. Structure of bacterial cell (Eukaryotes & prokaryotes). Morphology and classification of bacteria, viruses, actinomycetes, recksiae fungi and spirochetes.
2. **Nutrition, cultivation, isolation and identification of bacteria and fungi.**

UNIT – II

3. **Methods of Sterilization:**
 - a. **Physical Methods:** Dry heat and moist heat, Design of equipment, Factors governing selection of processes. Testing efficiency of sterilizers and their applications.
 - b. **Mechanical Methods:** Bacteria proof filtration. Different devices used to retain bacteria and mechanisms of bacterial filtration. Pore size determination and Bubble pressure technique.
 - c. **Chemical Methods:** Treating with a bactericide, Gaseous sterilization and factors affecting these methods.
 - d. **Radiation Methods:** Ultra violet and ionization radiations. Advantages and disadvantages, methods of radiations production.
4. **Aseptic Techniques:**

Routes of contamination and methods of prevention. Water for injection, and pyrogenicity, Evaluation for particular matter, design of aseptic area, laminar flow benches.
5. **Antiseptics and Disinfectants:**

Definition factors influencing disinfectants, dynamics of their action and evaluation. Preservatives and their recommended concentrations.

UNIT- III

6. Immunology and Immunological Preparations:

Principles, antigens and haptens, immune system, cellular and humoral immunity, immunological tolerance, antigen- antibody reactions and their applications. Hypersensitivity, active and passive immunization, their preparations, standardization and storage.

7. Microbial attack and host defense, virulence and pathogenecity, primary and specific defense

Mechanisms of body, infection and its transmission, interferons.

UNIT-IV

8. Microbiological Assays of antibiotics, vitamins, amino acids.

9. Sterility testing of pharmaceutical products and equipments.

10. Microbial limit test for pharmaceutical products.

UNIT – V

11. Fermentation and Industrial Microbiology : Fermentation and its design, Control of different parameters in Fermentation process. Use of mutagenic agents. Isolation of mutants, Factors influencing rate of mutation. Preparation and isolation of fermentation products with special reference to Penicillins, Streptomycines, Tetracyclines, Alcohol, Citric acid and Vitamin B₁₂ (Cyanocobalamin).

12. Genetic Engineering: Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies.

Books recommended (Latest editions):

1. S. J. Carter, "Cooper and Gunn's Tutorial Pharmacy", Sixth edition, pitman publishing co, London.
2. M. Furbisher, "Fundamentals of Microbiology", 8th Edition, W. B. Saunders Company Philadelphia, USA.
3. W. B. Hugo and A. D. Russell, "Pharmaceutical Microbiology", Blackwell Scientific Publications, Oxford.
4. Presscot and Donn, "Industrial Microbiology", CBS, Publishers, Delhi.

5. K. K. Kieslich (Editor). "Biotechnology", Vol. 6a, Verlag chemic, Basel, Switzerland.
6. M. J. Pcelzar, Reid and Chan, "Microbiology", TATA Mc-Graw Hill Publishing, New Delhi.
7. S. J. Carter, "Cooper and Gunn's dispensing for pharmaceutical students", 12th Edition CBS Publisher & Distributors, 485, Bhola Nath Nagar, Shahdara, Delhi-32.
8. A. Osal, "Remington's Pharmaceutical Sciences", Mack publishing company, Pennsylvania, U.S.A.

THEORY
BPM – 206

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs
PHARMACEUTICS – IV [PHARMACEUTICAL ENGINEERING OPERATIONS]

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Material of Pharmaceutical Plant Construction:** Metals, Alloys and non-metals, Corrosion and methods to reduce it.
2. **Fluid Flow:** Manometers, types of flow, viscosity, concepts of boundary layer, Basic equation of fluid flow, Law of conservation in flow of fluids, Valves, pumps, Flow meters.

UNIT – II

3. **Mixing, Dissolving and Emulsifying:** Theory of mixing, Mixing equipment, types of mixing(solid-solid, solid- liquid, & liquid-liquid). Factors affecting dissolution, theory of emulsification.
4. **Centrifugation:** Principle of centrifugation, Industrial centrifugal filters, Application in pharmacy.
5. **Filtration:** Theory of filtration, Filter aids, Filtering media, Various filters, factors affecting rate to filtration, Application in Pharmacy.

UNIT - III

6. **Size Reduction:** Definitions, factors affecting size reduction, laws governing energy and power requirements. Different methods of size reduction, Application in Pharmacy.
7. **Size Separations:** Various methods and equipments employed for size separation, e.g. sieving sedimentation, cyclone separator, elutriation. Application in pharmacy.
8. **Evaporation:** Basic concept of phase equilibria. Factors affecting rate of evaporation, Single effect and multiple effect evaporators, film evaporators. Factors governing selection of evaporation process and evaporators.

UNIT- IV

9. **Distillation:** Theory of distillation of mixtures, Vapour-liquid equilibrium relationship, Volatility, azeotropic mixtures, Phase diagrams, Rectification, Construction of columns, McCabe-Thiele method for the calculation of number of theoretical plates. Simple Fractional, Vacuum, Molecular and Steam distillation. Production of water for injection.
10. **Heat Transfer:** Mode of heat transfer, Heat transfer coefficient, OHTC, Convection concept of overall film coefficient, Evaluation of individual film coefficient radiation, Heating media equipments. Steam as heating medium properties and uses of steam, Steam traps, Pressure reducing valve, Steam heated heat exchanger, Lagging and condensation, Heating by electricity, Numerical problems.

UNIT – V

11. **Refrigeration:** Theory of refrigeration, Refrigeration and air conditioning Current cycle, Refrigeration equipments employed, Psychometry, Humidification, Dehumidification, Cooling towers, Application in pharmacy.
12. **Drying:** Theory of drying principles, Equilibrium Moisture content, Rate of drying, Factors affecting drying rate, Drying of dilute solution and suspensions, Types of dryers, Special drying methods, Freeze drying, Calculations for rotary dryers.
13. **Crystallization:** Introduction, characteristics of crystals like-size, purity, shape, geometry, habit, forms and factors affecting them, types of crystallizers, nucleation mechanism, crystal growth, equilibrium data(solubility), energy balances, solubility curves, theory of crystallization,

effect of operating variables, magma density, calculation o yields, caking of crystals and its prevention.

Books recommended (Latest editions):

1. Mc Cable & Smith, "Unit Operations of Chemical Engineering".
2. Bedger et. Al; "Introduction to Chemical Engineering", McGraw Hill Co.
3. E. Lrown, "Unit Operations".

THEORY
BPM – 207

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACOGNOSY – I

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Introduction, development, present status and future scope of Pharmacognosy, different groups of plants constituents.
2. **Classification of Drugs:** Morphological, Taxonomical, Pharmacological and chemical.

UNIT – II

3. **Study of carbohydrate containing drugs:** Biological source, Geographical distribution, Collection, commercial production, chemical constituents, chemical tests for identity, Substitutes, adulterants and uses of the following:
Gum Acacia, Trogacanth, Sterculia, Guargum and Plantago, Starch, (wheat, potato, maize and rice).
4. **Study of lipids and lipid containing drugs:** General methods of extraction of fixed oils, Biological sources, Chemical constituents, Tests for identity and uses of the following:
Arches oil, Caster oil, Sesame oil, Cottonseed oil, Almond oil, Olive oil and linseeds oil.

UNIT - III

5. **Study of drugs containing, resins and Resin combinations:** *Colophony, Podophyllum, Jalap, Cannabis. Capsicum, Myrrh, Asafoetida, Balsam of Peru, Balsam of Tolu and Benjoin, Turmeric, Ginger.*
6. **Study of tannins and tannin containing drugs:** *Hamamelis, Pale & Black catechu, Ashoka bark, Arjuna bark, Bahera, Harde and Nut gall.*

UNIT- IV

7. **Processing;** Study of Biological sources, Cultivation, Collection, Commercial varieties, Chemical constituents, Substitutes, Adulterants, Uses, Diagnostic

macroscopic and microscopic features and chemical tests for identity of the following groups of drugs.

a) **Glycoside containing Drugs:**

- i. **Saponin Containing Drugs:** *Glycyrrhiza*, Senega and Dioscorea.
- ii. **Cardioactive Drugs:** *Digitalis*, Squall, Strophanthus and Thievetia.
- iii. **Anthraquinone Cathartics:** Aloe, *Senna*, Rhubarb and Cascara.

b) **Alkaloids Containing Drugs:**

- i. **Pyridine piperidine group:** Tobacco, *Aricea*, and Lobelia.
- ii. **Trepan group:** *Belladonna*, Hyoscyamus, Datura and Cocoa.
- iii. **Quinoline isoquinoline group:** *Cinchona*, ipecac and opium.
- iv. **In dole group:** *Ergot*, Rauwolfia, Catharanthus, Nux-vomica and physostigma.
- v. **In diazole group:** *Pilocarpus*.
- vi. **Steroidal group:** *Veratrum* and kurchi bark.
- vii. **Alkaloid amino group:** *Ephedra* and colchicum corm and seeds.

UNIT – V

8. **Study of Drugs from Animal Sources:**

- i. *Cantharides*, Mylabris and Coccus.
- ii. *Beeswax*, Wool fat and Spermaceti.
- iii. *Shark liver oil* and Cod liver oil.
- iv. *Musk*
- v. *Honey*
- vi. *Gelatin*

Note: Italicized drugs would be dealt at primary level (whole Pharmacognosy) while other drugs would be dealt at secondary level (only source, chemical constituents and uses).

Books recommended (Latest editions):

1. T. E. Wallis, "The Text Book of Pharmacognosy", J. & A. Churchill Lets London.
2. G. E. Treason & W. C. Evans, "Pharmacognosy" (12 Edition), V Bailiore Findall, London, 1983, Lea Fobiger, Philadelphia.
3. V. E. Taylor, Lynn R. Brady, H. E. Robbers, "Pharmacognosy" (9th Edition), Lea & Fobiger, Philadelphia, 1988.

4. B. P. J. C. Jackson and D. W. Snowden, "Powered Vegetable drugs", Stenley Thorns Ltd, London 1974.
5. C. K. Atlas and B. K. Kappur, "Cultivation and Utilization of Medicinal plants", CSIR, India, 1982.
6. A. Krishnamurthi, "The Wealth of India", Vol. I to XI, CSIR, New Delhi, 1968.
7. Iyanger, "Powered crude drugs".

THEORY

BPM – 208

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACOLOGY - II

Instructions to Examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Introduction:** Definition, Scope, source of drugs, dosage forms & concept of receptors, factors modifying drug action.
2. **ADME:** Routes of drugs administration, Dynamics of absorption, Distribution, Metabolism and Excretion of drugs.
3. **Molecular Pharmacology:** Molecular mechanisms of drugs action, Receptors, Theories of receptors, Dose response relationship Affinity constants, Determination of p^A constants. Potentiation, Antagonism phenomenon. Tolerance and dependence advise drug reaction & treatment of poisoning.

UNIT – II

4. **Pharmacology of Autonomic Nervous System:** Automatic nerve transmission, Parasympthomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics Ganglion transmission and blockers, Neuromuscular blocking agents and Antispasticity drugs.
5. Pathophysiology and drug therapy of Myasthenia gravis.

UNIT – III

Drugs Acting on P.N.S:

6. Local anesthetics: Pharmacological study of various local anesthetic agents.
7. Autacoids: Arachidonic acid metabolites, Histamine, PAF, Bradykinin, 5 HT.

UNIT- IV

8. **Pharmacology of Central Nervous System:** Synaptic transmission in the CNS, General anesthetics, Hypnotics and sedatives, Opioid analgesics.

UNIT – V

9. NSAID's and drugs used in Gout, Antiepileptics, Antiparkinsonian drugs, Psychopharmacological agent, CNS stimulants and Hallucinogens.
10. Vitamins: Vitamin toxicity. Vitamin –drug interaction, role of vitamins in management of adverse drug reaction.

Books recommended (Latest editions):

1. B.G. Katzung, "Basic and Clinical Pharmacology", Lange Medical publication, 1995.
2. A. G. Gilman, L.S. Goodman, T. W. Rall & F. Murad, "The Pharmacological Basis Therapeutics", Macmillan Publishing Co., Ino, 1996.
3. C. R. Craige and R. F. Stitzel, "Modern Pharmacology" Little Brown & Co, 1994.

PRACTICAL

BPM – 209

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACEUTICAL CHEMISTRY – IV [PHYSICAL CHEMISTRY – I]

Laboratory experiments related to the following:

1. Determination of surface tension and Parachor of given liquid using stalagmometer.
2. Determination of coefficient of viscosity of given liquid by Ostwald's viscometer.
3. Determination of % composition of alcohol-water mixture by using stalagmometer and viscometer.

4. Handling of refractometer and Determination of Refractive index of solutions using Abbe's refractometer.
5. Handling of polarimeter and Determination of angle of rotation and specific rotation of solutions using polarimeter.
6. Demonstration of various crystal planes, planes of symmetry and axes of symmetry of cubic crystals.
7. Determination of molecular weight of non-volatile solutes using Landsberger's method ebullioscopically.
8. Determination of molecular weight of naphthalene by Rast's camphor method.
9. Determination of molecular weight of non volatile solute cryoscopically.
10. Determination of partition coefficient of I_2 between kerosene-water or CCl_4 – water.
11. Determination of partition coefficient of benzoic acid between benzene-water.
12. Determination of conductance, Cell constant and specific conductance of given electrolyte solutions using Resistance meter or conductometer.
13. Testing the validity of Freundlich's and Langmuir's adsorption isotherm equations for the adsorption of oxalic acid on charcoal.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 210

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACEUTICAL CHEMISTRY – V [PHYSICAL CHEMISTRY – II]

Laboratory experiments related to the following:

1. Handling of potentiometer.
2. Preparation of salt bridges, Calomel electrode and Silver electrode.
3. Determination of Cell potential using potentiometer.
4. Determination of single electrode potential of Ag electrode using potentiometer.

5. Determination of solubility of sparingly soluble salt like AgCl in water using potentiometer.
6. Handling of thermostatic water baths.
7. Evaluation of rate constant for the hydrolysis of ester catalyzed by H⁺.
8. Determination of activation energy for the hydrolysis of ester catalyzed by H⁺.
9. To study the mutual solubility curve for the water – phenol system and determination of Critical Solution Temperature.
10. Determination of heat of neutralization of strong or weak acid by a base using Calorimeter.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 211

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 3; **Duration of exam.:** 4 hrs

PHARMACEUTICAL CHEMISTRY – VI [PHARMACEUTICAL ANALYSIS –I]

Laboratory experiments related to the following:

1. Non – aqueous titrations: Preparation & standardization of perchloric acid and sodium/potassium/lithium methozides solution. Estimation of some pharmacopoeial products.
2. Complexometric titrations: Preparation and standardization of EDTA solutions. Some exercises related to pharmacopoeial products and determination of hardness of water.
3. Exercises related to diazotization, Kjeldahl and Karl-Fischer, Combustion and gasometry Methods. Determination of alcohol content in liquid galenicals, BPC procedures shall be covered.
4. Experiments involving separation of drugs from excipients.
5. Chromatographic analysis of some pharmaceutical products.
6. Acid base titrations in aqueous and non-aqueous media.
7. Conductometric titrations using conductometer. Titration of acids, Bases and mixture of weak and strong acids as well as precipitation titrations.

- Potentiometric titrations involving redox reactions and precipitation reactions using potentiometer.
- pH metric titrations including the Determination of acid base dissociation constants and plotting of titration curves using pH meter.
- Determination of concentration of sucrose solutions by using polarimeter and refractometer.
- Handling of Polarograph. Experiments related to polarography.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

Books recommended (Latest editions):

- A textbook of pharmaceutical chemistry by L.G.Chattona, Vol I and II, Morcol Dokkar, N.Y.
- Practical Pharmaceutical Chemistry by A. H. Bockett and J. D. Stenlake, VOL I and II, The Athlone press of the University of London.
- Instrumental Methods of Chemical Analysis by Willard, Merit, Dean and Seatle, Van Nostrand Reinhold, N.Y.

PRACTICAL

BPM – 212

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACEUTICAL CHEMISTRY – VII [ORGANIC CHEMISTRY – II]

Laboratory experiments related to the following:

- Organic preparations involving one or more than one step. Purification and spectroscopic analysis of the prepared organic compounds.
- Quantitative test for Alkaloids, Carbohydrates, Proteins, Amino acids and Tannins.
- Separation, purification and identification of compounds of binary organic mixture (Liquid-liquid, Liquid-solid and solid-solid) using chemical analysis, IR and H-NMR spectral data.

Note : Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 213

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACEUTICS – III [PHARMACEUTICAL MICROBIOLOGY]

Laboratory experiments related to the following:

1. Preparation and sterilization of aerobic and anaerobic media.
2. Aerobic and anaerobic cultivation of bacteria.
3. Gram's staining, Acid fast staining and Hanging drop preparation.
4. Separation of mixed cultures and maintenance of pure cultures.
5. Microbial viable count in pharmaceutical formulations.
6. Particle count in water for injection.
7. Thermal death time studies.
8. Morphological characteristics of moulds and yeasts.
9. Turbidimetric assay of at least one drug using microbial culture.
10. Bio-Chemistry reactions:
 - a. Starch Hydrolysis
 - b. Gelatin liquification
 - c. Haemolysis of blood
 - d. Catalase production
 - e. Fermentation of Carbohydrates (A/g production)
11. Evaluation of disinfectants & antiseptics.
12. Production of at least one product by fermentation.
13. Biological assay of tetracycline and cyanocobalamin.
14. Test for limit of alkalinity of glass.
15. Test for sterility of Pharmaceutical products as per I.P.
16. Preparation of injections of water, Dextrose, Normal saline and Oily phenol.
Carrying out quality control tests.
17. Microbial limit test for liquid and dry products.

Note: Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

1. Experiment(s)	:	50 marks
2. Record	:	10 marks
3. Viva voce	:	10 marks

PRACTICAL

BPM – 214

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

**PHARMACEUTICS – IV (A) [PHARMACEUTICAL ENGINEERING
OPERATIONS]**

Laboratory experiments related to the following:

1. (a) Determination of absolute humidity, Relative humidity, Dew point saturated-volume and humid heat using psychrometric chart.
(b) Determination of dew point using ice & water and to compare it with that obtained using psychrometric chart.
2. To compare the efficiencies of simple and differential manometers.
3. To perform Reynold's experiment and to calculate Reynold's number for laminar, Critical and turbulent flows.
4. Determination of overall efficiency of steam distillation unit (Aniline/water mixture).
5. Determination of overall heat transfer coefficient (HTC) of a distillation unit.
6. To determine rate of flow using water.
7. (a) Determine of rate of flow by Venturimeter / Orifice meter.
(b) Determine of coefficient of Venturimeter / Orifice meter.
8. To determine the hardness of water.
9. Study of effect of insulating material on loss of heat.
10. Study of effect of colours on radiation.
11. To study the effect of factors affecting rate of filtration (pressure, thickness of cake, filter acids, viscosity)
12. To study the effect of viscosity on rate of sedimentation.
13. To determine equilibrium-moisture-content(EMC) of various substances like(a) Kaolin. (b) Talc and (c) Starch.
14. To study the effect of factors affecting rate of drying (surface area, temperature etc.)
15. Study of factors affecting rate of evaporation(temperature, surface area)
16. Study to efficiency of number of balls on size reduction in Ball mill.
17. Study of characteristics of crystals, solubility curves of crystals

Note : Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

1. Experiment(s)	:	50 marks
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- | | | |
|--------------|---|----------|
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 215

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACEUTICS – IV (B) [PHARMACEUTICAL ENGINEERING DRAWING]

Laboratory experiments related to the following:

1. Importance of engineering drawing in pharmaceutical industry.
2. Construction of Seals.
3. Flow sheets basis and symbols employed in flow sheets
4. Orthographic projections. Various techniques of sectioning i.e. Offset, Full, Half, Partial, Removed and revolved.
5. Isometric projections and isometric views.
6. Layout of various sections in pharmaceutical unit with special references to supply of water steam, gases and electrical lines.
7. Basic engineering drawing practice – Bolts, Nuts, Rivet led fronts, Screws, Worn screws as per specification.
8. Drawing of simple pharmaceutical machinery part.

Books recommended (Latest editions):

1. A. manual of engineering drawing for students and draftsmen, Frechand Viorck.
2. Engineering Drawing, N. D. Bhatt.
3. Technical Drawing ciesocke Mitchell and sponcer.
4. Machine Drawing N. D. Bhatt.

Note : Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 216

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 4 hrs

PHARMACOGNOSY – I

Laboratory experiments related to the following:

1. Taxonomic study of some medicinal plants with at least one representative of each of the families covered in theory (organoleptic examination and physiochemical test of selected drugs).
2. Use, Care and focusing practices of microscope. Macroscopic examination of diagnostic principles of individual and mixtures of powdered crude drugs, *Sonchum oleraceum*, *Cinchona*, *Rauwolfia*, *Liquor ipeca*, *Sphera* and *Nuxvomica*.
3. Chemical tests of selected unorganized drugs.
4. Tests for identification of Glycosides, Saponins, Anthraquinone, Steroids, Tannins, Flavonoids.

Note : Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

1. Experiment(s)	:	50 marks
2. Record	:	10 marks
3. Viva voce	:	10 marks

PRACTICAL

BPM – 217

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 3; **Duration of exam.:** 4 hrs

PHARMACOLOGY - II

Laboratory experiments related to the following:

1. Preparation of different solution for experiments, drug dilutions, common laboratory animals and anesthetics used in animal study, commonly used instruments in experimental Pharmacology. Some common and standard techniques.
2. To study the effect of hepatic microsomal enzyme inhibitors and induction on the phenobarbitone sleeping time in mice.
3. Study of dose-response relationship, Calculation of EC_{50} , dose ratios and affinity constants.
4. Study of various routes of administration of drugs in mice/rate.
5. Common evaluation techniques of analgesic, Anticonvulsants, Drugs affecting muscle rigidity, Anti-inflammatory, Local anesthetics etc.

Note : Any other experiment(s) may be included in support of the theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

BPharm IIIrd Year

THEORY

BPM – 301

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICAL CHEMISTRY–VIII [PHARMACEUTICAL ANALYSIS-II]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Radioactivity:** Measurement of radioactivity, Analytical applications.
2. General Characteristics of Electromagnetic radiations, Absorption and Emission spectrum, Line and Band spectrum, Continuous and discontinuous spectrum, Low resolution and High resolution spectra, Relation between the spectra and structure of molecules. Kirchoff's law, Hartley's rule. Different types of energy transitions – Electronic transitions, Vibrational transitions and Rotational transitions. Effect of Fourier transform technique on emission and absorption spectra and its significance.
3. **UV–VIS Spectroscopy:** Chromophores and Auxochromes. Bathochromic, Hypsochromic, Hyperchromic and Hypochromic shifts. Electronic transitions involving n, σ and π electrons. Experimental set up for UV-VIS spectroscopy. Basic applications in determination of molecular structures. Beer-Lambert law. Application of UV-VIS spectroscopy in estimation of concentrations of solutions.

UNIT – II

4. **Nephelometry and Turbidimetry:** Theory, Technique and general applications.

5. **Spectrofluorimetry and Spectrophosphorimetry:** Basic theory, Instrumentation and simple applications.

UNIT – III

6. **I. R. Spectroscopy:** Vibrational and rotational transitions, Interaction of radiations to cause vibrational and rotational changes in molecules, Different vibrational and rotational modes, Experimental set up and basic applications of I.R. Spectroscopy in deciding the molecular structures.
7. **Raman Spectroscopy:** Theory, Technique and Applications.

UNIT – IV

8. **N. M. R. spectroscopy:** Basic principles of proton-NMR, Spectroscopy, Chemical shift, Chemical exchange, Spin-spin coupling, Coupling constant, Instrumentation and technique, Applications of H-NMR spectroscopy. A brief introduction to C-13 NMR spectroscopy.
9. **Mass Spectroscopy:** Theory, Instrumentation and application to some simple molecules only.

UNIT – V

10. **Flame Photometry or Atomic Emission Spectroscopy:** Basic theory, Instrumentation and simple applications.
11. **Atomic Absorption Spectroscopy:** Basic theory, Instrumentation and simple applications.

Books recommended (Latest editions):

1. Instrumental Methods of Chemical Analysis by Willard, Merit, Dean and Seale, Van Nostrand Reinhold, N.Y.
2. Molecular spectroscopy by C.J. Benwell
3. Spectrometric identification of organic compounds by Silverstein, Bassler and Morill, John Wiley & Sons, INC, N.Y.
4. Applications of absorption spectroscopy of organic compounds by J. H. Dyer, Prentice-Hall of India Pvt Ltd, N. Delhi.

5. Spectroscopy of organic compounds by P.S.Kalsi, New Age International LTD, publishers, N. Delhi

THEORY

BPM – 302

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam:** 3 hrs

PHARMACEUTICAL CHEMISTRY–IX [MEDICINAL CHEMISTRY – I]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Principles of Medicinal Chemistry:** Drug absorption, Distribution, Metabolism and Elimination. Drug receptor interaction, Physico-chemical and steric aspects.
2. **Drug Metabolism:** Activation of oxygen and electron transport system. Role of cytochrome P-450 monooxygenases. Drug metabolizing reactions: phase-I (Oxidative-reductive and hydrolytic) and phase-II (conjugative) reactions. Drug activation and consequences for human health. Factors effecting drug metabolism. Models mimicking drug metabolizing enzymes.
3. **Pharmaceutical Chemistry:** Source/synthesis structure, Stereochemistry, Physico-chemical properties, structure activity relationships, Mode of action and applications of the classes of drugs given in following units (Unit II to Unit V):

UNIT – II

4. **Vitamins:** Introduction, Water soluble vitamins (Thiamine, Riboflavin, Nicotinic acid, Folic acid, Pyridoxine, Pantothenic acid, Biotin, Choline, Inositol, Carotene, Ascorbic acid). Lipid soluble Vitamins (Vitamin A and analogue, Vitamin D, Vitamin K and analogues, Vitamin E). Cyanocobalamines. (Synthesis of Vitamins A, D, E, K, Folic acid, Vitamin C, B₁, B₂, Niacin).

UNIT – III

5. **Steroids:** Steroidal receptor. Steroidal hormones (Androgens, Estrogens, progestrogens, Glucocorticoids. Mineralocorticoids). Anabolic steroids, Oral

centreptives. Cardiotonic glycosides. Commercial production of steroids (Biosynthesis of Cholesterol, Progesterone, Testosterone, Synthesis of Progesterone, Estradiol, Stilbsterol, Norethisterone, Testosterone, Hydrocortisone, Cortisone).

UNIT – IV

6. **Peptide Hormones:** Insulin, Glucaagon, Hormones from hypothalamus. Pituitary hormones, Placental hormones, Parathyroid hormones. Hypertension. Bradykinin and kallidin. Thyrotropin. Thyrocalcitonin. Pentagestrin, oxytocics (Ergometrine).
7. **Analgesics and non-steroidal anti-inflammatory agents:** Morphine and related compounds, Non-steroidal anti-inflammatory analgesics. Antipyretics. Drugs for treatment of rheumatic arthiritis and Gout. Cox-2 inhibitors (Indomethacin, Sulindac, Ibuprofen, Naproxen, Piroxicam, Diclofenac, Nimesulide).

UNIT – V

8. **Antispasmodic, Anti-ulcer and Antiallergenic:** Histamine and anti-histaminic agents. Antiasthmatics, Antitussive. Antiparkinsonism drugs. Bradykinin & 5-hydroxytryptamine and their antagonists (Apomorphine, mepyramine, diphenhydramine, chlorpheniramine, Promethazine bromide, Benzhexol).
9. **CNS active agents: CNS depressants:** General anaesthetics, Sedatives and hypnotics, Central relaxtants with skeletal muscle relaxing properties. Tranquillizers. Anticovulsants. Stimulants: Analeptics, Purines, Psychomotor stimulants, Halucinogens (Psychotomimetics) (Diethyl ether, Ethyl Chloride, Chloropropane, Phenytoin, Troxidone, Theophlline, Chloromazine, Amitryptyline, Diazepam, Barbitone, Phenobarbitome, Cychlobarnitone, Thiopentone).

Books recommended (Latest editions):

1. Wilson & Gisvold's, Textbook of Organic Medicinal and Pharmaceutical Chemistry, 10th Edition, J. B. Lippincott Co. Philadelphia, USA.
2. W. C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA.
3. H. Singh and V. K. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi.
4. M. E. Wolff, Ed. Burger's Medicinal Chemistry and Drug Discovery, John Wiley and sons, New York.

5. J. E. F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U. K.
6. B. G. Baben and H. A. Wittcoff, Pharmaceuticals.
7. Chemicals in Prospective John Wiley and sons, New York, 1989.

THEORY

BPM – 303

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICAL CHEMISTRY–X

[HETEROCYCLES, CARBOHYDRATES, PROTEINS & NUCLEIC ACID]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Chemistry of Heterocyclic Compounds:** Nomenclature of heterocyclic compounds, Five and six membered heterocycles, Aromatic characteristics of heterocyclic compounds. Structure, synthesis and reaction of pyrrole, Furan, Thiophene, Pyridine and Piperidine.
Condensed five and six membered heterocyclics. Synthesis of reactions of indole quinoline and isoquinoline (Fischer indole synthesis, Skraup synthesis and Bischler Napieralski synthesis)

UNIT – II

2. Heterocyclic ring systems containing up to two hetero atoms. Chemistry of Pyrazole, Imidazole, Oxazole, Thiazole, Azines, Pyridazines, Pyrazine, Oxazine. Purines and Pyrimidines, Preparation of reactions of Adenine, Guanine, Cytosine, Uracil, Thiamine, Tautomerism.

UNIT – III

3. **Carbohydrates**
Occurrence classification interrelationship among monosaccharide. Constitution and reactions of glucose and fructose. Osazone formation, Mutarotation, Cyclic structures, Determination of ring size. Configuration and conformation of monosaccharides, Epimerization, Chain lengthening and shortening in aldoses, Interconversions of aldoses and ketones.

UNIT – IV

4. Chemistry of Ascorbic acid, Ribose and 2-deoxyribose. Disaccharides and polysaccharides-Maltose, Lactose, Sucrose, Cellulose, Starch and Gums, Glycosides.

5. Nucleic Acids:

Structure of Nucleosides and Nucleotides, RNA and DNA, General methods for the synthesis of oligonucleotides.

UNIT – V

6. **Amino Acids Peptides and Proteins:** Classification, Source, Essential and non essential amino acids; source and synthesis, Physical properties, Zwitterions structure, Isoelectric point, Chemical reaction and configuration of amino acids. Peptides and polypeptides, Geometry of peptide linkage, Peptide synthesis. Structure determination of polypeptides and group analysis.
Classification and general characteristics of proteins – Primary, Secondary, Tertiary and Quaternary structure of proteins, Helical and sheet structure.

Books recommended (Latest editions):

1. I. L. Finar, Organic Chemistry, Vol. I and II, The English Language Book Society, London.
2. R. T. Morrison and R. N. Boyd, Organic Chemistry 4th Ed. Allyn and Bacon, Inc. Boston.
3. R. N. Acheon, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience Publishers, New York.
4. L. Stryer, Biochemistry, W.H. Freeman and Company, San Francisco.

THEORY

BPM – 304

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICAL CHEMISTRY–IX

[BIOCHEMISTRY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Transportation:** Biochemistry, Organization and transport processes across cell membrane.
2. **Genetic Code and Protein Synthesis:** genetic code, components of protein synthesis. Protein synthesis inhibition.
3. **Regulation:** Regulation of gene expression.

UNIT – II

4. **Energy:** The concept of free energy, Determination of change in free energy from equilibrium constant and reduction potential, Bioenergetics, Production of ATP and its biological significance.
5. **Enzymes:** Nomenclature, Enzymes kinetics and its mechanism of action, Mechanism of inhibition, Isozymes and isoenzymes in clinical diagnosis with special reference to ELISA.
6. **Co-enzymes:** Vitamins as co-enzymes and their significance; Metals as co-enzymes and their significance.

UNIT – III

7. **Carbohydrate Metabolism:** Conversion of polysaccharide to glucose-1-phosphate, Glycolysis and Fermentation and their regulation, Gluconeogenesis and Glucogenolysis. Metabolism of galactose and galactosemia; Role of sugar in nucleotides biosynthesis.
8. **The Citric Acid Cycle:** Significance, reactions and energetic of the cycle; Amphibolic role of the cycle; Glyoxalic acid cycle.
9. **Lipid Metabolism:** Oxidation of fatty acid, Beta-oxidation, Energetics, Alphaoxidation, Omega-oxidation.

UNIT – IV

10. **Respiration:** Redox-potential: Enzymes and co-enzymes involved in oxidation-reduction; The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation.
11. **Nitrogen and Sulphur Cycle:** Nitrogen fixation, Ammonia assimilation, Nitrification and Nitrate assimilation, Sulphate activation, Sulphate reduction, Incorporation of H₂S in organic compounds: Release of sulphur from organic compounds.

UNIT – V

12. **Metabolism of Ammonia and Nitrogen Containing Monomers; Nitrogen Balance:** Biosynthesis of amino acids, Catabolism of amino acids; Conversion of amino acid to specialized products: Assimilation of ammonia; Urea cycle, Metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrin, Biosynthesis; Formation of bile pigments, Purine biosynthesis; Purine nucleotide interconversion, Pyrimidine biosynthesis: Formation of Deoxyribonucleotides.
13. **Genetic Material; Genetic Synthesis & Mutation:** Brief introduction to genetic organization of the mammalian genome alteration and rearrangements of genetic material, DNA synthesis; Replication; Mutation, physical and chemical mutagenesis / carcinogenesis: DNA repair mechanism: Biosynthesis of RNA.

Books recommended (Latest editions):

1. D. W. Martin, P. A. Maya & V. M. Redwell Harpers Review of Biochemistry, Lange Medical Publication.
2. E. E. Corn & P. K. Stumpf, Outlines of Biochemistry, John Wiley & Sons, New York, USA.
3. B. Harrow & A. Mazur, Text Book of biochemistry, W. B. Saunders Co. Philadelphia, USA.
4. A. B. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.
5. B. Stryer Biochemistry, W. H. Freeman & Company, San Francisco, USA.

THEORY

BPM – 305

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam: 3 hrs

PHARMACEUTICS – V [PHYSICAL PHARMACY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Solubility and related phenomenon, General considerations, Solubility expressions; Determination of solubility, Solute-solvent interactions, Solubility of

gases in liquids, Liquids in liquids and Solids in liquids, Presentation of solubility data, Solubility parameters, Solubility curves, Solubility product effect of co-solvents, pH and other factors.

2. **Complexation:** Metal complexes, Organic molecular complexes, Occusion compounds and analysis.

UNIT – II

3. Interfacial phenomenon surface tension, its origin and dimensions, Surface free energy, Pressure inside a droplet, Vapour pressure of curved surface and Kelvin equation. Concept of surface excess. Gibbs equation.

Contact angle of measurement of surface and interfacial tension, Spreading coefficient, Surface films, Surface active agents; Chemical classification, HLB, Solubilization and CMC, Co-solubilization, Emulsification, wetting, Imbibition, Detergency. Adsorption at solid surface interface. Electrical properties of interfaces, (Diffused double layer, Zeta potential) in interfacial properties of particles in suspension.

UNIT – III

4. Particle phenomenon, Low and high energy solid intermolecular forces, Particle-particle interactions. Particle interaction in liquids. Flocculation Kinetics.
5. **Colloids and Macromolecular System:** Dispersed system methods of preparation of colloidal dispersions, Size and shape of colloidal particles. Pharmaceutical applications. Types of colloidal systems. Optical kinetics and electrical properties. Stability of colloidal systems. Sensitization of protective colloidal action.

UNIT – IV

6. **Rheology:** Scope and concepts: Mechanical models or represents concepts. Newtonian systems and viscosity. Non-Newtonian system and flow expressions. Thixotropy: Determination of viscosity and other rheological parameters. Pharmaceutical application.
7. **Micrometrics and Powder Rheology:** Fundamental and derived properties of collection of particles, Particle size distribution and its determination. Specific surface area. Particle number porosity, Density, angle of repose, Flow properties, Compaction and compression of powders.

UNIT – V

8. **Kinetics and Drugs Stability:** General considerations and concepts. Complex reactions. Influence of Temperature, Light, Solvent, Catalytic species and other factors. Thermodynamics considerations and mechanisms in general, Solid-solid degradations, Solid dosage form degradations, Mechanisms that effect tablet stability. Calculation of shelf life and assigning of expiry date, Addition of overages in case of photo sensitive drugs like vitamins.

Books recommended (Latest editions):

1. Alfred Martin et. al., Physical Pharmacy, 4th Edition, 1994, B. I. Waberly Pvt. Ltd., New Delhi.
2. H. S. beans, A. H. Beckett and J. E. Careless, Advances in Pharmaceutical Sciences, Vol. I to IV.
3. Remington's Pharmaceutical Sciences, Mack Publishing Co., Eastern Pannsylvania, USA.

THEORY

BPM – 306

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam: 3 hrs

PHARMACEUTICS – VI [FORMULATION TECHNIQUES AND COSMETICOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Preformulation Studies:** Organoleptic properties, Purity, Particle size, Shape, Surface area, Solubility and dissolution of drugs, Chemical reactions involving drug excipient interactions.
2. **Preparation and Quality Control of Vaccines:** BCG, DPT, DT, TT, Rabies (), Anticholera, TA, Polio, Measles, Small pox, Preparation of anti-snake venom.

UNIT – II

3. **Blood, Glandular and Enzyme Products:** Classification, Production and preservation of following: Plasma and plasma protein fractions, Packed human

blood cell, Normal human serum and albumin, Dried human plasma, Dried human serum, Human normal immunoglobulin, Human fibrinogen, Thrombin, Fibrin Foam, Dextran, Polyvinyl pyrrolidone, Pituitary extract, Thyroxin, Pancreatin, Pepsin, Trypsin, Papain and diastase.

UNIT – III

4. **Enzymes:** Study of bacterial enzymes, Hyaluronidase, Penicillinase, Streptokinase, Streptodornase, Amylases and Proteases, Their preparation and pharmaceutical uses.
5. **Liquids:** Industrial production of Suspensions, Syrups and Emulsions, Batch product control (BPC) concept, Batch to batch uniformity, pH, Color, Taste etc., Concept of HLB, its ranges, uses and importance. Preparation of contact lens and wetting solution. Concentrated haemodialysis solution, Intraperitoneal dialysis solutions (acetate and lactate), Kidney perfusion solution and skin bank fluid.

UNIT – IV

6. **Semisolids:** Percutaneous absorption, Factors affecting it, Raw materials, Types of vehicles, Industrial Processing, Preservation, Production and packaging of cleansing creams, Cleansing lotions, Cold creams, Foundation creams, Moisturizing creams, Skin tonic and hand lotions, Ointments and Contraceptive products.
7. **Shampoos and Related Products:** Formulation, production and packaging of Shampoos, Anti-dandruff preparations, Hair creams, Hair fixers, Hair colourants, Hair removers, Shaving creams, Shaving sticks and After shave lotions.
8. **Beautification Articles:** Formulation, production and packaging of Lipsticks, Eye liner, Nail lacquers, Anti-perspirents, Deodorants, Tooth powder, Tooth paste and Perfumes-rose, Jasmine, Amla, lilac, Narcissus and Amber.

UNIT – V

9. **Quality Control and Quality Assurance:** GMP, C – GMP and compendial requirements, Systems, Documentation, Statistical quality control, Sampling plan, Raw material, Packaging material, Movement of material to quality control laboratory, Passing and rejection procedures of raw and packaging material, Storage of materials, Product inspection and approval market complaints marketing surveillance.
10. **Specifications** of the International Standard Organization.

Books recommended (Latest editions):

1. B. M. Mittal, A Textbook of Pharmaceutical Formulations.
2. Lachman et. al., Theory and Practice of Industrial Pharmacy 2nd Ed. Fea & Febiger, Philadelphia, USA, 1976.
3. J. B. Wilkinson & R. J. Moore, Harry's Cosmeticology, Chemical Publishing House, New York.
4. S. J. Carter, Cooper and Gunn's Dispensing for Pharmaceutical Students, CBS Publishers and Distributors, Delhi – 32.
5. ISO Reports.
6. Remington's Pharmaceutical Sciences, Mack Publication Co. Pennsylvania, USA.
7. IP/BP/USP/PC
8. W. A. Poucher, Perfumes, Cosmetics and Saops, (Vol. I, II, III)

THEORY

BPM – 307

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam: 3 hrs

PHARMACOGNOSY – II [NATURAL PRODUCTS]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. a) **Introduction:** Phytochemical screening, Selection of method for preparation of an extract. Isolation of phyto pharmaceuticals from extractives.
b) Study of biosynthesis of medicinally important secondary plant metabolites.
2. Methods used in standardization and detection of adulteration in foods and drugs.
3. Plant allergens and 11 allergenic substances.

UNIT – II

4. Screening of alkaloids, Polycyclic compounds, (Saponins, sterols, cardenclides and bufadienolides). Flavonoids and Leucoanthocyanidins, Tannins and polyphenols, Anthraquinones, Cynogenetic glycosides, Amino acids in plant tissues.

5. World wide trade in plant and plant derived products with special reference to Dioscoreas (Diosgenin), Digitalis. Tropane alkaloid containing plants. Carica papaya, Rauwolfia, Cinchona (quinine and quinidine). Ipeacac (emetine) Glycyrrhiza, Gineg, plants containing laxatives and valerian.

UNIT – III

6. Biological sources, Preparation, Identification, test and uses of the following enzymes: Diastase, Pepsin, Trypsin and pancreatin.
7. Pesticides with special reference to plant derived insecticides and their uses.
8. **Volatile Oils:** General methods of obtaining volatile oils from plant, Knowledge of important volatile used as flavouring agents and in perfumery. Pharmacognostic study of the following drugs & yielding Volatile oils: Mentha, Cinnamon, Clove, Nutmeg, Eucalyptus, Cardamom, Fennel, Drill, Sandalwood, Vertiver, Rose, Celery, Geranium, Pine, Matricaria, and cedarwood, Utilization of waste of essential oil industry

UNIT – IV

9. **Alkaloids:** Definition isolation, General methods of determination structure, Structure elucidation and synthesis of the following groups.
Phenylethylamine group (ephedrine, amphetamine), Pyrrolidine group (hygrine), Pyridine-piperidine group (Areca nut and Hamlock alkaloids, piperine), Pyrrolidine-pyridine group (Tobacco and coca alkaloids), Quinoline group (cinchona alkaloids), Isoquinoline and phenanthrene group (opium alkaloids) and indole group (mesembrine).

UNIT – V

10. **Terpenoids:** Classification, Isolation, General methods of determining structure and chemistry of the following members: Monoterpenoids (citral geraniol, terpinol, limonene menthol, pinene and camphor), Sesquiterpenoids (borneol, juvenile hormones, santonin) Diterpenoids (phytol) and Triterpenoids (squalene).
11. **Flavonoids:** Structure, Elucidation and synthesis of Anthocyanins, Flavones and isoflavones.

Books recommended (Latest editions):

1. G. R. Treaso & W. C. Evas, Pharmacognosy (12 Edition), Tindoll London 1983, Lea & Febifger, Philadphia.
2. V. E. Tylon Brady, H. E. Robbers, Pharmacognosy (9th Edition), Lea & Febiger, Philadphia, 1988.
3. J. E. Finar, Organic Chemistry, Vol. I and II, The English LanguageBook Society, London.
4. T. Eorrison and B. N. Boyd, Organic Chemistry, 4th Edition, Allya and Bacon, Ind, Boston.
5. T. E. Wallis, The Textbook of Pharmacognosy, J. & A. Churchill, London.
6. Trover Robbinson, The Organia Constituent of higher plants, Birgass Publishing Co., 1967.
7. C. K. Atal & B. M. Kapur, Cultivation & UIC Utilization or Medicinal Plants, CSIR, India, 1982.
8. G. V. Satyavati and M. K. Rania, Medicinal Plants of India Vol. I and IC, ICMR, New Delhi, 1976 & 1987.

THEORY

BPM – 308

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam: 3 hrs

PHARMACOLOGY – III [PATHOPHYSIOLOGY AND TOXICOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Tissues and Joints: Hypoplasia, Hyperplasia, Hypertrophy, Metaplasia, Neoplasia, Osteoporosis, gouts, Arthritis.
2. Respiratory System: Tonsilitis, Bronchitis, Asthma, Emphysema, Cough, Atelectasis.
3. Renal System: Glomerulonephritis, Renal calculi.

UNIT – II

4. Nervous System: Multiple sclerosis, Hypoxia, Dementia, Migraine, Depression, Schizophrenia, Psychosis, Epilepsy, insomnia, Parkinson's disease.
5. Endocrine System: Diabetes, Hyper & Hypothyroidism, Addison's disease, Cushing syndrome, Conn's syndrome and menstrual abnormalities.

UNIT – III

6. Blood & Cardiovascular System: Leucopenia, Leukemia, Erythrocyte disorders (anemia & polycythemia), bleeding and clotting disorders. Atheroma, Atherosclerosis, Aneurysms, Thrombophlebitis Embolism, Varicose veins, Hypertension, Arrhythmias, IHD, CCF.

UNIT – IV

7. Gastrointestinal tract: Gastritis, Peptic ulcers, Pancreatitis, Hepatitis, Liver cirrhosis, Jaundice, Constipation, Diarrhoea, Emesis, Vitamin deficiency disorders.
8. Posology: Adult daily and calculation of doses for children, Effect on dose with respect of various clinical conditions, Concept of loading dose and maintenance dose.

UNIT – V

9. Toxicology: Concept and scope of toxicology. Types of toxicities viz behavioral toxicity, Cardiac toxicity, Hepatotoxicity, Pulmunotoxicity, Nephrotoxicity, Toxicants viz- drugs, Chemical etc.

Books recommended (Latest editions):

1. Rose & Wilson, Anatomy and Physiology.
2. Chatterjee, Human Physiology.
3. Grace, Human Anatomy, ELBS.
4. Keel & Neil, Samson Wright's Applied Physiology.
5. W. F. Ganong, Review of Medical Physiology.
6. A. C. Guyton, Text Book of Medical Physiology.
7. Kumar, Cotron, Robbins- Textbook of Pathology

THEORY

BPM – 309

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam: 3 hrs

PHARMACOLOGY – IV

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Pharmacology of Cardiovascular System:** Cardiac glycosides, other cardiospecific inotropic drugs, Antihypertensive, Antiarrhythmic, Antianginal agent, Drugs for congestive heart failure, Coronary vasodilators used in arteriosclerosis, Antihyperlipaemic drugs.

UNIT – II

2. **Drugs Acting on Blood and Blood Forming Agents:** Coagulants and Anti-coagulants, Anti-platelet and fibrinolytic drugs, Haematonics (iron, cyanocobalamine, folicacid and ascorbic acid).
3. **Drugs Acting in Renal System:** Diuretics, ACE inhibitors (Angiotensin-renin converting system), Vasopressin.

UNIT – III

4. **Pharmacology of Endocrine System:** Introduction to endocrine pharmacology, Thyroid and anti-thyroid agents, Hormones of pancreas and oral hypoglysemics, Adrenocorticosteroids and adrenocortical Antagonists, Pituitary hormones, Gonadal hormones and their inhibitors, Oral contraceptives, Hormones regulation calcium homeostasis.

UNIT – IV

5. **Chemotherapy:** General principles of chemotherapy, Sulphonamides, Urinary antiseptics, Antibiotics, Antiprotozoal drugs, Antimalarial drugs, Antimicrobial agents, Antifungal agents, Anthelmintics.

UNIT – V

6. **Chemotherapy:** Chemotherapy of Tuberculosis Leprosy and Cancer Antiviral drugs(AIDS).
7. **Drugs Acting on Gastrointestinal Tract:** Purgatives, Antidiarrhoeals, Antacids and anti-ulcer drugs, Drugs affecting hepatic biliary system.

Books recommended (Latest editions):

1. B. G. Katzung, Basic Clinical Pharmacology Lange Medical Publications, 1995.

2. A. G. Gilman, B. S. Goodman, T. W. Rall & F. Murad, The Pharmacological Basis of Therapeutics, Macmillan Publishing Co. Inc, 1996.
3. C. R. Graig and R. E. Stitzol, Modern Pharmacology Little Brow & Co, 1995.

PRACTICAL

BPM – 310

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 4 hrs

PHARMACEUTICAL CHEMISTRY–VIII [PHARMACEUTICAL ANALYSIS–II]

Laboratory experiments related to the following:

1. Handling of Fluorimeter, Flame photometer, Colorimeter and VIS-Spectrophotometer.
2. Demonstration of handling of Computerised UV-VIS spectrophotometer.
3. Demonstration of handling of Computerised FT - IR spectrophotometer.
4. Quantitative estimation of some drugs using Fluorimeter.
5. Estimation of Na⁺, K⁺ and Ca⁺⁺ using Flame photometer.
6. Determination of absorption maxima of substances like KMnO₄, K₂Cr₂O₇, CuSO₄ etc and some drugs using spectrophotometer.
7. Determination of concentration of given solutions of chemicals and some drugs using spectrophotometer.
8. I.R. of samples with different functional groups like -COOH, - COOR -, -CONHR, - NH₂ , -NHR, -OH etc.
9. Workshop to interpret the structure of simple organic compounds using UV-VIS, IR, NMR and Mass spectra.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

Books recommended (Latest editions):

1. A textbook of pharmaceutical chemistry by L.G.Chattona, Vol I and II, Morcol Dokkar, N.Y.
2. Practical Pharmaceutical Chemistry by A. H. Bockett and J. D. Stenlake, VOL I and II, The Athlone press of the University of London.

3. Instrumental Methods of Chemical Analysis by Willard, Merit, Dean and Seadle, Van Nostrand Reinhold, N.Y.
4. Indian Pharmacopoeia Vol I and II.

PRACTICAL

BPM - 311

PHARMACEUTICAL CHEMISTRY- IX [MEDICINAL CHEMISTRY- I]

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 04 hrs

Laboratory experiments related to the following:

1. Synthesis of selected drugs from the course content involving two or more steps.
2. Establishing the pharmacopoeia standards of the synthesis drugs.
3. Isolation and characterization of bioactive component of plant origin.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 312

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

PHARMACEUTICAL CHEMISTRY–X

[HETEROCYCLES, CARBOHYDRATES, PROTEINS & NUCLEIC ACID]

Laboratory experiments related to the following:

1. Application of chromatographic techniques for analytical and preparative chemistry.
2. Isolation of Natural products and their spectroscopic characterization.
3. Multistep synthesis of organic medicinal compounds and heterocycles including preparation of raw material by commercial routes.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 313

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

PHARMACEUTICAL CHEMISTRY–XI [BIOCHEMISTRY]

Laboratory experiments related to the following:

1. Estimation of Glucose in Blood.
2. Estimation of Liver glycogen.
3. Estimation of proteins in serum.
4. Determination of creatinine and creatin in blood and urine.
5. Estimation of chloride in serum & urine.
6. Estimation of free fatty acids in serum.
7. Estimation of uric acid in serum and urine.
8. Determination of acid and alkaline phosphatase.
9. Determination of SGOT and SGPT in serum.
10. Determination of blood cholesterol.
11. Estimation of RNA and DNA.
12. Electrophoretic separation of serum proteins.
13. Fat determination in milk.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 314

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

PHARMACEUTICS – V [PHYSICAL PHARMACY]

Laboratory experiments related to the following:

1. Experiments demonstrating the measure of angle of repose of loose powders (graphical methods and foot scale methods). The factors affecting the flow of powders. (Use of lubricant with granules and to watch the change in angle and repose).
2. Viscosity determination of Newtonian and non-newtonian liquids by one point and multipoint viscometers. (Falling sphere method/ostwald's method).
3. Determination of particle size by optical method.
4. Determination of particle size by shifting methods and to study efficiency of screening operating system. (Granules).
5. Determination of particle size by sedimentation methods using Andreason pipette (Sodium carbonate, Barium sulphate, Barium chloride, Acacia etc.)
6. Study of the flow rates of loose powder through the tubes as a function of length of tube, Diameter of orifice and pressure head (different diametered tubes to be used).
7. Determination of H. L. B. value of surfactant by Saponification methods (glyceryl monostearate).
8. Determination of H. L. B. value of modified Griffin Acasia Emulsion methods (Glyceryl monostearate).
9. Determination of C. M. (critical micelle concentration) of surfactant by surface tension and / or other methods. (Sodium lauryl sulphate).
10. Designing conduction and reporting of accelerated testing in studying chemical stabilization against hydrolytic/thermolytic decomposition of drugs. (Aspirin tablets, paracetamol tablets, multivitamin tablets).
11. Experiments demonstrating the usefulness of solubilizing agent in forming a clear liquid phase of two immiscible liquids. Ternary phase diagram, Observation of effect of temperature (Peppermint oil, Propylene glycol, Water).

12. Determination of spreading co-efficient of organic liquid or water as sub layer liquid.
13. Preparation of occlusion compounds and their studies.
14. Solubility of drugs with respect to activity coefficient.
15. Adsorption of drugs on adsorbing material efficiency feasibility.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

Books recommended (Latest editions):

1. M. N. Ghosh, Fundamentals of Experimental Pharmacology, Scientific Book Agency, Calcutta, II Edition.
2. S. K. Kulkarni, Handbook of Experimental Pharmacology, Vallabh Prakashan, Delhi – 110034.

PRACTICAL

BPM – 315

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

**PHARMACEUTICS–VI [FORMULATION TECHNIQUES &
COSMETICOLOGY]**

Laboratory experiments related to the following:

1. Formulation, Preparation, Packaging and presentation of following classes of dosage forms. Medicated syrups, Dry syrups and Tropical ointment.
2. Formulation & preparation of emulsions and suspensions by homogenizer and colloid mill, Evaluation of these products.
3. Preparation and quality control of Cold creams, Vanishing creams, Moisturizing creams, Cleansing lotions, skin. tonics, Shampoos, Hair colorants, Depilatories, Shaving creams, Tooth powder, Tooth paste and After shave lotion.

4. Experiments to illustrate comparative study of Suspending agents, Emulsifying agents and Preservatives, use of HLB.
5. Small scale preparation of glandular products.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 316

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

PHARMACOGNOSY – II [NATURAL PRODUCTS]

Laboratory experiments related to the following:

1. Microscopic examination of diagnostic tissues in powdered crude drugs.
2. Pharmacognostic identification of various crude drugs.
3. Processing, extraction, isolation and characterization of natural products.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 317

Max. Marks: 50; Pass percentage: 40; Duration of Exam: 3 hrs

PHARMACOGNOSY – III [PLANT COLLECTION TOUR]

1. A Pharmacognosy tour of minimum one week duration (Inclusive of Journey days) or tours of short duration shall be conducted under expert supervision of two teachers of department for visiting various natural sites in India for which the University shall finance the tour as per rules.
2. Student shall be required to submit a report and herbarium of plants collected from natural habitat visited which shall be evaluated by a panel of examiners consisting of the Head and two accompanying teachers of the department and shall be awarded out of 50 marks.

PRACTICAL

BPM – 318

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of Exam: 05 hrs

PHARMACOLOGY – IV

Laboratory experiments related to the following:

1. Bioassay designs using various isolated preparations (acetylcholine, histamine, 5-HT, oxytocin) and intact preparations (ADH, Insulin and some biological preparations).
2. In-vivo effect of antihypertensive drugs.
3. Effect of anti-coagulant drugs on clotting time.
4. Effect of antiarrhythmic drugs on isolated heart preparation.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

BPharm IVth Year

THEORY

BPM – 401

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam. 3 hrs

PHARMACEUTICAL CHEMISTRY – XII [MEDICINAL CHEMISTRY – II]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

Pharmaceutical chemistry (source/synthesis, structure, stereochemistry, physico-chemical properties, structure activity relationship, mode of action and applications) of the classes of drugs given in following units.

UNIT – I

12. **Adrenergic Agents:** Adrenergic neuro transmitters. Adrenergic receptors. Sympathomimetic agents. Adrenergic blockers.
13. **Miscellaneous Organic Pharmaceuticals:** Antirhemetic gold compounds. Alcohol detterent agents. Psoralens, Uricosuric agents. Antiemetic agents. Depigmenting agents. Chelating agents. Miscellaneous gastrointestinal agents.

UNIT – II

14. **Cholinergic Drugs and Related Agents:** Cholinergic neuro transmitters. Cholinergic agonists. Cholinergic blocking agents. Parasympathetic postganglionic blocking agents. Solanaceous alkaloids and synthetic analogs. Synthetic amino alcohol esters. Ganglionic blocking agents. Neuromuscular blocking agents.
15. **Local Anaesthetics:** Nervous tissue, Mechanism of action of local anaesthetics products.

UNIT – III

16. **Cardiovascular Drugs:** Antianginal drugs and vasodilators. Antiarrhythmic agents. Antihypertensive drugs. Antihyperlipidemic agents. Coagulants and anticoagulants. Sclerosing agents, synthetic hypoglycemic drugs. Thyroid hormones, anti-thyroid drugs. Cardiotonic agents.

UNIT – IV

17. **Diuretics:** Water and osmotic agents. Acidifying salts. Mercurials phenoxyacetic acids. Purines and related heterocycles. Sulfonamide, sulfamyl bezoic acid derivatives. Endocrine antagonists. Miscellaneous compounds.

UNIT – V

18. **Anti-infective agents:** Local anti-infective agents, phenols and their derivatives. Urinary tract and anti-infectives and antiseptics. Antiscabious and antipedicular agents preservatives.

19. **Diagnostics Agents:** Radioopaque diagnostic-agents. Agents for kidney function test. Agents for liver function tests. Miscellaneous diagnostic agents.

Books recommended (Latest editions):

6. Wilson & Gisvold's. Text Book of organic Medicinal and Pharmaceutical Chemistry, 10th edition, J. B. Lippincott CO, Philadelphia, USA.
7. W. C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA.
8. H. Singh & V. Kapoor, Medicinal & V. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi.
9. M. E. Volff, Ed. Burger's Medicinal Chemistry and Drugs Discovery, John Wiley and Sons, New York.
10. J. E. F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U.K.
11. B. G. Baden and H. A. Wittcoff, Pharmaceuticals.
12. Chemicals and Prospective John Wiley & Sons, New York, 1989.

THEORY

BPM – 402

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICAL CHEMISTRY – XIII [MEDICINAL CHEMISTRY – III]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

Pharmaceutical chemistry (source/synthesis, structure, stereochemistry, physico-chemical properties, structure activity relationship, mode of action and applications) of the classes of drugs given in following units.

UNIT – I

1. **Sulfonamides, Sulfones and folate reductase inhibitors with antibacterial action:** Sulfonamides and folate reductase inhibitors, well absorbed, short and intermediate acting sulfonamides. Well absorbed, and long acting sulfonamides. Sulfonamides for ophthalmic infections. Sulfonamides for burn therapy, Sulfonamides for intestinal infections. Therapy ulcerative colitis and reduction of bowel flora. Folate reductase inhibitors.
2. **Antimalarials:** Cinchona alkaloids, 7-chloro-4-aminoquinolines, 8-aminoquinolines. 9-aminoacridines. Mefloquine. Diaminopyridines. Biguanides. Sulfones and other miscellaneous antimalarials.

UNIT – II

3. **Antibiotics: β -Lactam Antibiotics:** Aminoglycosides. The Tetracyclines. Macrolide antibiotics. Polyene antibiotic. The lincomycine. Polypeptide antibiotics. Fluroquinolones. Chloramphenicol and other unclassified antibiotics. Antitubercular agents(p-amino-salicylic acid and its salts, isoniazid, Ethionamide, pyrazinamide, prothionamide, Antitubercular antibiotics, Cycloserine). Antileprosy agents (Dapsone sodium sulfoxone, acetosulfone clofazimine)

UNIT – III

4. **Antifungal Agents:** Fatty acids and their derivatives, Salicylic acid derivatives. Salicylanilids, Tolnaftate p-chloro-methoxylenol. Acrisorcyin, Fluconazole, Itratanzole, Hahoprogin, Clotrimazole, Econazole, Miconazole. Ketoconazole (Nystatin, Amphotericin-B). chcorphensin, dithranal.
5. **Antiviral Agents: Screening Methodology:** Adamantane derivatives (Amantadine, Rimantadine). Idoxuridine, Trifluoruridine, Vidarabine, Ibravarine, Acycloguanosine, Inosiplex, Methisazone. Zidovudine, Acyclovir, Ganciclovir, Foscarnet, Human interferon.

UNIT – IV

6. **Antineoplastic Agents:** Alkylating agents (Nitrogen mustards, Aziridines), sulfonic acid esters, Nitrosoureas, Epoxides. Trizines, phosphemides, Mitomycin).

Antimetabolites (Methotroxate). Antimetabolites involved in the synthesis of nucleic acids (Mercaptopurine, Thioguanine, Fluoruracil, Floxuridine, Cytarabine, Azathioprine). Antitumor antibiotics (Dactinomycin, Daunorubicin, Aclarinomyacin, Mithramycin, Bleomycin). Antitumor alkaloids (Vincristine, Vinblastine). Hormones (Steroids, Tamoxifen, Mitotane, Dormantanolone propionate, Testalactone, Mestrol acetate). Miscellaneous compounds (Hydroxy urea, Cisplatin, Pipobroman).

UNIT – V

7. **Anthelmintics:** Tetrachloroethylene, Piperazine, Gentian violet pyriminium pamoate. Thiabendazole, Mebendazole, Bephenium hydroxynaphthoate, Dichlorophene, Niclosamide, Levamisole hydrochloride. Tetramisole, Niridazole, Biothional, Antimony potassium tartarate stibiophene, Sodium stibocaptate.
8. **Antiamoebic and antiprotozoal drugs.** Emetine hydrochloride, 8-hydroxyquinoline, Iodochlorohydroxyquinol, Metronidazole, Diloxanide furoate, Hydroxystilbamidine isothionate, Pentamidine isothionate, Nifutimax, Suramin sodium, Carbarsone, Cyclobiarsol, Melarsoprol sodium biogluconate, Dimercaprol, Diethylcarbamazine citrate, Centarsoene, Acetarsoene, Bismuth sodium thioglycollate, Stibiophen, Furazolidone.

Books recommended (Latest editions):

1. Wilson & Gisvold's. Text Book of organic Medicinal and Pharmaceutical Chemistry, 10th edition, J. B. Lippincott CO, Philadelphia, USA.
2. W. C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA.
3. H. Singh & V. Kapoor, Medicinal & V. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi.
4. M. E. Volff, Ed. Burger's Medicinal Chemistry and Drugs Discovery, John Wiley and Sons, New York.
5. J. E. F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U.K.
6. B. G. Baden and H. A. Wittcoff, Pharmaceuticals.
7. Chemicals and Prospective, John Wiley & Sons, New York, 1989.

THEORY

BPM – 403

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACEUTICS – VII [PHARMACEUTICAL MANAGEMENT]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **General Management:** Concept, Functions and principles, Techniques of management of objectives management by exception, management by crisis, management by departmentation. Span of management, delegation: Concept and significance, authority and power, centralization and decentralization, line and staff conflicts; Motivation: Need for recognizing motivating factors, hierarchy of human needs, theories X and Y; Communication; purpose, importance process, barriers and breakdown in communication, making communication effective.

UNIT – II

2. **Personal Management:** Definition, importance and objectives, qualities and functions of personnel manager; Human resource planning: meaning and need, job analysis, job description and job specification. Recruitment and selection process: Source and manpower, recruitment policies, selection procedures. Promotion, demotion, transfer and separation. Employee training: Need, importance, principles of training methods. Performance appraisal: Meaning, objectives, approaches and methods.

UNIT – III

3. **Principles and Material Management:** Scope problems, cost of item, vendor development, vendor audit (suppliers and quotations). Ordering procedures. Procurement and raw material and packaging material as per warehouse system, inwarding of material and goods, statutory records vis-à-vis schedule M requirements, issue of materials to production department and documentation system thereof. Central Excise Act: Chapters 28, 29, 30, records thereof CENVAT, record keeping and total documentation of central excise, filing of central excise papers, classification and price list, C, E. tariff and AHC products, general exemption No. 1 C.E. Tariff, dispatch of goods from Pharmaceutical manufacturing unit.

UNIT – IV

4. **Marketing and Production Management:** Meaning, function and problems, function of marketing executives. Product life cycle, product line policies and strategies. Concept and components of marketing information system. Ethical and unethical marketing of Pharmaceutical products. Pricing of Pharmaceutical formulations. DPCO considerations. Production planning & control, production process analysis, plant location and layout.

UNIT – V

5. **Management of Hospital Pharmacy:**
 - i. Introduction to health care systems in India and abroad, Health services and hospital Pharmacy, recommendations of various committees and commissions.
 - ii. Pharmacist's role in administration, dispensing / manufacturing, quality control, Pharmacy therapeutic committee, Hospital formulary and provisioning of drugs in Hospitals of different beds strength.
 - iii. Principles of stores management, establishment of central and sub stores in hospitals, centralized decentralized stores, precautions of storage of drug receipts and issue, OTC products.
 - iv. Procedure for purchase of materials for hospital Pharmacy units, application of modern management techniques like ABC, VED, SDE, FMS analysis for inventory control, lead time item cost, inventory caring cost, procurement cost, safety stock recorders level and EOQ analysis, receipt and issue, OTC products.

Books recommended (Latest editions):

1. Principles and methods of Pharmacy Management, Harrg A. Smith Loa & Febiger, Philadelphia.
2. Personnel Management by Edwin B. Flippo.
3. Materials Management by Gopalkrishna, Prentice Hall India.
4. Marketing Management Analysis, Planning and Control, Philips Kotler.
5. Central Excise Tariff, Government of India Publication.

6. Relative Acts & Rules Published by the Government of India.
7. Principles of Practice of Management Koontz/o Donnal.
8. Marketing and managerial Introductions, J. C. Gandhi.

THEORY

BPM – 404

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACEUTICS – VIII [PHARMACEUTICAL TECHNOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Tablet :

- i. **Tablet Formulation:** Systematic approach to tablet product design. Components and additive methods of manufacture, problems in manufacture. Properties of tablets influenced by compression. Measurement, transmission and distribution of forces in compressed tablet, effect of pressure of relative volume. Lubrication, adhesion and cohesion of particles, factors affecting strength of tablets.
- ii. **Various Forms of Tablets:** Coated and compressed tablets, effervescent, sublingual, buccal and chewable, lozenges and sustained release tablets etc.
- iii. **Evaluation of Tablets:** Tablets thickness, colour, weight variation, friability, disintegration, hardness, dissolution rate and content uniformity etc.
- iv. **Tablet Coating:** Sugar coating, film coating, compression coating and enteric coating. Methods of evaluation of coated tablets. Particle coating techniques.
- v. **Tablet Tooling:** Terminology, tablet design specification and information required, use and care of tooling problem solving.

UNIT – II

2. **Aerosols:** Classification of aerosols systems, propellants, containers, values aerosols, packaging and applications.

UNIT – III

3. **Microencapsulation:** in Study of core and coat materials, equipment and processing.
4. **Appliances:** Medical and surgical plastic appliances, nature of polymer, classification, uses and evaluation.

UNIT – IV

5. **Pharmaceutical Packaging:** Packaging components, types, specifications and methods of evaluation stability aspects of packing. Various packaging equipments.
6. **Pharmaceutical Pilot Plant Scale Up:** Factors to be considered during development. Pilot plant design, problems due to change of origin of additives.

UNIT – V

7. **Modern Drug Delivery System:** Formulation of oral and parenteral prolonged act on dosage forms, their evaluation, targeted drug delivery system. Transdermal drug delivery system, Occuerts pumps and implants.

Books recommended (Latest editions):

1. L. Lachman et. Al, Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Hind Rajasthan Building, Dodar Bombay-400014.
2. J. R. Robinson & Vincent Pel-Lee, Controlled Drug delivery, Marcel Dekker, New York, 1987.
3. M. H. Rubinstein Pharmaceutical Technology, (Tablating technology), Volume – I, Ellise Horwood Limited, John Wiley & Sons, 1987.
4. Bentely's Text Book of Pharmaceutics, ELBS.
5. Remington's Pharmaceutical Sciences, Mack Publishing Company, Pennsylvania, USA.

THEORY

BPM – 405

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACEUTICS – IX [PHARMACOKINETICS AND BIOPHARMACEUTICS]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. **Introduction:** Pharmacokinetics and biopharmaceutics including history and their role in related disciplines.
2. **Pharmacokinetics:** Absorption, distribution, metabolism and excretion of drugs. Factors affecting absorption of drugs. Fluid compartments, circulatory system and protein binding.

UNIT – II

3. **Compartment Models:**
 - i. One compartment open model: Pharmacokinetics of single dose administration as applied to intravenous and oral administration, intravenous transfusion, multiple intravenous and oral administration, pharmacokinetics basis of sustained release formulations.
 - ii. Two compartment open model: Pharmacokinetics of single and multiple dose administration as applied to intravenous and oral administration, basis of sustained release formulations.

UNIT – III

4. **Compartment Models:**
 - i. Curve fittings, area under blood level curves and its significance.
 - ii. Urinary excretion, sigma minus plot and its significance.
 - iii. Dosage regimen adjustment in patients with and without renal failure.

UNIT – IV

5. **Biopharmaceutics:** Definitions, physico-chemical factors altering biological performance of drugs, biopharmaceutical data of gastrointestinal tract, bioavailability, methods of determination of bioavailability, using blood level and urinary excretion data.
6. **Radioimmunoassay.**

UNIT – V

7. **Innovations:** Recent trends in pharmacokinetics and biopharmaceutics.

Books recommended (Latest editions):

1. W. A. Ritschel, handbook of Basic Pharmacokinetics, Drug Intelligence Publications, Hamilton III, 1977.
2. J. G. Wagner, Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications, Hamilton, 1975.
3. Remington's Pharmaceutical Sciences, Chapter Bioavailability and Bioavailability Testing, Mack Publishing Co, Easton, Pennsylvania, USA.
4. Rowland, Malcolm and Tozer, Thomas Ng, Clinical Pharmacokinetics, Lea Febiger, Philadelphia, 1980.
5. R. E. Notari, Biopharmaceutics & Clinical Pharmacokinetics Fourth Edition. Marcel Dekker, Inc. New York. Basel.

THEORY

BPM – 406

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.** 3 hrs

PHARMACEUTICS – X [PHARMACEUTICAL JURISPRUDENCE & ETHICS]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Code of professional ethics.
2. Study of drugs and cosmetics Act 1940 and rules made there under; with special reference to application for import of drugs, licensing formalities for whole sale, retail sale manufacturing test, license for drugs and cosmetics, DPCO, special emphasis on schedules C; C1.G, M, P, U, W, X and Y. Emphasis on labeling of various classes of drugs, recent amendments in drugs and Cosmetics Act.

UNIT – II

3. Pharmacy Act 1948.
4. Dangerous Drugs Act 1930 and rules made there under.

UNIT – III

5. Medicinal and Toilet Preparations (excise duties) Act and rules made there under.
6. Drugs and Magic Remedies (objectionable advertisements) Act.

UNIT – IV

7. The Shops Act of Uttarakhand State.
8. The medicinal termination of Pregnancy Act.

UNIT – V

9. International Documentation: New drug application. Relevant information for marketing the pharmaceutical products in other countries, IPR studies, procedure of filling patent (National and International).
10. Forensic Toxicology.

Books recommended (Latest editions):

1. Drugs and Cosmetics Act, 1940 and all amendments, Government of India.
2. B. M. Mithal, Text Book of Forensic Pharmacy, National Book Centre, Dr. Sundari Mohan Avenue, Calcutta – 700014.
3. Relevant Acts & Rules published by the Government of India.
4. Drug Laws by P. L. Malik.

THEORY

BPM – 407

Max. Marks: 70; **Pass percentage:** 40; **Hrs/ wk:** 2; **Duration of Exam.:** 3 hrs

PHARMACOLOGY – V [CLINICAL PHARMACOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Definition, scope, and development of clinical pharmacy and clinical pharmacology.
2. Concept and clinical pharmacy wing. Epidemiology of drug use and organization of drug information services, documentation and counseling of patients.
3. Monitoring of drug therapy in paediatric patients, geriatric patients and pregnancy, Drug surveillance and patient safety.

UNIT – II

4. **Teratogenicity:** Drug induced diseases, drug metabolism and excretion in milk.
5. **New Drug Development Process:** Concept of Pharmacogenology, preclinical evaluation, market planning, safety evaluation clinical evaluation data management, statistical design and documentation, post making surveillance and drug regulatory affairs.

UNIT – III

6. **Adverse Drugs Reaction and Drug Interactions:** Mechanisms of drug interactions. The management of following ADR-drug interactions (1) Antibiotics and non antibiotics (2) Analgesics and anti-inflammatory agent (3) Anti-histaminics (4) Cardiac drugs (5) CNS depressants and (6) Vitamins.

7. **Clinical Toxicology:** Principles and management of different types of poisoning and toxicity reactions.

UNIT – IV

8. **Clinical Presentation, diagnostics Tests, Clinical Management of specific Disorders:**

- i. **Renal Disease:** Nephritis, nephrosis, Renal Calculi.
- ii. **Diseases of Cardiovascular System:** Angina pectoris, congestive heart failure, hypertension, myocardial infarction, anemia, coagulation disorders.
- iii. **Diseases of GIT:** Hepatocellular failure, cirrhosis, jaundice, peptic ulcer, stomach ache.
- iv. **Diseases of Nervous System:** Schizophrenia, mental depression, parkinsonism, epilepsy, migraine headache.

UNIT – V

9. **Clinical Presentation, diagnostics Tests, Clinical Management of specific Disorders :**

- i. **Infectious Diseases:** Tuberculosis, viral dysenteries, diarrhoeas, typhoid, cholera, diphtheria, herpes, measles, polio, whooping cough, pneumonia, TB, UTI, GKT infections, STD, malaria, meningitis, AIDS.
- ii. **Diseases of Endocrine system:** Diabetes, hyperlipidemia, thyroid disorders.
- iii. **Diseases of joints and bones:** Rheumatoid arthritis, osteoarthritis, gout, osteoporosis, osteomalacia.
- iv. **Diseases of Respiratory system:** Asthma, cough, bronchitis.

Books recommended (Latest editions):

1. D. G. Grahaene Smith and J. K. Arensero oxford Text Book of Clinical Pharmacology and Drug. Therapy, Oxford University Press.
2. Kannath. L. Melmen & Howard F. Morrelli, Clinical Pharmacology, Basic Principle in Therapeutics, Macmillan Publishing Co, Inc. New York.
3. D. G. Detarsderf, R. D. Adam, E. Braunwald, K. J. isselbuchor, J.B. Martin, J.D. Wilson Harrison's principles of internal medicine, 10th Ed, Mc Graw Hill, International Book Company, 1983.

4. E. T. Harfindal and J.L. Hirschman, Clinical Pharmacy and Therapeutic, The Willams and Wilkins Company, Baltimore, 1977.
5. M. C. Allwed and J. T. Hell, Test Book of Hospital Pharmacy, Blackwell Scientific Publications, Oxford London, 1980.
6. P. K. Gupta Modern Toxicity, Vol. 1-3 Matropoliton, New Delhi-1985.
7. J. Doull, C. D. Klasgen & M. A. Amdur, Casarett & Daull;s Toxicology 2nd Ed., Mac Millan Pub. Co, Inc. 1980

THEORY

BPM – 408

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 2; Duration of Exam.: 3 hrs

PHARMACOGNOSY – IV [PHARMACEUTICAL BIOTECHNOLOGY]

Instructions to examiners: Two questions should be asked from each unit. Students shall be required to attempt one question from each unit. In all, five questions shall be attempted. All questions shall be of 14 marks each.

UNIT – I

1. Introduction to pharmaceutical biotechnology, concept of basic techniques in tissue culture and their application in pharmaceutical sciences.
2. The pharmacists' practitioner's role in biotechnology, introduction and various biotechnological products.
3. Drug Delivery Aspects of Biotechnology Product: Introduction, stability of peptides and proteins, non-conventional routes of administration.
4. Clinical use of monoclonal antibodies, commercial manufacturing.

UNIT – II

5. Micropropagation: Organogenesis and stomatic embryogenesis, clinical propagation of elite germ plasma of pharmaceutical importance. Technical problems in micropropagation such as vitrification, explant exudation etc., Effect of micro environment on micropropagation.
6. Production and application of synthetic seeds:

UNIT – III

7. The use of nonclassical techniques in the production of secondary metabolites by plant tissue culture: Plant cell culture as new alternative sources of secondary

natural products. Production of endogeneous compounds and transformation involving foreign genes.

8. Production of flavaouring compounds through tissue culture.
9. Antimicrobial agents from plant cell culture.

UNIT – IV

10. Production of anti tumour compound by plant cell culture.
11. Increasing secondary metabolite production in plant cell culture with fungal elicitors.
12. Immobilization of cell systems for the production of plant metabolites.

UNIT – V

13. Production of edible-vaccines by successful expression of foreign antigenes in genetically engineered plants.
14. Application of bioreactors of large scale production of useful pharmaceutical products.
15. Application of biotechnology in pharmacy and intellectual property rights

Books recommended (Latest editions):

1. Biotechnology and Pharmacy, John M, Pazzute, Michael E. Johnson and Hanri R, Manasse, Jr.
 2. An Introduction to Plant Tissue Culture by M. K. Razdan, 1994, Oxford & IEH.
 3. Plant Cell Tissue and Organ Culture Fundamental Methods by O. L. Gambarg and G. C. Phillips, 1996 Narosa Publishing House.
 4. Secondary Metabolisms on Plant Cell Cultures by PhillipMarris, Alan H. Scragg, Angle Staff and Michael W. Fowlar, 1986, Cabridge University Press.
 5. Biotechnology in Agriculture and Forestry Vol. IV, Medicinal and Aromatic Plants I by V. P. S. bajaj, 1988, Sringer Verlag.
 6. Biotechnological Application of Plant Cultures by Peter D. Shargoel and That T. Ngo, 1994, CRC Press, Inc.
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PRACTICAL

BPM – 409

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 5 hrs

PHARMACEUTICAL CHEMISTRY –IX, XII & XIII [MEDICINAL CHEMISTRY – I, II & III]

Laboratory experiments related to the following:

10. Synthesis of selected drugs involving two or more steps.
11. Special analysis of synthesized and other drugs.
12. Establishing the Pharmacopoeial standards of the synthesized drugs.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |
-

PRACTICAL

BPM – 410

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 5 hrs

PHARMACEUTICS –VIII [PHARMACEUTICAL TECHNOLOGY]

Laboratory experiments related to the following:

1. Preparation and evaluation of tablets by dry and wet granulation methods.
2. Preparation of tablets and study of the influence of formulation factors (binding agent, disintegrants, lubricants and glidants) on the dissolution rate of tablets.
3. Preparation and pan coating of granules and tablets, evaluation of granules, coated granules and tablets. Prepared from uncoated granules and coated granules.
4. Microencapsulation and evaluation of microcapsules prepared by phase separation conservation method and multiorifice centrifugal microencapsulator.
5. Coating of drug practicals by fluidization and their evaluation (Wurster process)

6. Preparation of an Aerosol system by using different combination of propellants and their evaluation.
7. Strip packaging of tablets and capsules and quality control tests, thereof, evaluation of packaging material strip packs and blister packs.
8. Thickness of Aluminium foil lamination
9. Water permeability and quality of printing.
10. Leakage test.
11. Preparation of sustained release tablets and capsule of drugs and their *in-vitro* evaluation using dissolution rate testing apparatus.
12. Filling, sealing and evaluation of hard gelatin capsules and comparison with marketed products.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 411

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 5 hrs

**PHARMACEUTICS – IX [PHARMACOKINETICS AND
BIOPHARMACEUTICS]**

Laboratory experiments related to the following:

1. Intestinal transport of drugs including plotting of standard curve (salicylic acid, riboflavin).
2. Protein binding of drugs through diffusion cell.
3. Determination of dissolution rate constant using Noyes-Whitney equation.
4. Determination of effect of pH on dissolution rate constant.
5. Determination of urinary excretion of sulfonamides / any others drug.
6. Determination of partition coefficient of hydrophilic and hydrophobic drugs in water / octanol system.
7. In-vitro evaluation of sustained release versus traditional dosage forms (capsules and tablets).

8. In-situ absorption studies of Paracetamol.
9. Study to release rate of drug through various ointment bases using agar plates / dialysis membrane.
10. Study of effect of various additives on rate of release of drugs using dialysis method.
11. To study acid neutralizing capacity and rapidity of action of antacid tablets.
12. Determination of bioavailability of sulfonamides / any other drug.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 412

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 5 hrs

PHARMACOLOGY – V [CLINICAL PHARMACOLOGY]

Laboratory experiments related to the following:

1. Calculation of LD-50, values and therapeutic index (Statistical approach).
2. Prescription evaluation : exercises on clinical problems related to topic covered in theory.
3. Experimental methods related to biochemical, clinical pharmacology.

Books recommended (Latest editions):

1. S. K. Kulkarni, Handbook of Experimental Pharmacology, Vallakh Prakashan, Delhi – 110034.
2. M. N. Ghosh, Fundamentals of Experimental Pharmacology Scientific Book Agency, Calcutta, Second Edition (1984)

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 413

Max. Marks: 70; Pass percentage: 40; Hrs/ wk: 3; Duration of exam.: 5 hrs

PHARMACOGNOSY – IV [PHARMACEUTICAL BIOTECHNOLOGY]

Laboratory experiments related to the following:

1. Laboratory design, aseptic techniques, media preparation.
2. Initiation and maintenance of callus cultures.
3. Initiation and maintenance of plant cell suspension cultures.
4. Microdroplet and single cell nurse culture.
5. Culture organ explants and micropropagation by axillary bud proliferation and somatic embryogenesis.
6. Production of secondary metabolites, anthocyanin pigments and aromatic compounds.
7. Synthesis of artificial seeds and study of their delivery system.

NOTE: Any other experiment(s) may be included in support of theoretical aspects of the course.

Distribution of Marks:

- | | | |
|------------------|---|----------|
| 1. Experiment(s) | : | 50 marks |
| 2. Record | : | 10 marks |
| 3. Viva voce | : | 10 marks |

PRACTICAL

BPM – 414

Max. Marks: 50; Pass percentage: 40

PHARMACEUTICS – X [INDUSTRIAL TOUR]

(TWO WEEKS)

1. An industrial tour of minimum two weeks duration (inclusive of journey days) or tours of short duration shall be conducted under expert supervision of one teacher of department for visiting a Pharmaceutical Companies in India for which the University shall finance the tour as per rules.
2. Students shall be required to submit a report on companies visited which shall be evaluated by a panel of examiners consisting of the supervisor teacher of the department and an external expert and shall be awarded out of 50 marks. The external expert and supervisor shall be paid remuneration etc as per university rules for project evaluation.